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Exploring the Dynamic Relationship between Income and Consumption in Central Asia: An ARDL Approach

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	Abstract
<p>Shams Ul Amin M.Phil Scholar, Department of Economics, City University of Science and Information Technology, Peshawar, Khyber Pakhtunkhwa, Pakistan. Email: shamsamin624@gmail.com</p> <p>Khairullah Jan PhD Scholar, Department of Economics, University of Peshawar, Peshawar, Khyber Pakhtunkhwa, Pakistan. Email: khairullah8932532@gmail.com</p> <p>Muhammad Adnan Khan* PhD Scholar, Department of Economics, Faculty of Business & Economics, Abdul Wali Khan University Mardan, Khyber Pakhtunkhwa, Pakistan. Corresponding Author Email: adnankhan3079@gmail.com. https://orcid.org/0000-0002-8241-7736</p>	<p>As argued by Keynes and Friedman, consumption is a significant part of the gross domestic product (GDP) and is largely influenced by income levels. This study provides an empirical estimation of the consumption function for four Central Asian economies (Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan) from 1993 to 2020. The results reveal that income exerts a statistically significant influence on consumption in both the short and long term. The short-term results support the Keynesian Absolute Income Hypothesis, while the long-run results are consistent with Milton Friedman's Permanent Income Hypothesis. However, the study reveals that the marginal propensity to consume in Central Asian countries falls outside the range suggested by Keynes and therefore does not fully validate the Absolute Income Hypothesis. Based on the results, the study recommends policies aimed at enhancing savings and investment, while maintaining consumption at sustainable levels to foster stronger and more stable economic growth in the region.</p>
<p>Keywords:</p>	<p>Consumption Function; Income; Absolute Income Hypothesis; Permanent Income Hypothesis; Panel ARDL; Central Asian Countries</p>

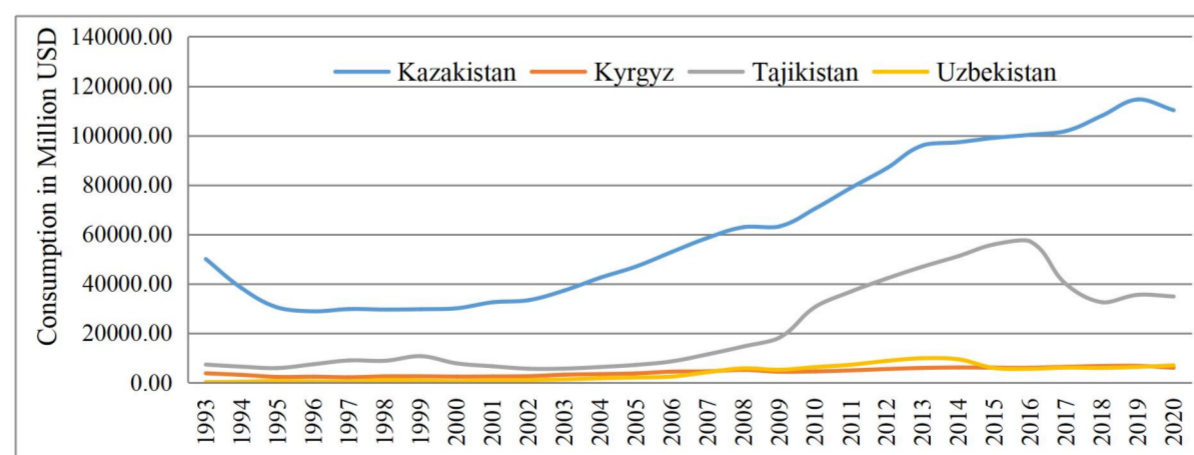
1. Introduction

The legendary work of John Maynard Keynes ‘Consumption Function’ has received widespread attention across the globe. In 1936, he published a book, ‘*General Theory of Employment, Interest and Money*’, where he highlighted the connection between consumption and income, which is known as the consumption function. Keynes, in his theory of Absolute Income Hypothesis (AIH), argued that aggregate consumption is primarily determined by the current income (Laiqat et al. 2018). Kuznets (1946) was the first to empirically investigate the consumption function to estimate the Average Propensity to Consume (APC) for the short run and long run using cross-sectional and time series data in the case of the U.S.A. In contrast, Dusenbery (1949) argued that consumers’ utility is determined by relative income, not by absolute income (as Keynes believed), but by current income compared to former income and present income.

Friedman (1957) stated that a household's spending is proportional to its permanent income, or the average income that a household may expect to earn over a period of time (in the future). This idea arose from the long-standing observation that earnings other than current disposable income influenced current purchasing patterns. The Permanent Income Hypothesis (PIH) helps explain the long-run consistency of the APC, as well as why, during cyclical fluctuations, this ratio fluctuates inversely with income. The PIH explains the more important aspects of consumer behavior intuitively. Based on the fact that changes in permanent income over long periods of time reflect changes in an economy's aggregate income growth, i.e., the economy’s resources increase permanently (Khan, 2012). Ando and Modigliani (1963) developed the life cycle hypothesis (LCH). In many aspects, the LCH and the PIH are similar, including the fact that consumption is a constant percentage of income. However, according to this perspective, consumption is dictated by a person's various stages of life, with the average consumer's goal being to balance consumption across a lifetime in which income varies dramatically with age (Arapova, 2018). Because people are not earning in adulthood and old age after retirement, their consumption patterns are maintained by borrowing or depleting previous savings. As a result, consumption accounts for a substantial portion of income during these phases of life. When income is relatively high during the middle phase of a person's life, he is able to save more, and later on, these savings are utilized to pay post-retirement consumption, resulting in a reduced fraction of income being consumed in the current period of time (Xiao & Liao, 2018; Yun et al. 2024).

The most basic version of the LCH assumes that the consumer's lifetime arranging possibility, joined with the expected proportionality between spending and permanent income, guarantees that no net lifetime savings are arranged, and that transfers to beneficiaries are simply equivalent to their own underlying legacy. Changes in the current income affect current spending just to the degree that they are permanent, necessitating a recalculation of lifetime consumable assets. The impact of transient income increases on spending is expected to be minor (Ammad & Ahmed, 2020). Each of the three theories is based on the microeconomics theory of consumer decision. This is particularly valid for the LCH and PIH hypotheses, which explicitly imply that rational buyers seek to maximize utility by dispensing their permanent incomes (i.e., their long-lasting stream of income) for lifetime spending. Conversely, the Relative Income Hypothesis (RIH), contradicts the fundamental assumption that an individual's choices should be independent of others' consumption patterns, and hence goes against mainstream microeconomic theories of consumer behavior. This is one of the reasons that the RIH has failed to evoke the same level of empirical interest as the PIH and LCH approaches (Al-Gahtani et al. 2020).

Figure 1 shows the consumption is measured on the vertical axis in million US dollars. In Kazakhstan, the consumption has increased steadily from 1993 to 2020. The ups and down is noticed in Kyrgyz. In Tajikistan and Uzbekistan, the consumption remains constant as compared to Kazakhstan and Kyrgyzstan. Kazakhstan and Kyrgyzstan are the consumption-based economies in the Central Asian countries. These two countries spend more income on consumption.



Source: World Development Indicators (2022), World Bank

Figure 1: Household Consumption Trends in Central Asia

Overall, the gross domestic product (GDP) consists of consumption, investment, and net exports. The largest element of GDP is consumption. More consumption means a higher effective demand of an economy. According to the Keynesian effective demand concept, higher effective demand results in more production and employment opportunities. The reason for conducting this study is that it is the first and latest study for the Central Asian countries. This article aims to suggest some policy measures for policymakers.

The Central Asian countries recently got freedom from Russia with the collapse of the Soviet Union in 1991. The present study is important because it will be helpful for the policy makers in developing effective policies for the Central Asian countries, whether these policies will be consumption-oriented or saving-oriented. This article is the first and latest study for the Central Asian countries. Consequently, the prime objective of the current paper is to investigate the consumption function for selected Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan) using data from 1993 to 2020. The Central Asian countries are selected for this research because the extant literature exhibits that there are no solid empirical studies on testing the consumption function for these countries, and their examination is indispensable. The income of a consumer is divided by the consumer into two parts: consumption and saving. Some part of income goes to savings, and savings is that part of income that is not consumed. However, in every economy, about 60 to 70 percent of the GDP is spent on consumption. This means that income earned is mostly utilized for consumption purposes in these countries, and it is one of the major components of GDP.

Consumption can play a crucial role not only in the determination of the aggregate demand but also plays a key role in the production and supply of goods in an economy. Therefore, it is important to analyze the consumption function for Central Asian countries, to know the people's tendency towards consumption, and what proportion of their income they save and consume. These findings will be helpful for the management authorities in formulating policy related to the consumption and saving for achieving macroeconomic stability and enhancing the level of economic growth and development for Central Asian countries.

This article consists of five sections. In section one, the introduction of the study with a brief objective and importance is already presented. The theoretical and literature review is given in section two. Section three is concerned with the data and models information. Section four consists of empirical results of the study. The conclusion is given in section five.

2. Literature Review

2.1 Theoretical Literature

The theoretical link between income and consumption is explained through the Keynesian consumption function. The consumption is influenced by many factors, such as income, prices, population growth, taste, etc., but is most importantly affected by current income, as argued by Keynes (1936) in AIH; Duesenbury (1949) in RIH; Friedman (1957) in PIH, followed by Modigliani (1963) in LCH. These theories are different from each other in some basic facts, but the theme of each theory is almost the same: “*Consumption and Income relationship*”. Absolute income is the most important predictor of consumption in Keynes's consumption theory, and the amount devoted to consumption is determined by the marginal willingness to consume, dependent on personal disposable income. Keynes used a psychological approach to consumption, rejecting the utility maximization consumer model. Duesenberry (1949) improved on Keynes' method by highlighting the importance of psychological and social variables in consumer decisions (the relative income hypothesis). Duesenberry's analysis comes to similar results about the effect of income on consumption and supports the Keynesian theory. The life-cycle hypothesis of Modigliani & Brumberg (1954) and Friedman's (1957) permanent income hypothesis emerged as two more alternatives to Keynes' and Duesenberry's approaches. Modern orthodox consumption theories are generalizations of these two theories in a rational expectations framework. In the life-cycle and permanent income hypotheses, and much less so in contemporary orthodox consumption theories, current or relative income plays a minimal role.

2.2 Empirical Literature

Many studies have been done on the relationship between income and consumption. For instance, Manitsaris (2006) examined the AIH and PIH for European Union economies. The study's findings revealed that the European economies studied supported the PIH. Khan (2010) investigated the validity of the AIH and PIH for Pakistan and discovered that the PIH is invalid. In 2012, Khan et al. investigated the consumption function for Pakistan. The outcomes of the study verified the AIH for Pakistan. Altunc and Aydın (2014) tested the consumption function for eight OIC countries over 1980-2010. Their results supported the permanent income hypothesis and the ‘adaptive expectations model’. Nikbin and Panahi (2016) estimated the private consumption function employing time series data from 1978 to 2012 and the ARDL approach. The result found that the GDP have positive impact on private consumption but showing negative relationship with inflation. The study of Xiao and Liao (2018) empirically tested the Keynesian and life-cycle hypotheses for China using yearly data from 1978-2013. The findings depicted that all Chinese citizens are irrational consumers; however, the causes of irrational consumption differ amongst the citizens, with urban residents experiencing money illusions while rural inhabitants experiencing over-reaction to price fluctuations.

Similarly, Yasmeeen et al. (2019) investigated the relationship between income and consumption in rural Chitral, Pakistan. The analysis was based on the Keynesian consumption hypothesis (AIH). The study used the OLS technique and primary data for the analysis. The results verified that Keynesian AIH is worth working on and that consumption in District Chitral is determined by income. Bilik and Kok (2020) analyzed the consumption function for the European Union using panel data from 2000 to 2017 and GLM & GMM approaches. The result found that the PIH is applicable for the European Union countries, which are verified through both methods. Laiqat et al. (2018) investigated the AIH and PIH validity for the Chinese economy by utilizing the yearly data from 1970 to 2016. The results were against the PIH applicability and supported the AIH validity in the case of China. Gahtani et al. (2020) estimated the life-cycle consumption model using time series data from 1970 to 2017 and the ECM for Saudi Arabia. Their results revealed that income and wealth had significant impacts on consumption.

Consumption is fundamental to human well-being and represents a primary economic objective for individuals across income groups, whether residing in urban or rural areas. Kasturi et al. (2023) estimated consumption functions for rich and poor households in rural and urban areas across India and its twenty-eight states. The findings indicate that the marginal propensity to consume (MPC) at the macro level, based on time-series data from 1990 to 2020, is 49.8 percent. However, micro-level household data reveal that although income continues to have a positive and statistically significant effect on consumption, the MPC is considerably lower than the macro estimate. The results further show that consumption levels are higher in urban areas compared to rural areas, and substantial inter-state variations are evident across India. Ebadi & Are (2023) investigated the asymmetric behavior of U.S. consumption using disaggregated quarterly expenditure data on durables, nondurables, and services covering the period 1994–2019. Employing a nonlinear autoregressive distributed lag (NARDL) model with a regime-switching framework, the analysis reveals that consumer responses differ between periods of economic expansion and contraction. The findings show significant asymmetry in the consumption of durables in the long run and in services in both the short and long run, while no such asymmetry is detected for nondurables. Given that services contribute more than 40 percent to total U.S. output, the evidence of slow adjustment toward equilibrium and an income elasticity below unity suggests that services function more as necessities than luxuries for consumers. Overall, the results highlight services consumption as the central driver of U.S. consumer behavior and indicate that monetary policy exerts only a limited influence on aggregate consumption.

Poudel (2024) examined Nepal’s aggregate consumption function over the period 2000–2022 using the Auto-Regressive Distributed Lag (ARDL) model. The key determinants considered include real income, the real exchange rate, the interest rate, and the inflation rate. The ARDL bounds testing approach confirms the existence of a long-run equilibrium relationship among these variables. The results indicate that real income has a statistically significant and positive impact on consumption, whereas the real exchange rate, interest rate, and inflation rate exhibit negative coefficients. In the long run, real depreciation of the domestic currency is associated with a decline in real economic activity, including consumption. The real interest rate influences consumption through substitution effects, while inflation affects aggregate consumption via real balance effects. The estimated error correction term ($\gamma = -0.892$) suggests a strong speed of adjustment toward long-run equilibrium following short-run shocks. In similar way, Yun et al. (2024) developed a conceptual framework for estimating and analyzing household consumption functions in the state. To achieve this objective, the study employs a narrative review of existing literature to construct the proposed framework. The resulting framework is intended to identify the key factors underlying household consumption behavior and to assess whether the estimated consumption function aligns with the predictions of the Permanent Income Hypothesis. Ultimately, the study aspires to generate valuable empirical insights that can support policymakers in formulating effective strategies to improve the welfare of households living in poverty in Sabah.

Estimating the consumption function is crucial for guiding policymakers in designing strategies that foster sustainable economic growth, reduce poverty, and enhance social development (Poudel, 2024). After going through the literature (i.e., a few studies presented), it can be seen that the consumption function has its own values and importance in macroeconomics, which is supported by both the theoretical and empirical results. On the basis of the consumption pattern, one can forecast the consumption and savings of an economy. This article is an attempt to analyze the consumption patterns of the Central Asian countries. The current study is an important addition and contribution to the existing literature, because to date, none of the previous studies have been carried out on this issue for the Central Asian countries.

Table 1: *Selected Studies on Consumption Function*

Author(s)	Sample Period,	country(s),	Dependent Variable	Independent Variables	Estimated coefficient (t-ratio)
Habanabakize (2021)	2008Q1-2020Q2, South Africa, ARDL		Total household expenditure	Disposable income, price, exchange rate	0.2108 *

Aropova (2018)	1991-2015, Asia, Panel Regression	Consumption	GNI, Interest, Population,	0.8209*** 0.0631**, 0.0805**
Khan et al (2014)	1975-2012, Pakistan, OLS, AEG, ECM	Consumption	GDP, lag of consumption	0.604 (4.18) 0.696 (9.21)
Khan (2014)	300 Households, Pakistan, OLS	Consumption	Income, education, age, family size	0.566 (9.41) 0.446 (4.773) -0.173 (-2.246)
Ofwona (2013)	1992-2011, OLS	Household Consumption	Household Income	0.116 (9.38)
Akekere & Yousuo (2012)	1981-2011, Nigeria, OLS	Household Consumption	Household Income	0.671 (41.22)
Bin & Renjing (2012)	1997-2009, China, ELESE	Consumption	Per capita disposable income	0.017 (6.21)
Shaikh (2012)	1974-2010, Pakistan OLS	Private Consumption	Net Income	0.791 (114.46)
Hui-min (2010)	1978-2009, China, OLS, ECM	Consumption	Income	0.464 (3.160)
Barot (2006)	1970-1998, UK, Sweden, ECM	Private consumption	Disposable income, worth	0.39 (7.3) 0.26 (5.6)
Abeysinghe & Choy (2004)	1978-2003, Singapore, OLS, ECM	Consumption	Income, wealth	0.64 (13.7)
Breido & Tregub (2000)	1961-1996, USA, OLS	Consumption	Disposable income	1.03***
Carroll (2001)	1970-2000, Panel regression	Consumption	Income	0.7612*
Bunting (1989)	1929-1982, USA, OLS	Consumption	Income	0.931 (105.34)

Source: Author's compilation

3. Data and Methodology

3.1 Data and its Sources

In order to analyze the consumption function, the study utilized time series annual data from 1993 to 2020. The data has been taken from World Development Indicators (WDI), World Bank, 2022. All the data are in current US dollars.

3.2 Empirical Model

This study is based on Keynes's (1936) consumption function. The same function was used by Laiqat et al. (2018) for China; Xiao and Liao (2018) and Gahtani et al. (2020) for Saudi Arabia; Yasmeen *et al* (2019) for Pakistan, and Poudel (2024) for Nepal. The standard form of the Keynesian consumption function is as follows:

$$C = C_0 + cY \quad (1)$$

$$C_0 > 0, 0 < c < 1 \quad c = \text{MPC}$$

The above function can be written in econometrics form as follows:

$$C_t = \alpha + \beta Y_t + \mu_t \quad (2)$$

Where C = Household consumption in millions US dollar, t = time period, α = Autonomous consumption, β_1 = Slope, Y = Income in million US dollar, and μ = error term

3.3. Estimation Techniques

3.3.1 Augmented Dicky Fuller (ADF)

The unit root test, namely ADF, developed by Dickey and Fuller, is applied. In an autoregressive time series model, the ADF tests empirically test the null hypothesis, i.e. unit root is present. An alternative hypothesis, the time series model lacks a unit root. Because the study used time series data, it's crucial to check the series or data for the unit root. Most of the time series data is not stationary, i.e., the data have unit root. The article utilized the ADF test to check the unit root.

3.3.2 Auto-Regressive Distributed Lag (ARDL) Model

The ARDL model of Pesaran et al. (2001) is used to explore the effect of income on consumption. The ARDL technique is powerful and superior to other approaches because (1) it incorporates the lag of the dependent variable in the model, (2) ARDL can be applied if the factors are integrated of I(0), I(1), or a mixture of both, (3) ARDL gives short and long run results simultaneously. Equation (2) can be written in ARDL form as follows.

$$\Delta \ln(CON)_t = \beta_0 + \sum_{t=1}^p \beta_1 \Delta \ln(CON_{t-i}) + \sum_{t=1}^p \beta_2 \Delta \ln(Y_{t-i}) + \lambda_1 \ln(Y_{t-i}) + \mu_t \dots \dots (3)$$

Where β_0 the intercept, μ_t is the random error term, and $t-i$ denotes the number of lags (i.e., $i=1, 2, 3, \dots$). The error correction elements are addressed by β_1 and β_2 . The long-run elements are shown by λ_1 . The words with the delta (Δ) sign denote short-run elements, while the lambdas (λ) represent the long-run elements. The study converted the model into log-linear form to evaluate the consumption function and measure the direct elasticities (Aropova, 2018). The heteroscedasticity problem can also be reduced by taking the log.

The short-run estimates can be depicted using the Error Correction Mechanism (ECM) in the presence of co-integration, according to the Granger representation theorem (Maddala, 1992). Equation (3) determines the representation of ECM as follows:

$$\Delta \ln + \sum_{t=1}^p \beta_1 \Delta \ln(CON_{t-i}) + \sum_{t=1}^p \beta_2 \Delta \ln(Y_{t-i}) + \lambda_1 \ln(Y_{t-i}) + \Phi ECM_{t-1} + \varepsilon_t \dots \dots (4)$$

Where ECM_{t-1} is the error correction mechanism term and reflects the rate at which the system adjusts to the long-run equilibrium.

4. Result and Discussion

This section presents the results and discussion of the study. The section consists of descriptive statistics, unit root (i.e., ADF), and ARDL test results. In Table 2, the descriptive statistics of the consumption and income for the Central Asian countries are given. The data are in US million dollars. For Kazakhstan, the average consumption is 62845.87 million US dollars, and the average income is 112087.8 million US dollars on average. The maximum consumption is 114574.4 million dollars, and the maximum income is 186205.1 million dollars. Similarly, for Kyrgyz data, the average consumption is USD 4248.882 million, while income is 4670.84 US million dollars. The maximum consumption and income are 6759.12 and 7320.68. This implies that in Kyrgyzstan, about 90 percent of income is spent on consumption expenditures. The average consumption is 21815.13 million dollars, while the average income is 36621.81 million dollars in Tajikistan. This implies that 60 percent of income is spent on consumption expenditures in Tajikistan. Consequently, the average consumption and income are 3846.04 and 5016.87 US million dollars in Uzbekistan. Kazakhstan and Tajikistan are richer countries economically compared to Kyrgyzstan and Uzbekistan. The more income they have, the more they consume.

Table 2: Descriptive Statistics Summary

Counties	Kazakhstan		Kyrgyzstan		Tajikistan		Uzbekistan	
	C	Y	C	Y	C	Y	C	Y
Mean	62845.87	112087.8	4284.88	4670.84	21815.13	36621.81	3846.04	5016.87
Median	55712.93	109503.8	4414.10	4479.98	11060.43	20242.11	3308.44	4095.12
Maximum	114574.4	186205.1	6759.12	7320.68	57103.07	87622.91	9852.44	11296.34
Minimum	28829.80	58837.41	2154.31	2601.51	5610.551	9542.79	209.023	824.392
Std. Dev.	30402.89	44132.52	1562.81	1498.95	17784.89	27489.10	3124.68	3852.65

Note: Data are in US dollars

Table 3 shows the important components of Keynesian consumption function, i.e. average propensity to consume (APC) and marginal propensity to consume (MPC). APC falls with an increase in income. APC is greater than 1 ($APC > 1$) when consumption is greater than income. APC is equal to one where consumption is equal to income ($APC = 1$). $APC < 1$, when consumption is less than income. MPC value lies between 0 and 1 ($0 < MPC < 1$). MPC of the poor is more than rich. MPC falls with a successive increase in

income (Keynes, 1936). In 1994, the APC was 0.78, the MPC was 0.04, and the MPS was 0.96 in Kazakhstan. As the income increases, the APC decreases. Similarly, during 2020, APC, MPC, and MPS were 0.53, 0.41, and 0.59, respectively. In the case of Kyrgyzstan, during 1994, APC was 0.78, MPC was 0.63, and MPS was 0.37. In 2020, APC was 0.75, MPC was 0.88, and PMS was 0.22. In the same way, in Tajikistan, APC was 0.26, MPC was 0.40, and MPS was 0.60. Similarly, APC was 0.73, MPC was 0.82, and MPS was 0.18. With an increase in income, the APC declines gradually. The APCs, MPCs, and MPSs of Uzbekistan are also shown in the table during the time period. Kyrgyzstan and Uzbekistan were still poor countries compared to Kazakhstan and Tajikistan.

Table 3: *APC, MPC, and MPS in Central Asian Countries*

Country	Kazakhstan			Kyrgyz Republic		
Year	APC	MPC	MPS	APC	MPC	MPS
1993	0.71	----	----	0.76	---	---
1994	0.78	0.04	0.96	0.78	0.63	0.37
2000	0.62	0.63	0.37	0.66	0.58	0.42
2007	0.45	0.43	0.57	0.87	0.65	0.35
2014	0.48	0.70	0.30	0.96	0.31	0.69
2020	0.53	0.41	0.59	0.75	0.88	0.22
Year	Tajikistan			Uzbekistan		
1993	0.13	----	----	0.56	----	----
1994	0.26	0.40	0.60	0.50	0.31	0.69
2000	0.79	0.92	0.08	0.57	0.87	0.13
2007	0.88	0.38	0.62	0.49	0.48	0.52
2014	0.83	0.46	0.54	0.62	0.57	0.43
2020	0.73	0.82	0.18	0.58	0.74	0.26

Note: ---- Data for aggregate consumption and GNI for the selected countries were not available for 1993 on World Development Indicators (2022), World Bank. Hence, the MPC and MPS are not computed for 1993.

As the current study is based on time series data, it is vital to ensure that the series is stationary or not? The data was checked for stationarity by using the ADF test. According to the null hypothesis, the variable is not stationary. The alternative hypothesis, on the other hand, is that the variable is stationary. When the estimated ADF value in absolute form is greater than the absolute critical value at 1% or 5%, the null hypothesis of the presence of a unit in the data is rejected. The ADF results for each country are given in Table 4. The ADF results show that all the variables have a unit root at the level but become stationary at 1st difference at 1% and 5% levels of significance. Now the data is stationary and suitable for regression.

Table 4: *Augmented Dickey Fuller (ADF) test Results*

Country	At level		At 1 st Difference	
	C	Y	C	Y
Kazakhstan	-1.3567	-0.6077	-3.8382***	-3.9048***
Kyrgyz Rep	-0.3788	0.1279	-4.1811***	-5.7485***
Tajikistan	-1.1796	-1.1102	-2.9773**	-2.9147**
Uzbekistan	-1.3163	-0.8044	-4.8341***	-3.5932***

Note: ** & *** show significance level at 5% and 1% respectively

4.2 ARDL Co-integration Result (Bound's Test)

According to Pesaran et al. (2001), the ARDL bounds test is used to test for co-integration. The main advantage of the ARDL technique is that one can estimate co-integration regardless of whether the elements are integrated in the same order or not. Another benefit of the approach is that it analyzes both long- and short-term results at the same time.

Because of its limited sample size feature, the ARDL technique outperforms Johansen co-integration. The null hypothesis of the approach indicates that there is no co-integration between the components, while the alternative hypothesis states that there is co-integration. The ARDL co-integration test produces two bounds: a lower bound and an upper bound. If the estimated F-statistic value is greater than the critical F-statistic value for the upper bound, then the null hypothesis of no co-integration is rejected. In contrast, the null hypothesis isn't rejected when the calculated F-statistic value is less than the F-statistic value of the lower bound. However, if the estimated value of the F-statistic lies between the lower and upper bounds, the bound test is inconclusive.

Table 5: Bound's Test Results

Countries	F-statistic Value	Countries	F-statistic Value
Kazakhstan	23.58***	Tajikistan	5.80**
Kyrgyz Rep	6.77**	Uzbekistan	40.83***

Source: Null Hypothesis: No long-run relationship exists,

The presence of a long-run association between the elements in the model is demonstrated via co-integration analysis. Table 5 shows the results of the bounds test for co-integration among factors that influence consumption. The computed F-statistic value for Kazakhstan and Uzbekistan is greater than the F-critical values at 1%. In the case of Kyrgyzstan and Tajikistan, the computed values (5.80 and 6.77) are greater than the critical values. The bounds test result for co-integration demonstrated the occurrence of a long-run connection between the factors, thus the null hypothesis is rejected. The bounds result of ARDL affirmed that the variables are co-integrated.

4.3 Long Run Results

The long-run results of the consumption function are presented in Table 6. The coefficient of income is 1.32, which demonstrates a significant impact on consumption of Kazakhstan at the 1 percent level of significance, showing that if income increases 1%, consumption increases by 1.32% in the long run. This result is justified and verified by the consumption function, as the income of Kazakhstan increases, consumption also increases. The outcome is in accordance with the theory. The same result was found by Laiqat et al. (2018) for China, Gahtani et al. (2020) for Saudi Arabia, and Poudel (2024) for Nepal. In the case of Kyrgyzstan, the coefficient of income is 1.23, which depicts a positive and significant effect on consumption at a 1 percent significance level. In the long run, a 1% rise in income increases consumption by 1.23 percent. In Tajikistan, a 1% rise in income leads to a 1.07 percent increase in consumption over time. The same result was found by Khan et al. (2012) for Pakistan, Gahtani et al. (2020), and Poudel (2024) for Nepal. In the case of Uzbekistan, the coefficient of Income is 0.97, which means a significant and positive effect on consumption. With a 1 percent rise in income, consumption will rise by 0.97 percent in the long run. A similar result was found by Xiao and Liao (2018) for China, and Poudel (2024) for Nepal. The robustness of the results is also checked by the panel result. The panel result showed that the income has a favorable (positive) and significant impact on consumption in the selected Central Asian countries in the long run.

4.4 Short Run Results

The ARDL technique is used to estimate the ECM (Error Correction Mechanism) short-term results. In the case of Kazakhstan, the income has a positive and statistically significant effect on consumption at a 1 percent significance level. With a 1 percent increase in income, consumption will increase by 0.63 percent. The ECM value is significant and with the correct negative sign, showing the speed of adjustment and confirming the co-integration between variables. If there is any short-term disequilibrium, it will return to equilibrium in one year by 48 percent. A similar result was found for Kyrgyz; the income has a significant impact on consumption.

In the same way, in Tajikistan, income has a positive and significant impact on consumption at a 1% level of significance. If a 1 percent increase in income consumption will increase by 0.98 percent means more elastic. The ECM value is significant, and with a negative sign, shows that if there is any short-term disequilibrium, it will return to equilibrium in one year by 50 percent.

In the case of Uzbekistan, the income has a positive and statistically significant effect on consumption at a 1 percent level of significance. If income increases by 1 percent, consumption will increase by 1.32 percent. But this result is opposed to the consumption function as Keynes argued that the value of MPC lies between 0 and 1. The ECM value is significant and with the correct sign, shows the speed of adjustment. If there is any short-term disequilibrium, it will return to equilibrium in one year by 50 percent.

Table 6: Long run and short run ARDL Results (Individual countries and Panel)

Variables	Kazakhstan	Kyrgyz Republic	Tajikistan	Uzbekistan
<u>Long Run Results</u>				
Y	1.3129***	1.2314***	1.0732***	0.9669***
	26.3129	11.7028	42.2472	19.7392
C	4.2121***	2.0396**	1.2917***	0.0194
	7.3088	2.3097	4.9453	0.0478
<u>Short run results</u>				
$\Delta(Y)$	0.6262***	0.6135***	0.9820***	1.3166***
	9.3537	4.9433	9.3528	10.0485
ECM(-1)	-0.4770***	-0.4982***	-0.6656***	-0.5174***
	-8.5389	-4.7374	-3.3851	-8.3687
R ²	0.99	0.96	0.99	0.99
Adj-R ²	0.98	0.95	0.99	0.98
F-statistic	8.27	278.95	877.55	734.88
DW	2.38	2.04	2.04	2.28
<u>Panel Long Run Results</u>				
Variable	Coefficient	Std. Error	t-Statistic	Prob
Y	1.0315	0.0360	28.6313	0.0000***
C	0.0681	0.0512	1.3317	0.1861
<u>Panel short run results</u>				
Variable	Coefficient	Std. Error	t-Statistic	Prob
$\Delta(Y)$	0.4205	0.1459	2.8818	0.0049***
ECM(-1)	-0.2544	0.0982	-2.5909	0.0111***

Source: Author's Calculation, * & *** shows significance level at 10% and 1% respectively (t-value)

These results are according to the AIH (Keynes, 1936) and PIH (Friedman, 1957). The short-run results supported the AIH Keynesian theory, while the long-run results supported and verified the PIH of Milton Friedman's theory. Similar result also found by Laiqat et al. (2018) for China; Xiao and Liao (2018); Gahtani et al. (2020) for Saudi Arabia; Yasmeen et al. (2019) for Pakistan, and Poudel (2024) for Nepal. But in the case of Uzbekistan, the coefficient value is greater than 1 in the short run, which contradict with consumption function, as Keynes argued that the MPC value lies between 0 and 1 ($0 < MPC < 1$). Similarly, the panel result (aggregated result) showed the same short-run result as the time series result (disaggregated result). In addition, the estimated consumption function for selected Central Asian countries is given in Figures 2 to 6.

Figure 2: Consumption function for Kazakhstan

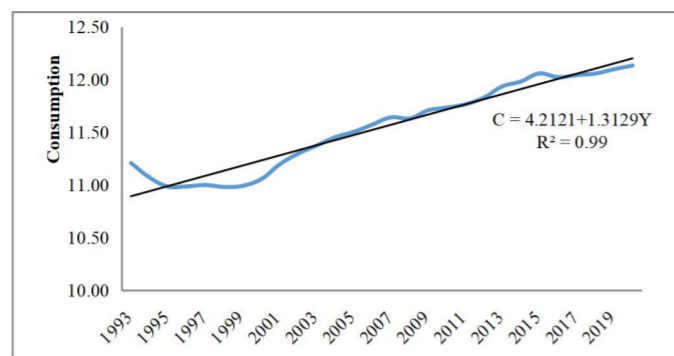


Figure 3: Consumption function for Kyrgyz

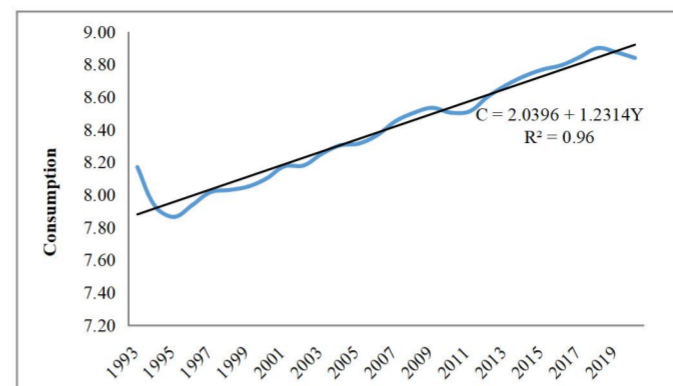


Figure 4: Consumption function for Tajikistan

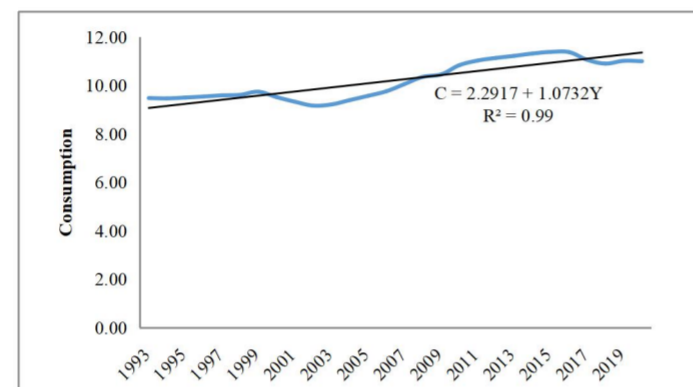


Figure 5: Consumption function for Uzbekistan

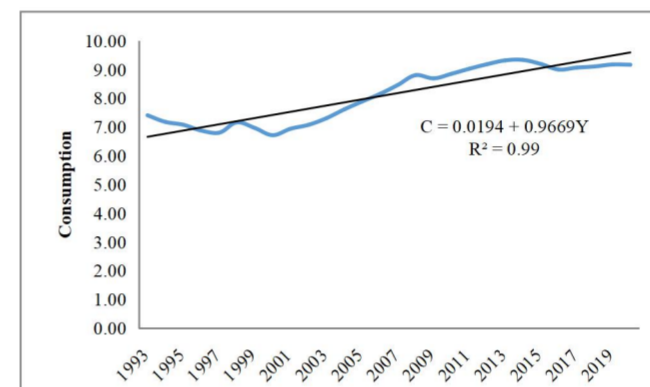
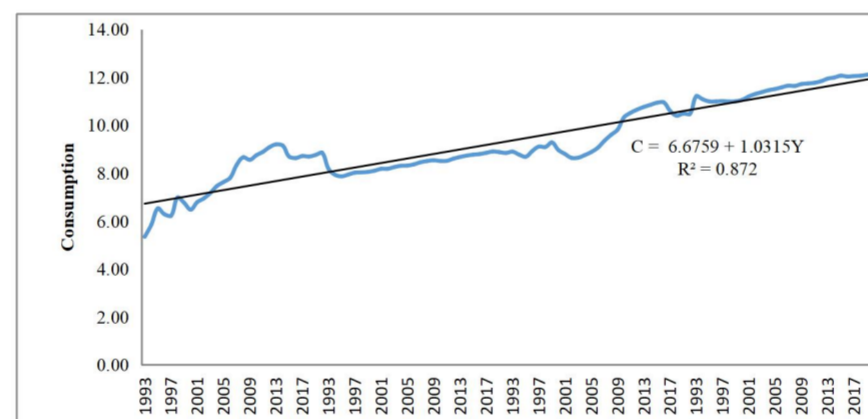


Figure 6: Consumption function for Panel data (For all countries)



5. Concluding Remarks

One of the most important components of GDP is consumption. It is impacted by a number of elements, the most important of which, according to John Maynard Keynes, is income. The link between income and consumption is depicted by the consumption function. The study's major goal is to empirically analyze the consumption function for Central Asian countries. The consumption function was estimated using time series data and the ARDL method. The findings demonstrated a long-term relationship between income and consumption. The findings revealed that income has a long-term positive and significant impact on consumption in the selected Central Asian countries. The study confirmed and verified the Keynes AIH (current income) by short-run results and the Friedman PIH by long-run results for the selected countries. However, the results contradict the Keynesian consumption function as the value of MPC is greater than 1 in Uzbekistan.

On the other side, if MPC increases, MPS decreases because of the inverse relationship existing between the two. Therefore, it is suggested that the policy makers shall take steps to increase the savings of the people. According to Keynes, if saving increases, investment also increases. More investment means more production. If production increases, employment opportunities will be created, and the surplus production will be exported to the international market to earn foreign exchange reserves.

Availability of Data and Materials

Data can be available on request.



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Vol-3, Issue-3, 2025

Competing Interests

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Advance Journal of Econometrics and Finance

Vol-3, Issue-3, 2025

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