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Upturns, Downturns, and U.S. Consumption

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Upturns, Downturns, and U.S. Consumption

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Abstract

This paper examines the asymmetric aspect of U.S. consumption using disaggregated quarterly consumption expenditure data, including durables, nondurables, and services from 1994 to 2019. We apply a novel nonlinear autoregressive distributed lag (NARDL) analysis and find that U.S. consumers behave differently during economic upturns and downturns, with asymmetry existing for the consumption of durables (in the long-run) and services (in both the short and long-run), but not for nondurables. In addition, our results illustrate how U.S. consumers are more confused during economic downturns and receive mixed information, as revealed by the dynamic multiplier. Since services account for more than 40 percent of U.S. aggregate output, the slow adjustment toward equilibrium and income elasticity less than unity proves that services are more of a necessity than a luxury for U.S. consumers. We postulate that service consumption is the primary determinant of U.S. consumer behavior and that smoothing services could solve the puzzle of higher savings for wealthier Americans.

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I. Introduction

Foster (2021) has argued that “the ratio of consumption to GDP has risen steadily over the past half-century" and that "in 2018, the U.S. consumption to GDP ratio was close to its limit." He constructed a model to explain this using an error correction model, including relevant economic theory variables. Despite his analysis, Foster's boldly aggregated picture of U.S. consumption ignores several disaggregated trends, including consumer patterns for durables, nondurables, and services.

As Figure 1 shows, although the consumption-over-GDP ratio (so-called average propensity to consume) has increased over time, only the consumption of durables has followed the same pattern. Nondurables consumption has declined, while consumption of services illustrates an inverted U-shape.

Since services contribute to more than 60 percent of U.S. consumption, this inverted U-shape should influence the total consumption pattern that aggregate consumption cannot illustrate. However, the cross-state average propensity to consume, which considers the median among states, clearly shows that the consumption-to-income ratio has the same pattern as service consumption (Figure 2).[1] The question therefore arises: which component of U.S. consumption responds more to shocks than others, i.e., how do consumers behave during economic upturns and downturns?

During the recent pandemic, we observed how fragile the essential part of the U.S. economy is: the services sector declined by about 12 percent in two quarters. This study shows that adequate macroeconomic policies are necessary for the U.S. economy to avoid falling consumption of services for at least 15 quarters. However, service consumption has recovered within seven quarters, with our model providing evidence for a positive shock in services lasting for almost eight quarters (Figure 18).

[1] The panel data is unavailable for disaggregated data before 1998 (Ebadi, 2022).

To investigate the role of consumption of services and other components in the United States, this paper, for the first time, attempts to reinvestigate the U.S. consumption function by applying the novel framework of nonlinear autoregressive distributed lags (NARDL).

The remainder of the paper is structured as follows. Section II reviews the literature. Section III provides the model and the method of study. Section IV discusses its empirical results. Finally, section V concludes the study.

II. Literature Review

The answer to the question of what determines consumption has different policy implications. For instance, if we consider current income as the sole determinant of consumption, we can describe consumers' behavior and prescribe fiscal and monetary tools to overcome market disequilibria. This idea is plausible, at least in the short run, as consumers have limited information and flexibility in response to market movements. However, in the long run, one could imagine more flexibility and optimal response from consumers, assuming information mobility, making them more responsive to the signals, and shaping their consumption patterns by adapting backward-looking (e.g., past consumption) and forward-looking (e.g., interest rates, prices, and exchange rates) parameters. In addition, assets are more liquid in the long run, and therefore, wealth plays a crucial role in determining consumers' behavior. In other words, liquidity constraints are weaker in the long run than in the short run.

Not long after the Great Depression, Keynes (1936) defined his "fundamental psychological law that men are disposed of, as a rule, and on the average, to increase their consumption as their income increases, but not by as much as the increase in their income" (Keynes, 1936, p. 96). To a scientist, there is no greater joy than finding a universal and invariant rule that can broadly be applied to explain the observed facts. Keynes was no exception, viewing his theory "as a rule" but cautiously adding, "on the average."

At the time of Keynes's remarks, there existed a macroeconomic understanding of aggregate consumption that enabled him to limit the rule with the "on the average" clause. This ensured a discussion could occur around a representative consumer who could play the average consumer role, forming the basis of later classical economists' microeconomic foundations and optimal behavior analysis built upon constraint utility maximization.[2] The distinction between the average propensity to consume (APC) and the marginal propensity to consume (MPC) is an essential aspect of the debate between economists from the two leading schools of thought, as the former (classical) considers equality. At the same time, the latter (Keynesian) postulates inequality, resulting in unitary elastic consumption concerning income for the classical school and a nonunitary pattern for Keynesians.[3] However, the lack of disaggregated data, including durables, nondurables, and services consumption, restricted the discussion surrounding consumption literature in the 1930s. For instance, considering Figures 3-6, Keynes's idea that average propensity to consume (APC) decreases as income rises only applies here to nondurables but not durables, as APC increases with income and services as follows an inverted U-shape pattern.

The falsifiability of the absolute income hypothesis (AIH) presented a challenge for economists, some of whom raised concerns that led to certain modifications and adjustments to the concept. For instance, Stone[4] and Stone (1938), in their budget studies, found statistical evidence to support "Mr. Keynes' General Theory" as they observed the fact that “for individual families, the proportion of income spent and, what is more important, the proportion spent from an increase in income diminishes as income increases.” In addition, “information other than that of changes in Y[income] is

[2] For the discussion of “micofundations,” see Lucas (1976), Kydland and Prescott (1977), and Sargent (1987).

[3] Paradiso et al. (2012).

[4] “Sir Richard Stone, knighted 1978 and 1984 Nobel Laureate in Economics, was one of the pioneers of national income and social accounts and one of the few economists of his generation to have faced the challenge of economics as a science by combining theory and measurement within a cohesive framework” (Pesaran and Harcourt, 2000).

[not] important in explaining changes in the movement of C[consumption], except where a change takes place in the relation of C to Y."

Polak (1939) also confirms the validity of the absolute income hypothesis mentioning that the "influence of all other factors is practically negligible (or in any case not determinable with any certainty) - even that of the distribution of income, if the distinction between labor and non-labor income is taken into account." He found that although the average propensity to consume alters for different income categories, the marginal propensity remains constant.

However, Gilboy (1938) criticized "Mr. Keynes' psychological law" using data from farmers' and non-farmers income and expenditure. Her statistical evidence revealed that "the relation between income, consumption, and savings is neither as simple nor as stable as Mr. Keynes assumes[5] in his statement of the propensity to consume," and she observed "a great diversity in these relationships and a marked increase in income-expenditure elasticity in certain income ranges." Although Brady and Friedman (1947) indicated the importance of regional factors and income distribution effect on consumption patterns, Gilboy (1956) partially corrected her idea and mentioned that regional and occupational differences in consumption patterns are not essential and that the consumption function seems to be stable even considering price changes.

Before releasing U.S. national account data in 1945, researchers applied household budget and survey data to describe consumer behavior. Kuznets's (1946) study was a one-of-a-kind, revolutionary contribution to the literature, adding a long-run time series analysis to test Keynes's theory. He found that the average propensity to consume was constant from 1869 to 1938.[6] However, a closer look at more recent U.S. consumption and its components reveals that, since 1947, the US APC has risen over time with an increase in income (Figure.1). The puzzle is that the APC for durables has increased,

[5] Keynes wrote to Gilboy (1939), "I beg for an occasional re-reading of what I did say!"

[6] Spanos (1989).

while services have shaped an inverted U-curve (so-called hump-shaped). The lesson here is that the period of study matters. The economy's structure is variant and requires new methodologies to be applied to different periods to explore changing facts and new, evolving phenomena, which results in new theories that may partially correct or reject previous hypotheses. The same applies to data availability on disaggregated levels.

Duesenberry (1949), in his relative income hypothesis (RIH), postulated that current income is not the sole determinant of consumption, as consumer behavior depends on the weighted average of the consumption of the other. One would translate this to consumers being concerned about other people's lifestyles and attempting to achieve high standards. Despite some empirical success, the RIH has mysteriously disappeared from the literature.[7] However, his "peak consumption" hypothesis still attracts attention. For instance, Foster's (2021) "diffusion" concept mirrors Duesenberry, and the connection is more apparent when Foster claims the consumption-to-GDP ratio peaked in 2018.[8]

In their life-cycle hypothesis (LCH), Modigliani and Brumberg (1954 and 1980) postulated that people spending on goods and services rely more on their lifetime resources than their current income. Hence, they make intelligent choices for the level of consumption at each period of their life, considering the assets they expect to accumulate until retirement. According to LCH, it seems reasonable to smooth and tailor consumption over the working years and continue the same pattern after retirement.[9] However, credit constraints and uncertainty are two factors that other economists have adapted to adjust the LCH.[10]

Although this theory investigates consumption by considering limited lifetime resources, it is silent regarding disaggregated consumption, including durables, nondurables, and services.[11] For instance,

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[7] Mason (2000) and McCormick (2018).

[8] Recently, the relative income hypothesis attracted more researchers. For instance, see Palley (2010) and his synthetic Keynes-Duesenberry-Friedman model.

[9] Modigliani and Ando (1963 and 1957) and Modigliani (1986).

[10] For instance, see Zeldes (1989), Börsch-Supan and Stahl (1991), and Dotsey et al. (2014).

[11] See Deaton (2005) for a comprehensive review of the life-cycle hypothesis.

the assertion that the average propensity to consume is higher for young and older people without considering durables, nondurables, and services is controversial. Healthcare services are a case in point, as older consumers demand more than other age groups. In addition, the hypothesis exaggerates consumers' intelligence in their decision-making process.[12] Suppose U.S. households are intelligent enough to tailor and smooth their consumption over time based on their lifetime resources. Why should we expect that 73 percent of Americans are likely to die in debt?[13]

Friedman's (1957) permanent income hypothesis was another challenge to Keynes's theory of consumption, claiming that "transitory components of income and consumption are uncorrelated," meaning that consumption depends on permanent income (expected lifetime income). Interestingly, when answering what a man would do with an unexpected windfall, Friedman added the qualifying remark that "the answer to these questions depends greatly on how consumption is defined." Unfortunately, due to a lack of disaggregated data, he had been able to apply empirical data "to only a limited extent."[14]

Using the Euler equation, Hall (1978) formulated the idea that consumption follows a random walk procedure, which makes consumption unpredictable as consumers only adjust their consumption when they receive a new set of information. In other words, consumers smooth and tailor their consumption based on current expectations of their lifetime resources through receiving new information (rational expectation). The idea of rational expectation is observable when we apply methods that include short-run dynamics as consumers gradually respond to changes in the market, adjusting their expectations.[15]

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[12] Employees will only know if their contract will be renewed and can measure their expected lifetime accumulated assets if they attain tenure.

[13] A comprehensive survey found that 73% of Americans are likely to die in debt. That finding comes from the credit reporting agency Experian, which tracks more than 220 million consumers (Fay, 2022).

[14] Friedman (1957).

[15] Romer, D (1993).

The evolutionary process of consumption function has reached the point that the "true structure" for consumption is the "Fisherian framework of intertemporal choices," which has remained a proper invariant representation based on structural realism criteria.[16] Although "micro-foundations" have become the realistic structure in the literature, falsifiability becomes another challenge when realizing consumers' preferences.[17]

While the PIH and rational expectations criticized the efficacy of macroeconomic policies in resolving market disequilibria, many studies challenged the ideas and tested their falsifiability through empirical investigations. For instance, Campbell and Mankiw (1990) found a substantial departure from the PIH as the evidence indicated the role of current income over permanent income for U.S. households. Lusardi (1996) rejected the rational-expectations-permanent-income model predictions and showed that consumption is susceptible to current income. Morley (2007) found that permanent income is relatively volatile, and consumption slowly responds. Upon rejecting the permanent income hypothesis, he suggested other consumption theories, such as habit formation or precautionary saving, to analyze consumers' behavior. In another attempt, Jappelli and Pistaferri (2010) clarified that consumption responds to the anticipated increase in income. If liquidity constraint has no bearing, consumption responds much less to anticipated income declines. This result contrasts with the classical idea of anticipated changes in income neutrality in affecting consumption.

According to the empirical literature, cross-section studies provide more support than time series for the PIH. For instance, Dejuan et al. (2004) and Dejuan and Seater (2006) endorsed PIH in the U.S. The former study cast doubt on the requirement of credit constraints[18], myopia, and risk to "make sense of the aggregate consumption." However, Sabelhaus and Groen (2000) could not find enough support for the hypothesis. This quotation may express the reality and nature of the consumption literature:

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[16] Chao (2007).
[17] Foster (2021).
[18] Carrol et al. (2006).

"What we call the beginning is often the end.

And to make an end is to make a beginning.

The end is where we start from."

T.S. Eliot

In this paper, we benefit from disaggregated U.S. data, including durables, nondurables, and services, to empirically test the hypotheses regarding the consumption function and see whether income is the sole determinant of consumption or if other factors matter. The study will also analyze how confident U.S. consumers are in their decision-making process, moving from a short run basis toward the long run.

III. Model and Methodology

Although Foster (2021) used an error correction model in his estimation, he avoided the idea of cointegration, which holds that the economy moves toward equilibrium in the long run through short-run adjustments. This reminds us of Carroll et al. (2001), who raised a concern that finding a stable cointegration relationship is implausible due to demographic factors and financial system changes.

However, cointegration is informative about consumers' behavior as it uncovers some stable behaviors in the long run. The problem arises when one applies an assumed invariant model to explain a fact over a very long period (for example, 1947-2018). As the economy's structure changes, consumers' behavior alters, and the long-run steady point moves toward another equilibrium until consumers are severely distracted by new sets of information. In addition, specific economic changes may convince them to adjust their behavior to survive (optimal decision). We might add habit formation[19] as another reason to believe there exists a long-run equilibrium that explains consumers' behavior upon a long-term average.

The cointegration approach neither downgrades history nor upgrades it, as the role of a model is to provide a viable explanation for some historical facts rather than describing the whole history. Hence, we consider the aggregate consumption function as follows:

$$c_t = \theta_0 + \theta_1 y_t + \theta_2 e_t + \theta_3 r_t + \theta_4 vix_t + \varepsilon_t \quad (1)$$

Where c is the logarithm of the aggregate consumption expenditure, y is the logarithm of aggregate income, e represents the logarithm of the real effective exchange rate.[20], r denotes the logarithm of the interest rate, and finally, the logarithm of vix (where VIX is the Chicago Board Options Exchange's CBOE Volatility Index) is a proxy for uncertainty.[21] However, unlike the literature, we postulate that consumers behave differently during economic upturns (y_t^+) and economic downturns (y_t^-) which means the aggregate consumption function is not a simple log-linear function but a nonlinear one. In other words, instead of Keynes's current income variable, we have partial sums of the positive and negative changes in current income, not current income per se.

Therefore, the model can be modified as follows:

$$c_t = \theta_0 + \mu_1 y_t^+ + \mu_2 y_t^- + \theta_2 e_t + \theta_3 r_t + \theta_4 vix_t + \varepsilon_t \quad (2)$$

Where y_t^+ and y_t^- are partial sums of positive and negative changes in y:

$$y_t^+ = \sum_{i=1}^{t} \Delta y_i^+ = \sum_{i=1}^{t} max(\Delta y_i, 0) \quad (3)$$

and

$$y_t^- = \sum_{i=1}^{t} \Delta y_i^- = \sum_{i=1}^{t} min(\Delta y_i, 0) \quad (4)$$

[19] Fuhrer (2000).
[20] Following Davidson et al. (1978), this variable captures the wealth effect.
[21] We prefer VIX over other indexes to represent uncertainty (Ebadi, 2022).

The econometrics approach that enables us to estimate the relationship we define above is the nonlinear autoregressive distributed lags (NARDL) method proposed by Shin et al. (2014):

$$\Delta c_t = \alpha + \delta_0 c_{t-1} + \delta_1 y_{t-1}^{+} + \delta_2 y_{t-1}^{-} + \delta_3 e_{t-1} + \delta_4 r_{t-1} + \delta_5 vix_{t-1} + \sum_{i=1}^{p} \gamma \Delta c_{t-i} + \sum_{i=0}^{q} \left(\vartheta_i^{+} \Delta y_{t-i}^{+} + \vartheta_i^{-} \Delta y_{t-i}^{-} + \vartheta_{e,i} \Delta e_{t-i} + \vartheta_{r,i} \Delta r_{t-i} + \vartheta_{vix,i} \Delta vix_{t-i} \right) + \epsilon_t \quad (5)$$

Pesaran et al. (2001) constructed this equation using the well-known autoregressive distributed lags[22] (ARDL) method. This ARDL approach to cointegration performs well with small samples despite having endogenous regressors[23] in the model. It also has an empirical advantage over methods such as dynamic ordinary least squares (DOLS), fully modified ordinary least squares (FMOLS), and maximum likelihood estimation (MLE).[24] It is known that due to excessive aggregation, sample-specific omitted variables, and/or measurement errors correlated with the regressors, the ARDL occasionally provides economically implausible coefficients for specific groups.[25] However, the relationship's nonlinear nature may be another reason behind that fact, as Shin et al. (2014) have attempted to correct the problem partially.[26]

In the model, while $\mu_1 = \frac{\delta_1}{\delta_0}$ and $\mu_2 = \frac{\delta_2}{\delta_0}$ denote the long-run impact of economic upturns (y_t^{+}) and economic downturns (y_t^{-}), respectively, $\sum_{i=0}^{p} \vartheta_i^{+}$ and $\sum_{i=0}^{p} \vartheta_i^{-}$ capture the short-run dynamics of the effect of income on U.S. consumers.

Although the ARDL model encounters invalidity of the cointegration bound test if there exists an I(2) variale in the model, it can be applied if the variables are I(1), I(0), or a mixture of both. Therefore, we apply the Dicky-Fuller (1979) stationary test to ensure there is no I(2) variable in the model.

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22 Pesaran et al. (1999 and 2001).

23 Foster (2021) raised a concern regarding the endogeneity issue as consumption and GDP are correlated by definition, explaining that there is no such thing as systemic correlation. However, even if we assume the problem exists, the method we apply to estimate the model solves the problem.

24 Panopoulou and Pittis (2004).

25 Pesaran and Shin (1999).

26 Our results confirm that the nonlinearity is another reason for the implausible results obtained from the linear ARDL.

Furthermore, to determine the optimal lags in the model, we use the Akaike information criterion (AIC), assuming a maximum of eight lags.

One of the main advantages of the NARDL model is its dynamic multiplier, which enables us to investigate the effect of the positive and negative shocks in the model. The multipliers are defined as follows:

$$m_h^+ = \sum_{i=0}^{h} \frac{\partial c_{t+i}}{y_{t-1}^+} \, , m_h^- = \sum_{i=0}^{h} \frac{\partial c_{t+i}}{y_{t-1}^-}, n = 0, 1, 2, \ldots.$$

Notice that, by construction, $h \to \infty$, $m_h^+ \to \mu_1$, and $m_h^- \to \mu_2$.

We expect to observe $\mu_1 > 0$ and $\mu_2 > 0$ for consumption of durables, nondurables, and services. However, we postulate that μ_1 and μ_2 are pronounced more for durables than nondurables and services. While the real effective exchange rate could carry a positive or negative sign, depending on the effect of currency devaluation (in real terms) on consumption, the interest rate coefficient would be negative as consumers replace consumption with increased saving based on the intertemporal choice framework.[27] In addition, we expect the uncertainty to hurt consumption, but the magnitude would be different. Although the core objective of this paper is to test the asymmetry of the long-run and short-run effects of economic activity on consumption, we discuss the model's predictive power. In addition, we provide some interpretations of the theories around the consumption function.

IV. Empirical Results

We use quarterly disaggregated data for durables, nondurables, and services consumption collected from the Federal Reserve of St. Louis[28] (FRED) from 1994 to 2019.[29] Since the Dicky-Fuller (1979) stationary test confirms there is no I(2) variable in our model, we estimate the model for each

[27] The real effective exchange rate has another advantage as it increases degrees of freedom in the model, allowing it to simultaneously contain foreign and domestic prices.
[28] Economic Research Division, Federal Reserve of St. Louis (2021).
[29] The study period is shorter due to the limited availability of a real effective exchange rate.

component of U.S. consumption using the ARDL specification and then apply the NARDL approach to test the asymmetry of the effect of the income variable.

The ARDL estimation results for consumption of durables (Table 1) reveal a positive effect of the income variable (assuming a symmetrical effect), as the elasticity is about 2.76 (far beyond unity). While the real effective exchange rate coefficient is positive, the interest rate and the uncertainty proxy coefficients are negative, as expected. In addition, the model performs well regarding serial correlation based on the L.M. test, and the Ramsey Reset test confirms misspecification in the model. We observe instability in our model, as the CUSUMQ shows, but the CUSUM test confirms the model is stable during the study period. The bounds test confirms cointegration among the model variables, and the error correction coefficient (-0.22) provides additional evidence for this.[30] The adjusted R-squared reveals that the variables explain 42 percent of the variation in U.S. durables consumption in the model.

When we apply the NARDL model, we obtain the income elasticity of consumption to be 2.59[31] during economic upturns and 1.50 during economic downturns[32] (Table 2). Neither classical economists, who postulate equality between the average and marginal propensity to consume, nor Keynesians, who hypothesize an inequality between those two factors, can explain the phenomenon. Interestingly, in the NARDL model, the real effective exchange rate, the interest rate, and the uncertainty[33] coefficients become smaller but carry a correct sign and remain significant. This could signal the nonlinearity in the model specification and partial sums contribution.

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[30] Banerjee et al. (1998).

[31] This result aligns with Kaplan (1938) as consumers become optimistic and create debt during economic upturns. Jappelli and Pistaferri (2010) also discussed that if liquidity constraint has no bearing, we could expect much less response to anticipated income declines.

[32] This rejects Duesenberry (1949), who postulated the marginal propensity should rise in downturns.

[33] The negative effect of uncertainty on the consumption of durables is in line with Romer, C. (1990) and Ebadi (2022).

The results denote a better model specification and stable performance, as the Ramey RESET test and CUSUMQ verify.[34] However, recursive residuals provide some evidence of instability in Q4 2002 and Q3 2004 (Figure 7-8). Since the Chow breakpoint test supports structural breaks when we include the instability dummies, the coefficients are insignificant, and the other coefficients in the model experience a slight change. We should add a recursive least squares coefficients plot as more evidence of stability in our model (Figure 9).[35]

There is still no serial correlation in the model. While the bounds test confirms cointegration among variables in the model, the error correction coefficient has increased (about twofold) with the NARDL specification (-0.42), which means a higher speed of adjustment toward equilibrium.[36] The dynamic multiplier shows that a one percent positive shock to the income variable boosts durables consumption for almost seven quarters. However, a negative shock lasts about 11 quarters (Figure 11). It is worth mentioning that during 2007-2008 the decline in durables consumption lasted for almost eight quarters, and it took approximately the same time to return to pre-recession levels (Figure 10).The impact of stimulus packages during the pandemic lasted almost seven quarters. The lesson from the Great Depression was that we should avoid waiting to see further deterioration in economic activities. The data naturally reveals the fact that we have learned this lesson.

The dynamic multiplier reveals another exciting aspect of consumption of durables, as we observe more confusion among consumers during recessions than in expansionary periods.[37] According to the "rational expectation" hypothesis, consumers adjust their behavior as soon as they receive new information. By contrast, the adjustment process reveals that U.S. consumers receive mixed

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[34] Carroll et al. (2001): the critique must be validated throughout our study as we expect a slight change in demographic factors and the financial system from 1994.

[35] Suppose we add more data to the estimating model. In that case, significant coefficient variation is a strong signal of instability, as dramatic jumps in the coefficient plots indicate that the equation is dealing with a structural break.

[36] The result rejects Caballero's (1993) slow adjustment hypothesis for durables.

[37] Kaplan (1938) found that "Americans are certainly not a regimented people." This fact might be another reason behind their confusion during economic downturns.

information (both positive and negative), and so optimism tends to be mixed with pessimism for some time.

We conduct an asymmetry test using the Wald test to investigate if the effect of income on U.S. durables is symmetric in the short and long run. The Wald test indicates the existence of a long-run asymmetry but short-run symmetry. When we compare the partial sums of positive and negative effects of income, we observe a higher impact from economic upturns than from downturns on the consumption of durables. One interpretation is that U.S. consumers are more optimistic than pessimistic when they deal with recessions and expansions, as they increase their consumption of durables at a higher rate during growth periods.

Our model is used to forecast durables consumption (level and first difference) beyond the period of this study (Figure 12-13). As the proportions of bias, variance, and covariance illustrate, the model performs well in forecasting. We present our forecasting method here to challenge the unpredictability of consumption.

In another attempt to test the sensitivity of our coefficients, we drop the variables (doing so from the last variable to reach the first regressor, the primary determinant). First, the model is only stable when we include all the defined variables we use to investigate durables consumption. Second, the model completely collapses (no cointegration and stability) when we have income as the only regressor. Although other variables have a less pronounced effect on durables consumption, dropping those variables significantly affects the model's performance. Third, the income elasticity of durables consumption during economic downturns responds more dramatically to eliminating variables than income elasticity during economic upturns. This fact attributes to consumers' behavior becoming more complex during recessions as they are likely to be more pessimistic and consider different factors in their decision-making than when they are optimistic and follow a simple pattern.

For services consumption, using the ARDL model, we obtain a positive and less than unity (0.89) elasticity of consumption concerning economic activity (Table 3). While the real effective exchange rate carries a positive sign, it is not significant. The reason should be that most services are non-tradable, and the exchange rate should be irrelevant. The same applies to uncertainty, as its coefficient is insignificant. This fact can be translated to the importance of services in the U.S. consumption basket, as consumers are reluctant to reduce their consumption of services significantly, even under conditions of uncertainty.

According to diagnostic tests, there is no serial correlation or misspecification issue in the model, and both the CUSUM and CUSUMQ tests confirm that the model is stable. The bound test verifies the cointegration relationship in the model as the error correction term is about -0.15, which defines a slower adjustment toward equilibrium when we compare it with durables. In addition, the variables in the model explain about 67 percent of the variation in services, which verifies the higher deterministic power of the variables for services than for durables.

When we apply the NARDL approach, services consumption responds differently to economic upturns and downturns in the short and long run (Table 4). The model reveals the income elasticity of services consumption to be 0.87 during economic upturns and 0.74 during economic downturns (i.e., the average propensity to consume is greater than the marginal propensity to consume). These coefficients are far below the coefficients of the income variable for durables consumption, which translates as services being more of a necessity than a luxury. According to diagnostic tests, there is no evidence of serial correlation and misspecification. While the model seems stable based on the CUSUM and CUSUMQ tests, recursive residuals provide some evidence of instability. Since the Chow test denotes a breakpoint in Q3 2008, we add a dummy for stability. However, the coefficient of the dummy is insignificant and has a minor effect on other coefficients in the model (Figure 14-15). Our recursive least squares coefficients plot is additional evidence for the stability of coefficients in the model (Figure 16). When we test the sensitivity of the coefficients dropping the variables, the results reveal evidence of serial correlation, misspecification, and instability. Again, income has more deterministic power than other variables in the model, but we should consider those variables statistically.

Although the asymmetry test can convincingly distinguish between economic upturns and downturns, the results are slightly different for other variables in the model. Likewise, the NARDL performs well as a diagnostic test to verify serial correlation, model specification, and stability. However, the speed of adjustment toward equilibrium has risen in the model to -0.24. The deterministic power of the variables to explain the variation in service consumption has also slightly increased, from 66 percent to 70 percent. Furthermore, consumers seem more confused during economic downturns than in upturns. The dynamic cumulative multiplier proves that consumer behavior is more stable for services consumption than durables. However, the downward shocks to this behavior are more severe, which is reasonable as services remain at the core of the U.S. household's basket (Figure 17-18). The coronavirus pandemic provided evidence that service consumption is more fragile during economic downturns, regardless of the reason for the decline in economic activity.

We have two exciting facts to discuss. First, previous consumption (backward-looking factor) decreases the consumption of durables, services, and nondurables, although it is not the only determinant of consumption (Hall, 1978). Second, in the case of services, the inverted U-shape of the average propensity to consume raises the question of whether the U.S. economy is saturated with services.[38]Third, a closer look at the personal saving rate (Figure 19) and the average propensity to consume reveals a potential connection between saving and service consumption.[39] Since services

[38] Pagel (2017) discussed that risk aversion and preferences generate a hump-shaped consumption profile.
[39]Dynan et al. (2004) found a strong positive relationship between saving rates and lifetime income. However, our findings postulate the relationship between saving rates and service consumption.

contribute to more than 40 percent of U.S. consumption[40], a model would have to include services in its analysis to explain the saving behavior of U.S. households. Do U.S. households save in order to smooth their patterns of service consumption?

The importance and, in some cases, the necessity of services were laid bare during the pandemic. For example, healthcare accounts for 19.7 percent of GDP and, therefore, one-third of the share of services in the U.S. economy. A recent study shows that about one in eight U.S. adults claim they reduce spending on food (12%) and over-the-counter drugs (11%) to cover healthcare or medicine costs. At the same time, many cut back on household spending to afford the care that they are currently receiving.[41]

We provide our forecast for services consumption (Figure 20-21). The model predicts service consumption within a reasonable range, so there is no point in claiming that consumption is unpredictable or a random walk.

The ARDL results for nondurables are highly similar to services consumption in terms of the income elasticity of consumption, with a coefficient of about 0.83 (Table 5). Although this coefficient is slightly below the income elasticity of services consumption, it reveals the essential nature of nondurables compared with durables. While the real effective exchange rate is positive and significant (and smaller for nondurables than durables), the interest rate is insignificant. Interestingly, U.S. consumers respond to economic uncertainty regarding a decline in nondurable consumption. It seems reasonable to postulate that U.S. consumers today depend more heavily on services than during the Great Recession when the considerable decline in nondurables could have happened to offset the negative effect of services.

[40] Historical | CMS. (n.d.). https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical.

[41] West Health-Gallup Healthcare Study (February 15, 2021, n=3,753).

According to diagnostic tests, we observe no serial correlation in the model, as the L.M. test confirms, and the Ramsey RESET test provides no evidence of misspecification. The model is stable, according to the CUSUM and CUSUMQ tests. In addition, cointegration exists in the model, and the speed of adjustment is about -0.14, while the deterministic power of the variables in the model is approximately 52 percent.

We apply the NARDL approach to estimate the coefficients of the variables in the model, thereby finding a long-run and short-run symmetrical effect of economic activity on nondurable consumption (Table 6). The speed of adjustment has slightly changed (-0.15), and so has the deterministic power of the variables in the model (54 percent). The diagnostic tests for serial correlation and specification attest to the model performing well in these respects; however, the recursive residuals plot shows a breakpoint in Q4 2005, as confirmed by the Chow test. After including a stability dummy, we find the coefficient insignificant, with only a minor effect on the other coefficients (Figure 22-24). According to the dynamic multiplier plot, we observe the immediate effect of a positive shock of economic activity on nondurable consumption, while the effect lasts longer for a negative shock (Figure 25-26). As mentioned, consumers need more information in their decision-making during economic downturns due to uncertainty.[42] As with durables and services, dropping other variables from the nondurables model creates no cointegration, instability, or misspecification.

When we use the model to forecast nondurable consumption, we find strong forecasting power, revealing the deterministic power of the variables included in the model (Figure 27-28).

[42] A shortage of ketchup packets appeared in the market due to U.S. households' accelerated demand for delivery and take-out during the pandemic. We observe two dramatic upsurges in consumption of nondurables (May 2020, 8.4 percent and March 2021, 7 percent), which occurred after the first and second stimulus checks were received. As the model confirms, this fact signals a windfall effect on nondurables (BBC News, April 7, 2021: U.S. restaurants face ketchup packet shortage amid the Covid pandemic. https://www.bbc.com/news/world-us-canada-56657822).

V. Conclusion and Discussion

Consumption as a core macroeconomic concept has attracted considerable attention from researchers despite experiencing ups and downs.[43] Different econometrics methodologies have challenged consumption theories, and the understanding of consumer behavior has been modified historically. Nevertheless, the lack of disaggregated data has generated controversial explanations about U.S. consumption. For instance, Foster (2021) formulated a consumption function for the U.S. macroeconomy to investigate the reason behind the increase in the consumption share of income over time. However, the fact that the consumption of nondurables has declined over time as a share of income, while services consumption has followed an inverted U-shape pattern, casts doubt on his "new perspective."

Although some leading economists[44] in the field believe that stable cointegration is problematic, mainly due to structural breaks in the model caused by demographic factors and financial system changes, any attempt to build an invariant model which can explain the whole history of consumption while accounting for variant economic agents' behavior seems irrational.

When we apply quarterly disaggregated consumption expenditure data and include diverse variables in the model from 1994 to 2019, using a methodology that enables nonlinearity, we find that consumers behave differently during economic upturns and downturns. Although the literature lacks attention to this phenomenon, we postulate that a critical factor may be "imperfect information" and confusion regarding consumers' decision-making processes. The results of our study support this. U.S. consumers are more likely to need clarification during recessions than in growth periods, as they receive more mixed information during an economic downturn. This fact causes severe uncertainty that makes individuals more pessimistic and erratic, as shown by the dynamic multiplier, which reveals

[43] For instance, by the 1990s, many economists, including Agnus Deaton, changed to other topics (Foster, 2021).
[44] For instance, Carroll (2001).

long-lasting shocks during economic downturns. While U.S. consumers rapidly adjust their spending on durables, the speed of adjustment is slow for nondurables and services. This may be a signal of habit formation concerning U.S. consumer behavior.

In addition, neither classical nor Keynesian consumption theory can adequately explain that the marginal propensity to consume is greater than the average propensity to consume durables as, at most, unitary income elasticity of consumption was hypothesized. However, the income elasticity of consumption is less than the unity for services and nondurables, following Keynesian doctrine.

Since services account for more than 60 percent of overall consumption, the asymmetry in the response of U.S. consumers to economic downturns and upturns arises more from the consumption of services than of durables and nondurables. Finally, we postulate that service consumption is the primary determinant of U.S. consumer behavior and that smoothing service demand could solve the puzzle of higher savings for more affluent Americans.[45] This hypothesis desires further research to build more service-focused models which can explain U.S. consumer behavior.

[45] In a study Carroll (1998) mentions that "unspent wealth yields a flow of services" that might be a reason for the accumulation of wealth (higher saving rates).

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Table 1

Full-information estimates of the linear model for durables.

Panel A: short run coefficient estimates

Lag Order	0	1	2	3	4	5	6	7	8
Δc		-0.35*	-0.25*						
		(0.00)	(0.02)						
Δy	1.85*	0.84*	0.57**						
	(0.00)	(0.02)	(0.08)						
Δe	-0.08								
	(0.30)								
Δr									
Δvix									

Panel B: long-run coefficient estimates

Constant	y	e	r	vix
-24.73*	2.76*	0.70*	-0.029*	-0.095*
(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Panel C: Diagnostics

F	ECM_{t-1}	LM	RESET	$\overline{R}^2$	CUSUM (CUSUMQ)
5.86*	-0.22*	0.75	4.19*	0.42	
	(0.00)	(0.47)	(0.04)		Stable (Unstable)

Notes:

a. Numbers inside the parentheses are *p*-values.

b. The asterisks indicate that the coefficients are significant at 5% and 10%, respectively.

c. Upper bound F-Statistic critical value at 5% significance level is 3.49.

Table 2

Full-information estimates of the nonlinear model for durables.

Panel A: short run coefficient estimates

Lag Order	0	1	2	3	4	5	6	7	8
Δc		-0.31*	-0.22*						
		(0.00)	(0.02)						
Δy-POS	1.33*	0.95*							
	(0.00)	(0.02)							
Δy-NEG	3.28*	-0.44	0.68	-0.91	1.46*	1.22*			
	(0.02)	(0.55)	(0.35)	(0.18)	(0.02)	(0.02)			
Δe	-0.07	-0.26*	-0.18*						
	(0.34)	(0.00)	(0.02)						
Δr	0.0006								
	(0.89)								
Δvix	-0.004	0.017*							
	(0.56)	(0.04)							

Panel B: long-run coefficient estimates

Constant	y-POS	y-NEG	e	r	vix
1.85	2.57*	1.50*	0.59*	-0.015*	-0.07*
(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Panel C: Diagnostics

F	ECM_{t-1}	LM	RESET	$\overline{R^2}$	CUSUM (CUSUMQ)	Symmetry Wald-L	Symmetry Wald-S
8.55*	-0.42*	0.48	0.50	0.64	Stable (Stable)	14.75*	0.68
	(0.00)	(0.62)	(0.48)			(0.00)	(0.41)

Notes:

a. Numbers inside the parentheses are *p*-values.

b. The asterisks indicate that the coefficients are significant at 5% and 10%, respectively.

c. F-Bounds Test: Upper bound F-Statistic critical value at 5% significance level is 3.38.

Table 3

Full-information estimates of the linear model for services.

Panel A: short run coefficient estimates

Lag Order	0	1	2	3	4	5	6	7	8
Δc		-0.20*							
		(0.02)							
Δy									
Δe	0.004	-0.018**	-0.009	-0.031*					
	(0.69)	(0.06)	(0.35)	(0.00)					
Δr	0.001*								
	(0.046)								
Δvix									

Panel B: long-run coefficient estimates

Constant	y	e	r	vix
0.31	0.89*	0.03	-0.002*	0.007
(0.11)	(0.00)	(0.27)	(0.03)	(0.11)

Panel C: Diagnostics

F	ECM_{t-1}	LM	RESET	$\overline{R^2}$	CUSUM (CUSUMQ)
13.72*	-0.15*	0.13	0.12	0.42	
	(0.00)	(0.87)	(0.73)		Stable (Stable)

Notes:

a. Numbers inside the parentheses are *p*-values.

b. The asterisks indicate that the coefficients are significant at 5% and 10%, respectively.

c. Upper bound F-Statistic critical value at 5% significance level is 3.49.

Table 4

Full-information estimates of the nonlinear model for services.

Panel A: short run coefficient estimates

Lag Order	0	1	2	3	4	5	6	7	8
Δc		0.23*	0.008	0.18*					
		(0.00)	(0.92)	(0.01)					
Δy-POS	0.05								
	(0.31)								
Δy-NEG	0.06	-0.11	0.005	-0.35*	0.05	-0.11	-0.06	-0.17*	
	(0.41)	(0.22)	(0.94)	(0.00)	(0.52)	(0.18)	(0.42)	(0.02)	
Δe	-0.005	-0.02*	-0.02*	-0.05					
	(0.54)	(0.02)	(0.03)	(0.00)					
Δr	0.001*								
	(0.02)								
Δvix									

Panel B: long-run coefficient estimates

Constant	y-POS	y-NEG	e	r	vix
8.76*	0.86*	0.72*	0.03	-0.001	0.006
(0.00)	(0.00)	(0.00)	(0.16)	(0.19)	(0.18)

Panel C: Diagnostics

F	ECM_{t-1}	LM	RESET	$\overline{R^2}$	CUSUM (CUSUMQ)	Symmetry Wald-L	Symmetry Wald-S
9.95*	-0.24*	2.21	1.40	0.76	Stable (Stable)	4.03*	8.55*
	(0.00)	(0.11)	(0.24)			(0.048)	(0.00)

Notes:

a. Numbers inside the parentheses are *p*-values.

b. The asterisks indicate that the coefficients are significant at 5% and 10%, respectively.

c. F-Bounds Test: Upper bound F-Statistic critical value at 5% significance level is 3.38.

Table 5

Full-information estimates of the linear model for nondurables.

Panel A: short run coefficient estimates

Lag Order	0	1	2	3	4	5	6	7	8
Δc		-0.16*							
		(0.03)							
Δy	0.56*								
	(0.00)								
Δe									
Δr									
Δvix									

Panel B: long-run coefficient estimates

Constant	y	e	r	vix
-0.82*	0.83*	0.20*	0.0005	-0.04*
(0.03)	(0.00)	(0.02)	(0.85)	(0.02)

Panel C: Diagnostics

F	ECM_{t-1}	LM	RESET	$\overline{R^2}$	CUSUM (CUSUMQ)
5.53*	-0.14*	0.62	0.33	0.52	
	(0.00)	(0.54)	(0.57)		Stable (Stable)

Notes:

a. Numbers inside the parentheses are *p*-values.

b. The asterisks indicate that the coefficients are significant at 5% and 10%, respectively.

c. Upper bound F-Statistic critical value at 5% significance level is 3.49.

Table 6

Full-information estimates of the nonlinear model for nondurables.

Panel A: short run coefficient estimates

Lag Order	0	1	2	3	4	5	6	7	8
Δc									
Δy-POS	0.67*								
	(0.00)								
Δy-NEG	0.35*	-0.42*	0.34*						
	(0.04)	(0.03)	(0.04)						
Δe	0.007	-0.04*	0.03						
	(0.75)	(0.05)	(0.18)						
Δr									
Δvix									

Panel B: long-run coefficient estimates

Constant	y-POS	y-NEG	e	r	vix
7.15*	0.83*	0.74*	0.18*	0.0008	-0.03*
(0.00)	(0.00)	(0.00)	(0.02)	(0.79)	(0.02)

Panel C: Diagnostics

F	ECM_{t-1}	LM	RESET	$\overline{R^2}$	CUSUM (CUSUMQ)	Symmetry Wald-L	Symmetry Wald-S
3.24**	-0.15*	1.68	0.14	0.54	Stable (Stable)	0.33	1.67
	(0.00)	(0.19)	(0.71)			(0.57)	(0.20)

Notes:

a. Numbers inside the parentheses are *p*-values.

b. The asterisks indicate that the coefficients are significant at 5% and 10%, respectively.

c. F-Bounds Test: Upper bound F-Statistic critical value at 10% significance level is 3.

Figure.1: Average Propensity to Consume (APC)

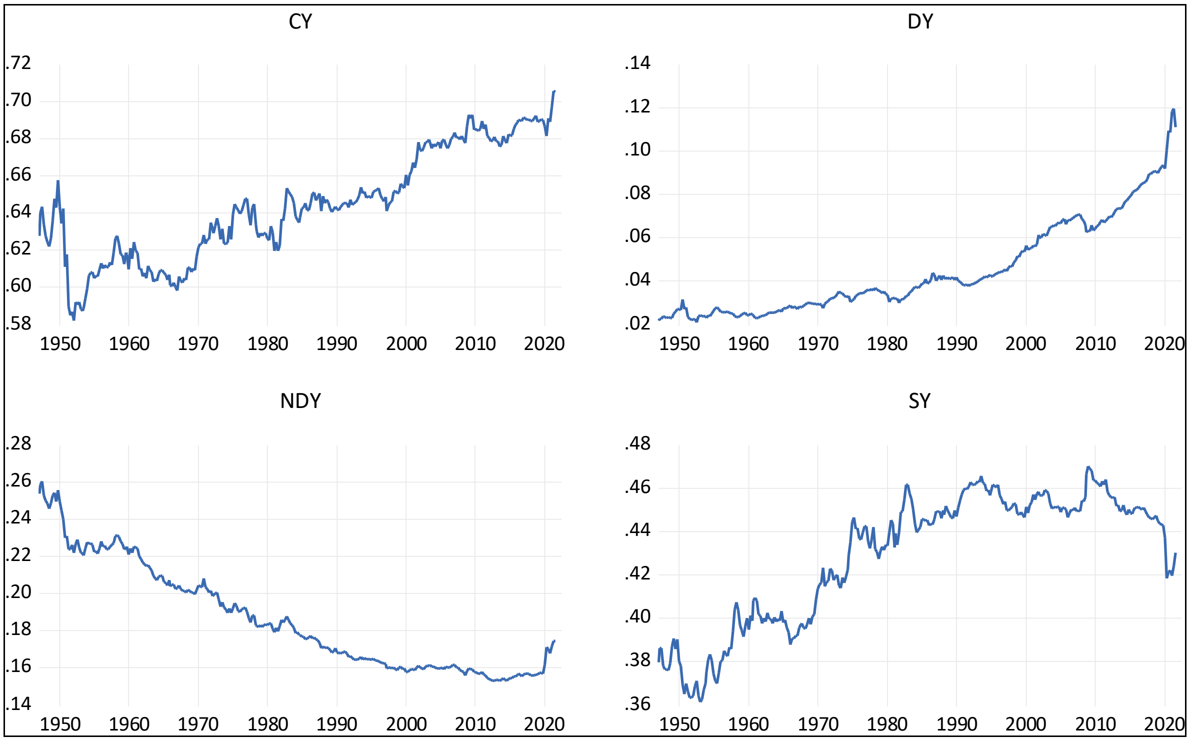

Figure.2: Cross-State Average Propensity to Consume (APC)

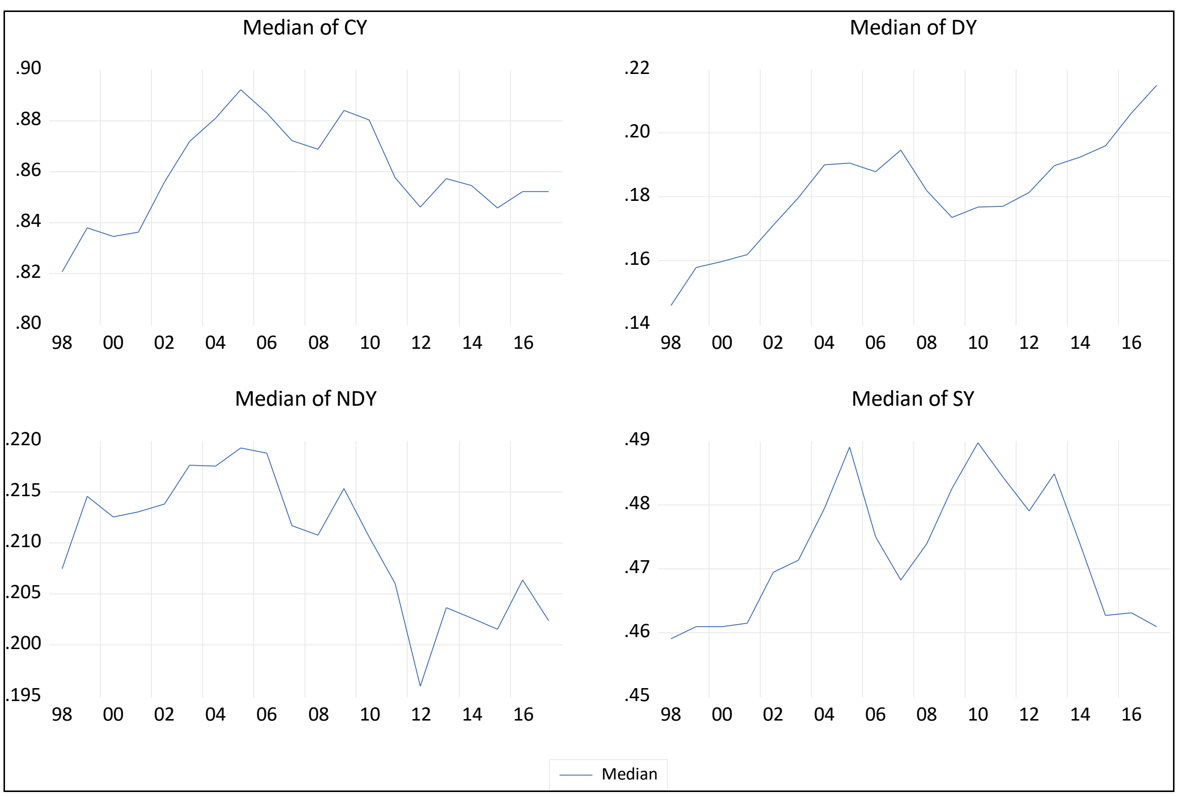

Figure.3: Average Propensity to Consume (Total) Vs. GDP (The Kernel Fit Method)

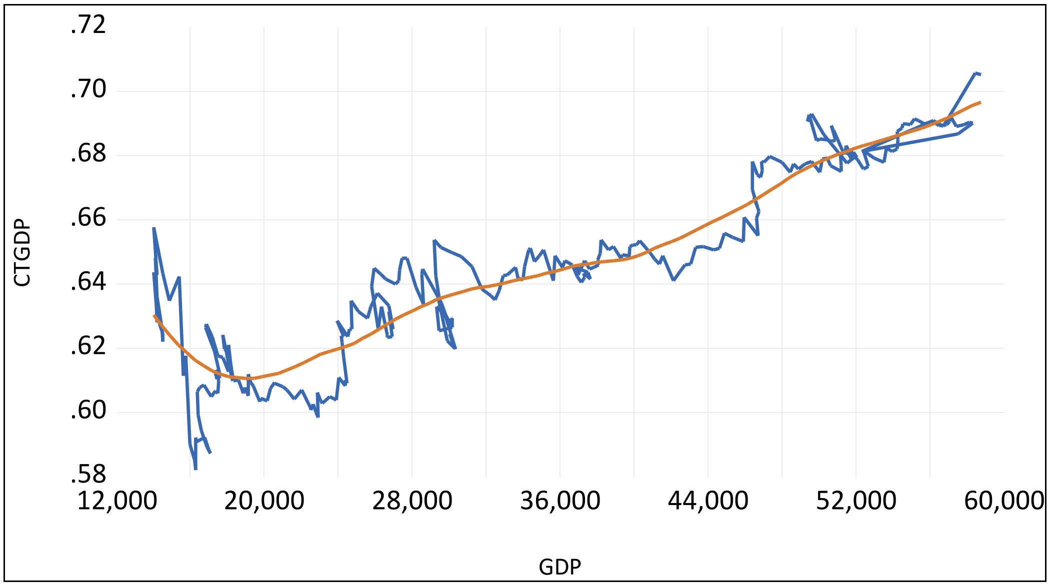

Figure.4: Average Propensity to Consume (Durables) Vs. GDP (The Kernel Fit Method)

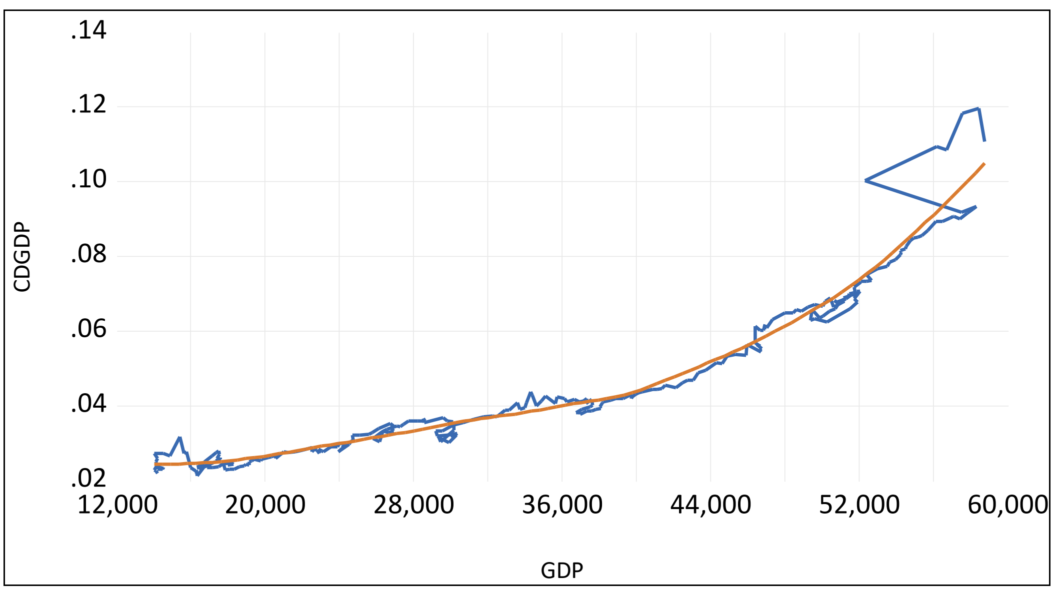

Figure.5: Average Propensity to Consume (Nondurables) Vs. GDP (The Kernel Fit Method)

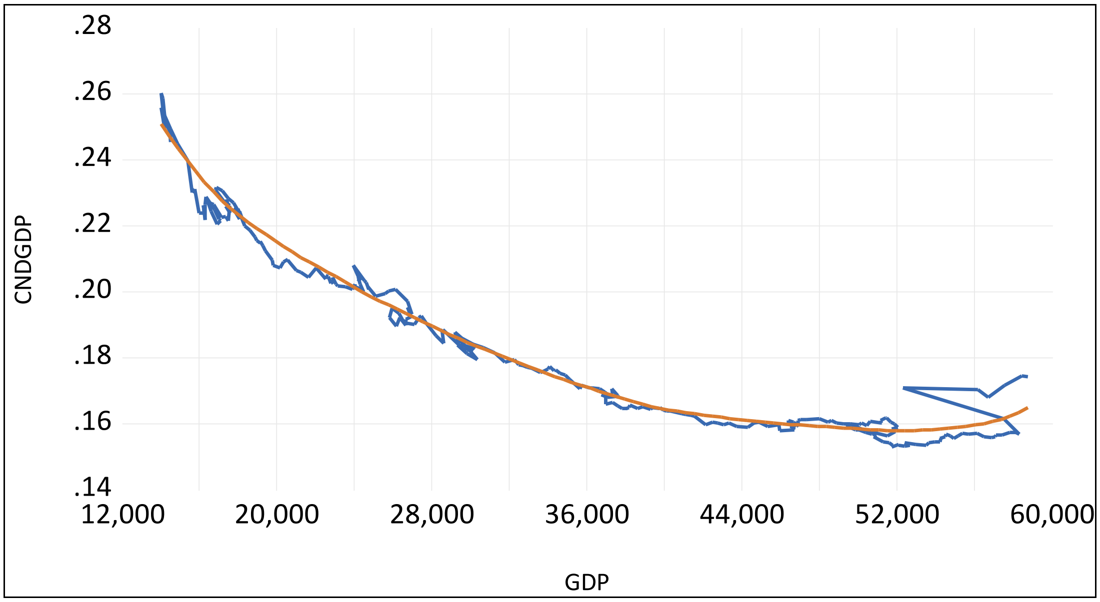

Figure.6: Average Propensity to Consume (Services) Vs. GDP (The Kernel Fit Method)

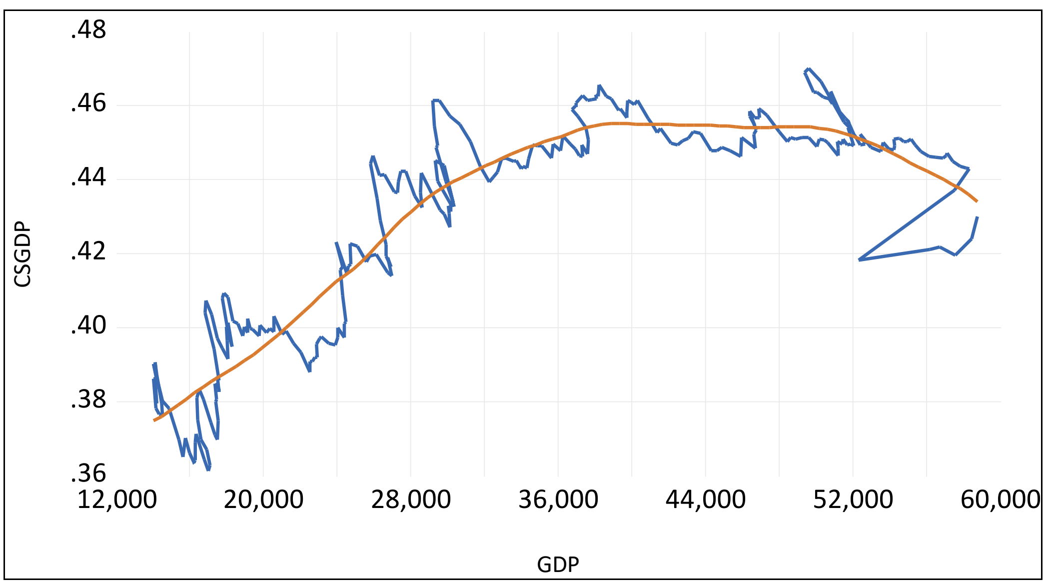

Figure 7: Recursive Residuals for Durables

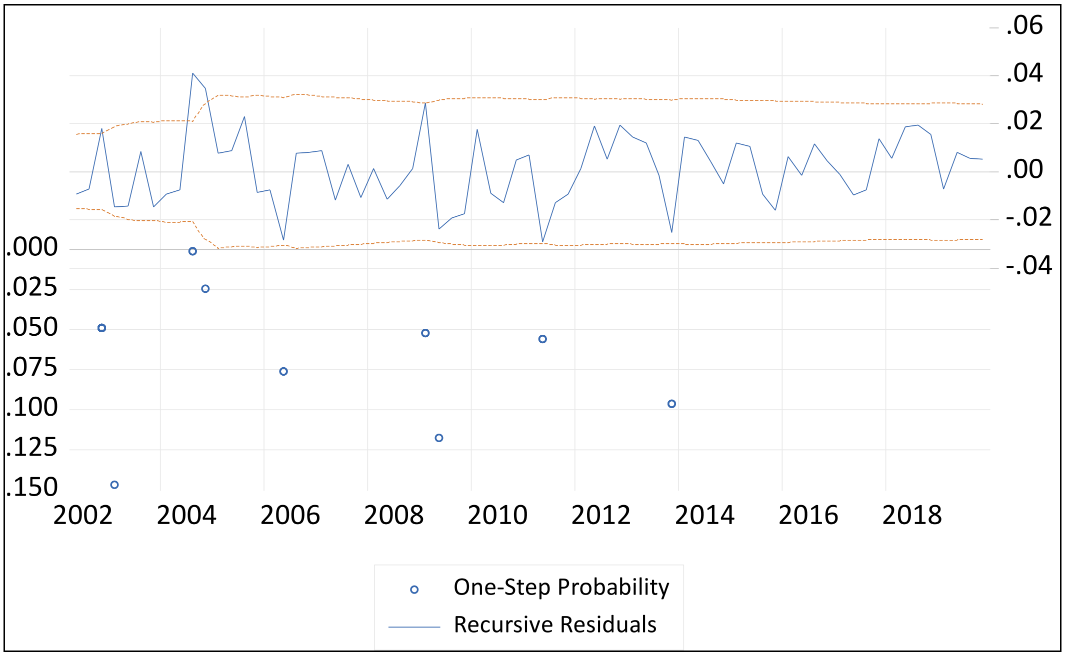

Figure 8: Recursive Residuals for Durables

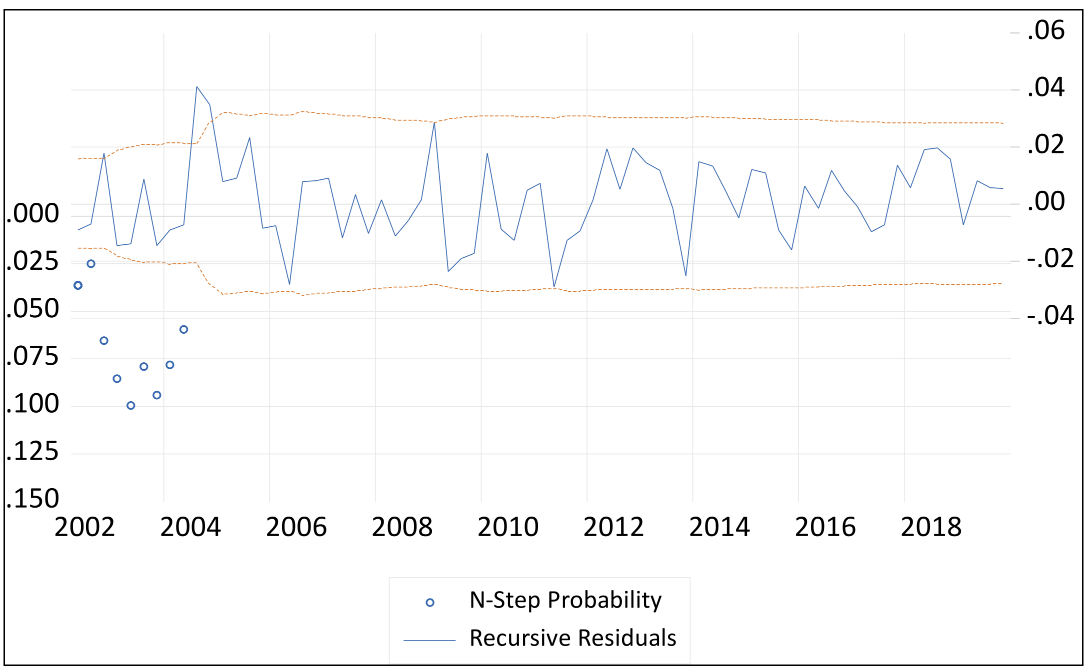

Figure 9: Recursive Least Squares Coefficients Plot for Durables

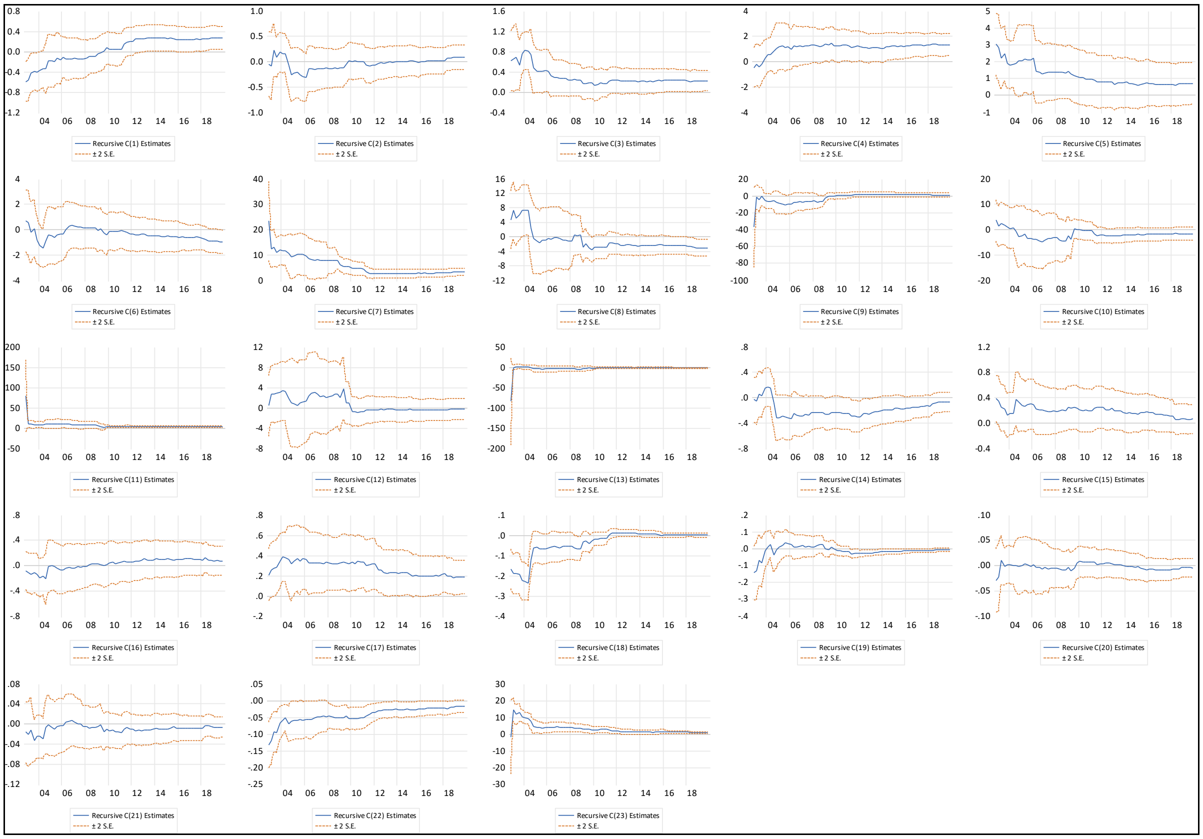

Figure 10: Durables Consumption

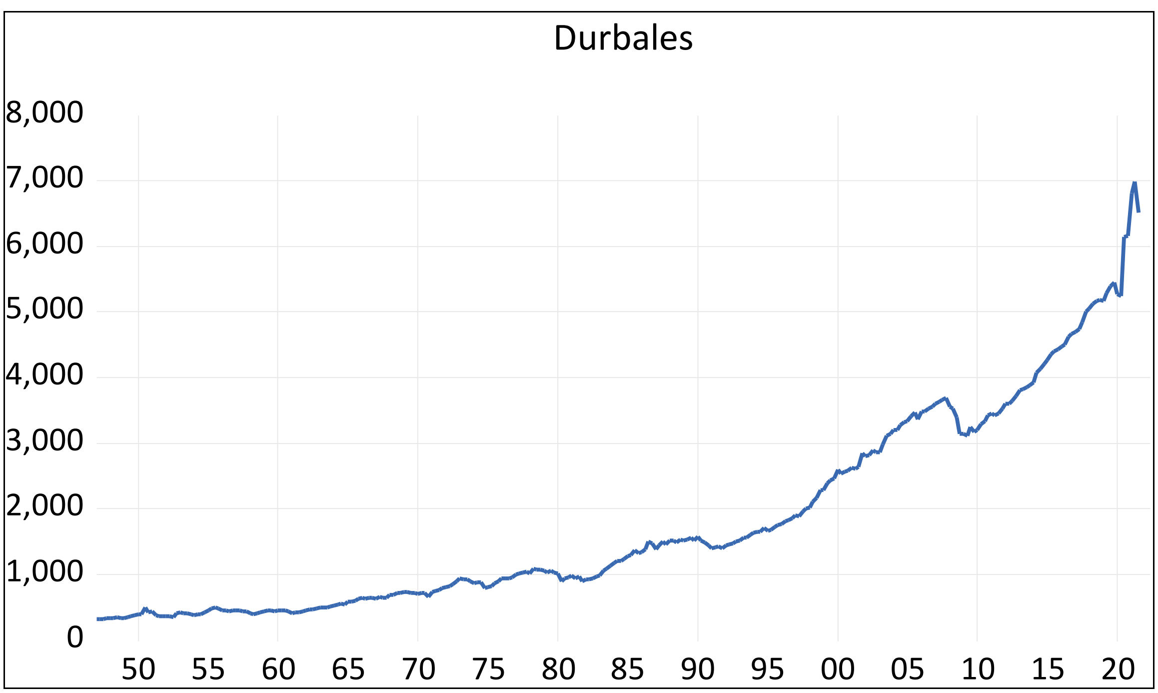

Figure 11: Cumulative Multiplier Effect of Economic Activity on Durables Consumption

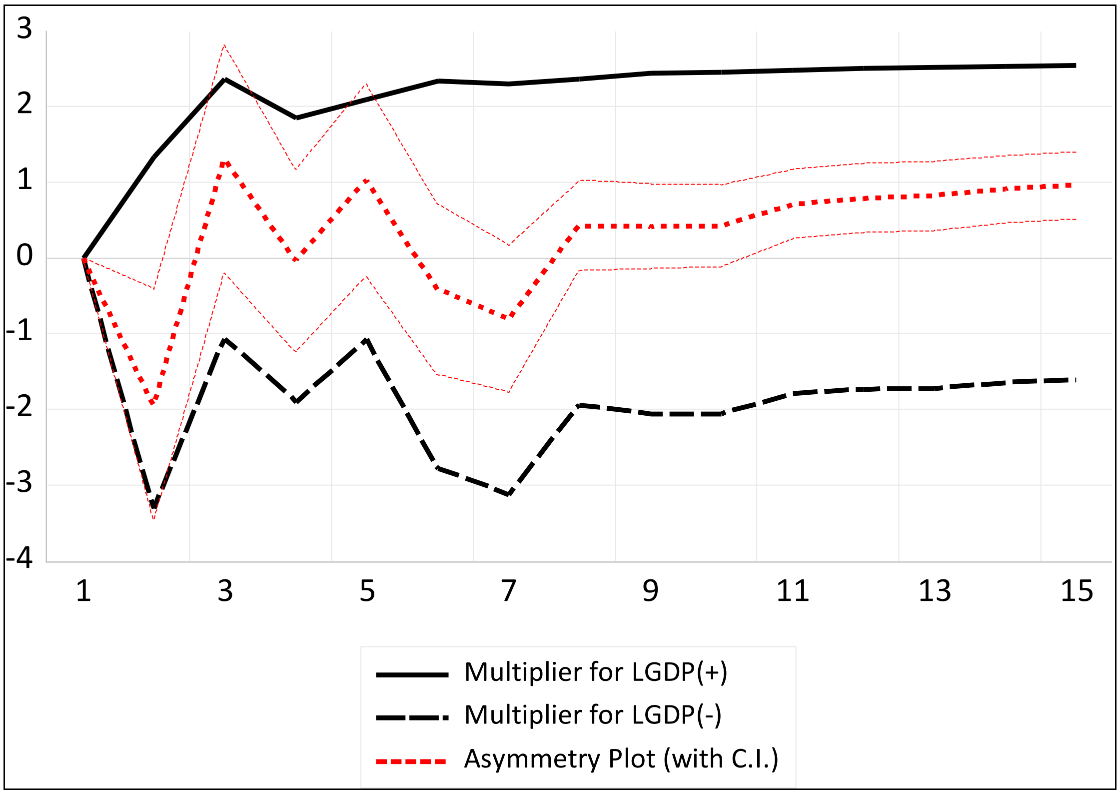

Figure 12: Dynamic Forecasting for Durables (Level)

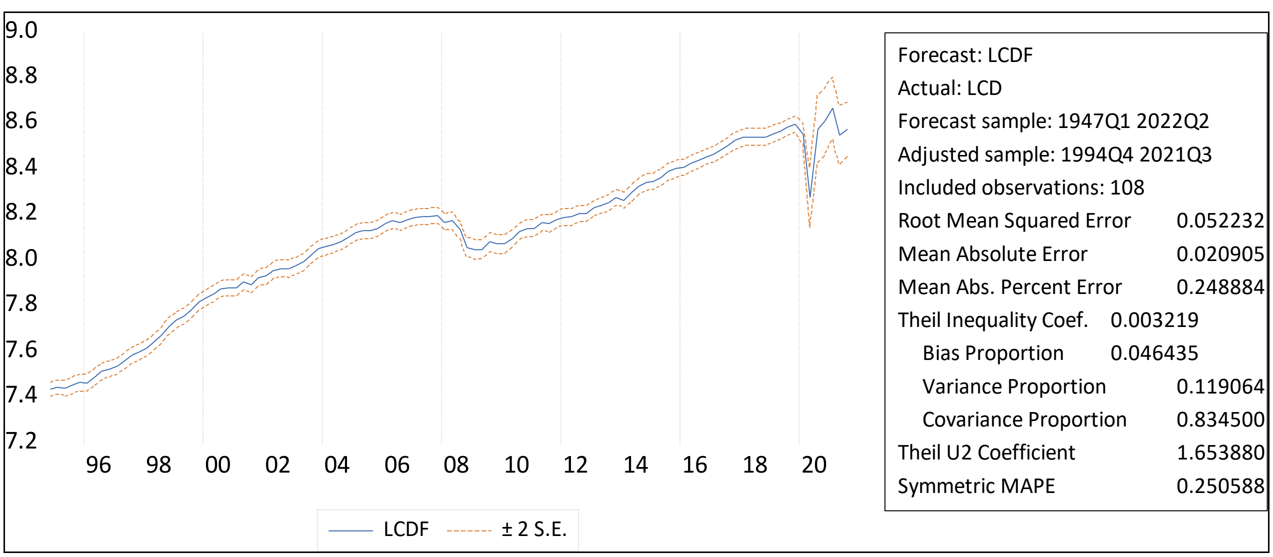

Figure 13: Dynamic Forecasting for Durables (First Difference)

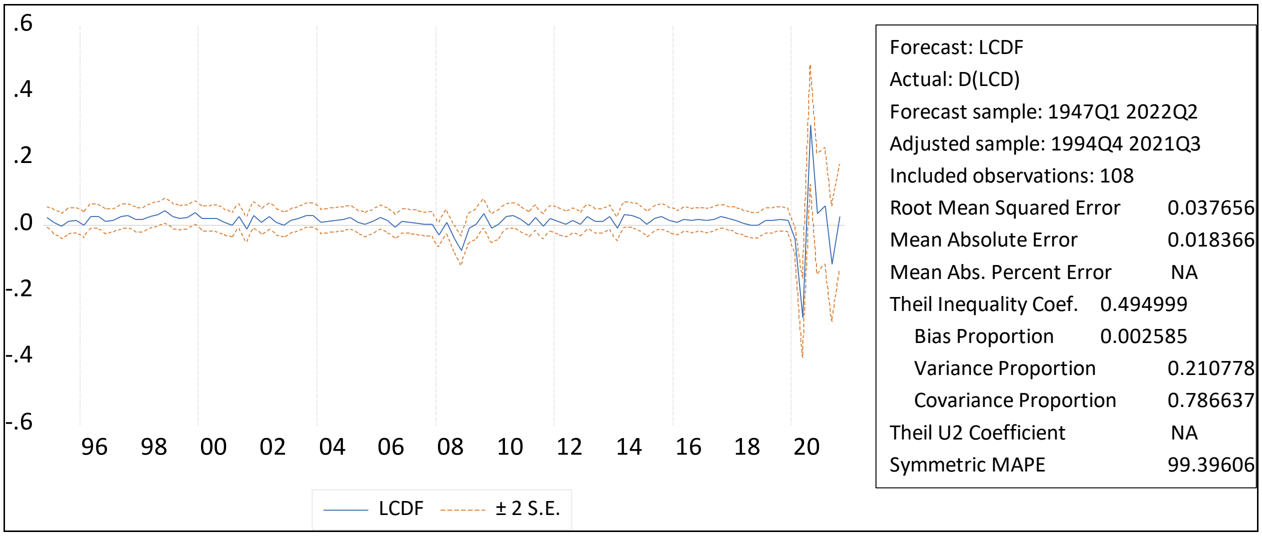

Figure 14: Recursive Residuals One-Step Forecast Test for Services

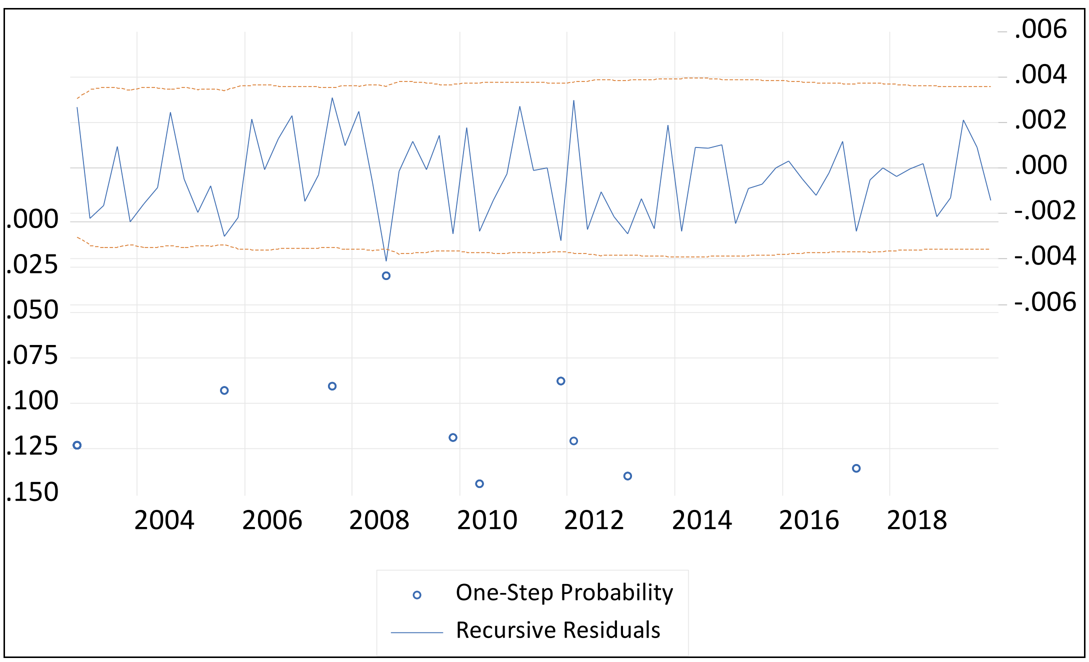

Figure 15: Recursive Residuals One-Step Forecast Test for Services

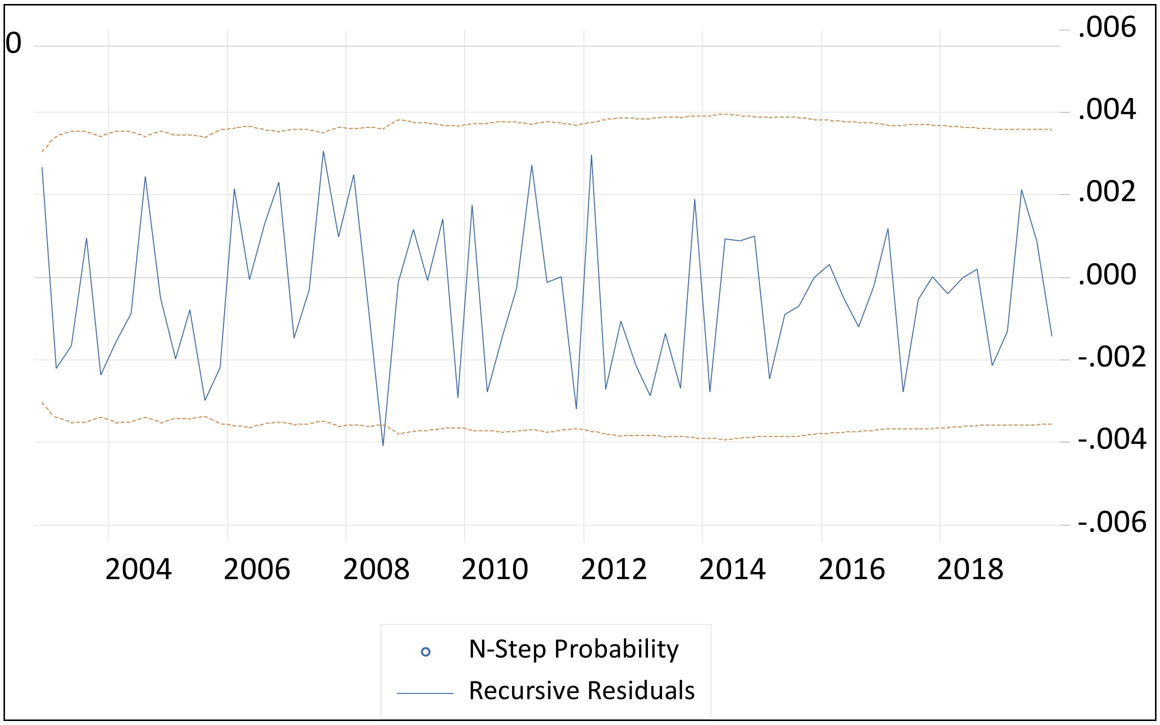

Figure 16: Recursive Least Squares Coefficients Plot for Services

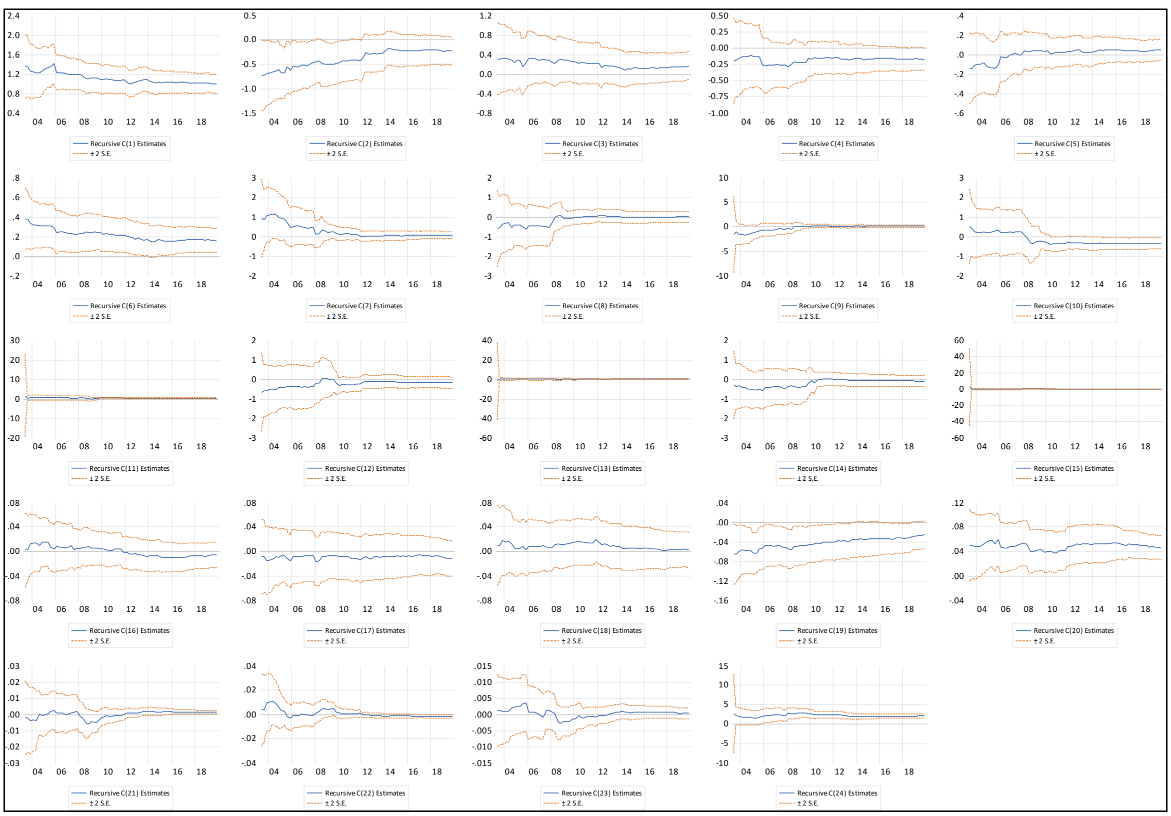

Figure 17: Real Personal Consumption Expenditure: Services

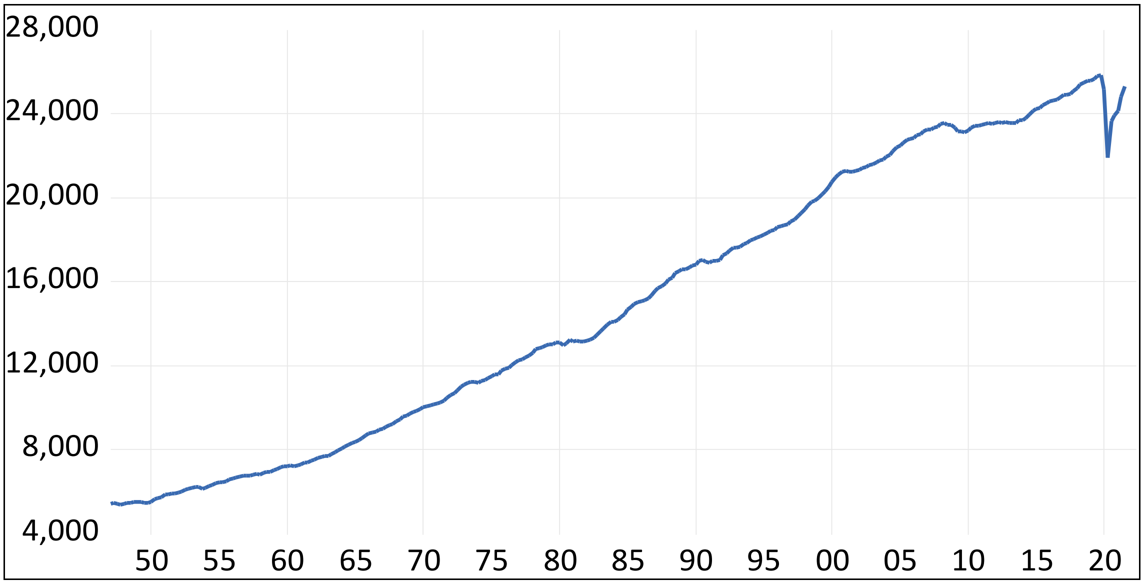

Figure 18: Dynamic Multiplier for Services Consumption

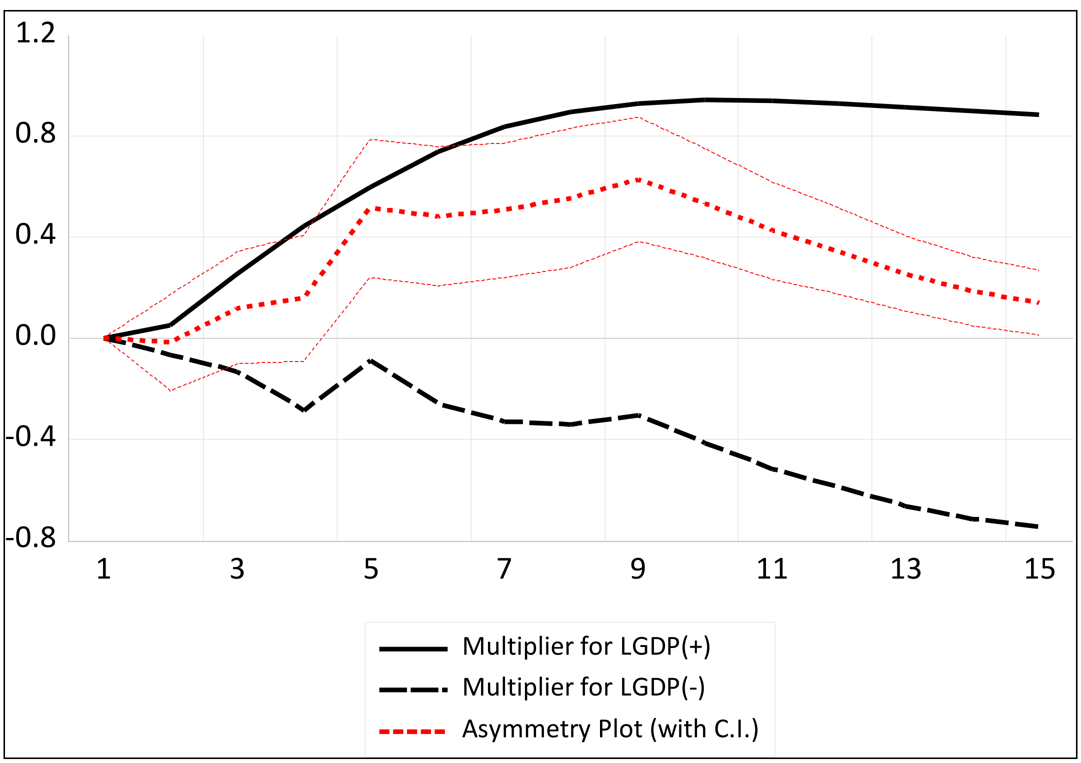

Figure 19: Personal Saving Rate Vs. GDP (The Kernel Fit Method)

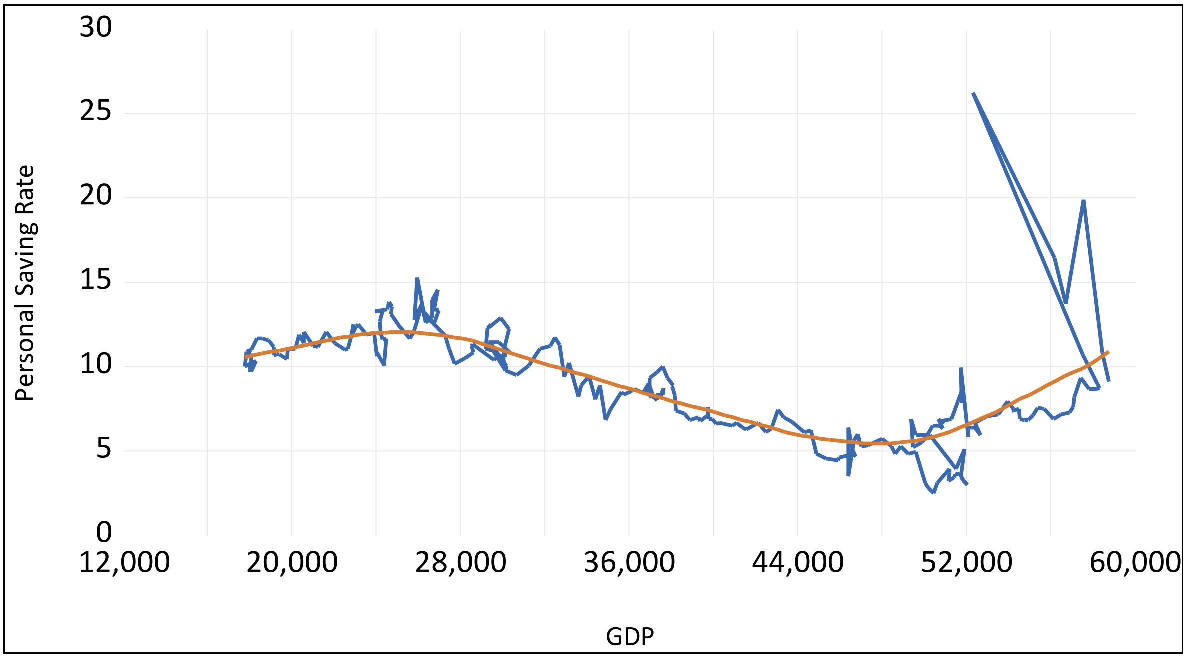

Figure 20: Dynamic Forecasting for Services (Level)

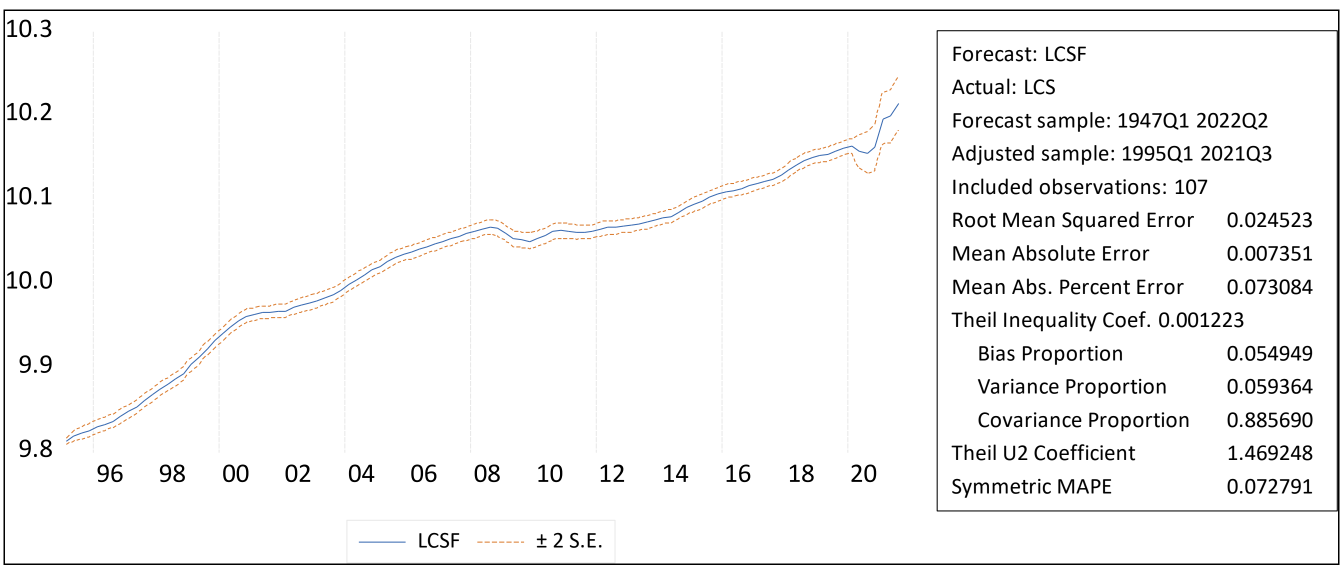

Figure 21: Dynamic Forecasting for Services (First Difference)

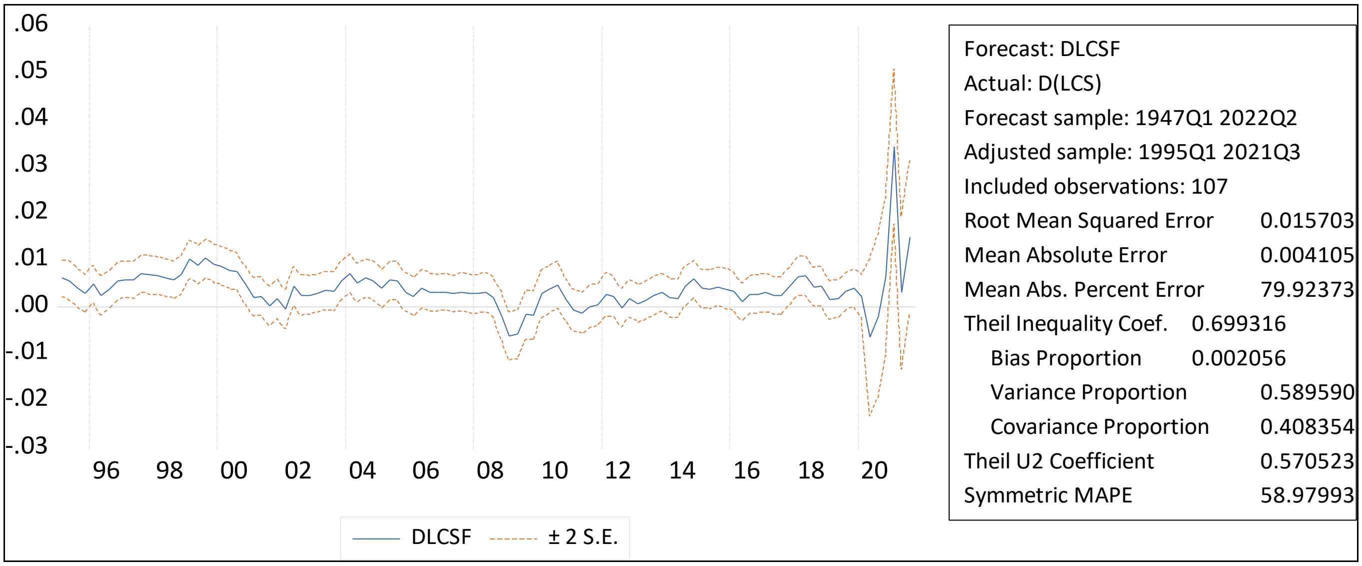

Figure 22: Recursive Residuals One-Step Forecast Test for Nondurables

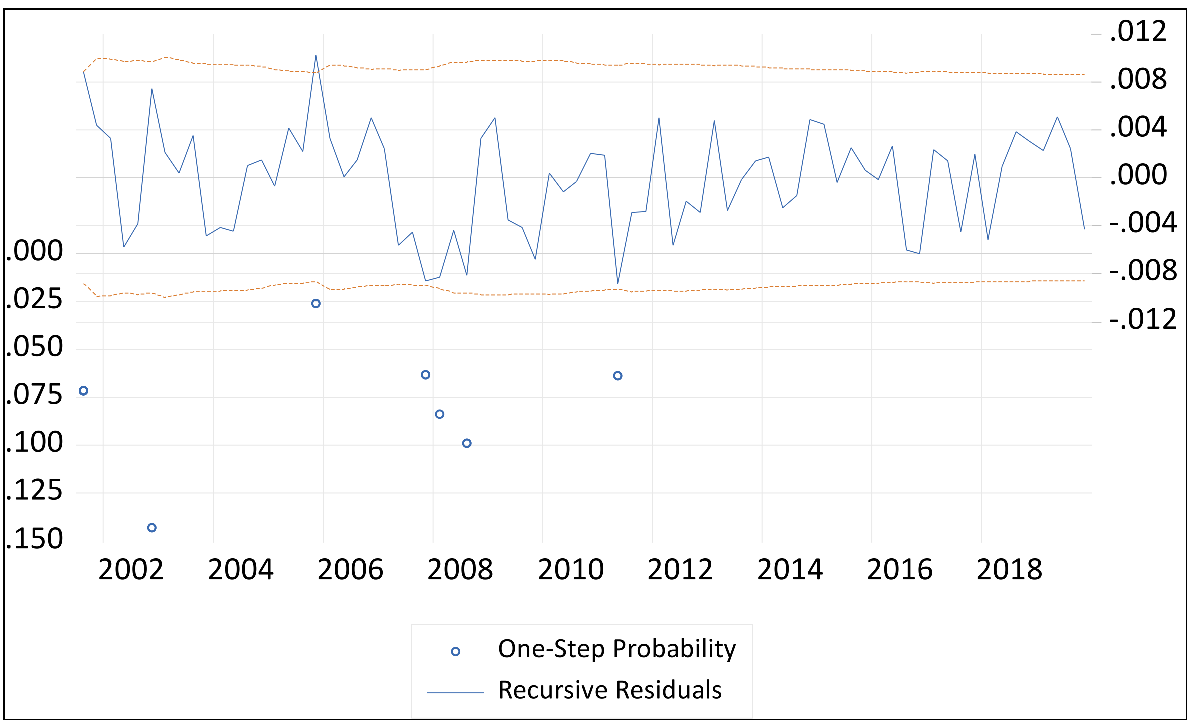

Figure 23: Recursive Residuals One-Step Forecast Test for Nondurables

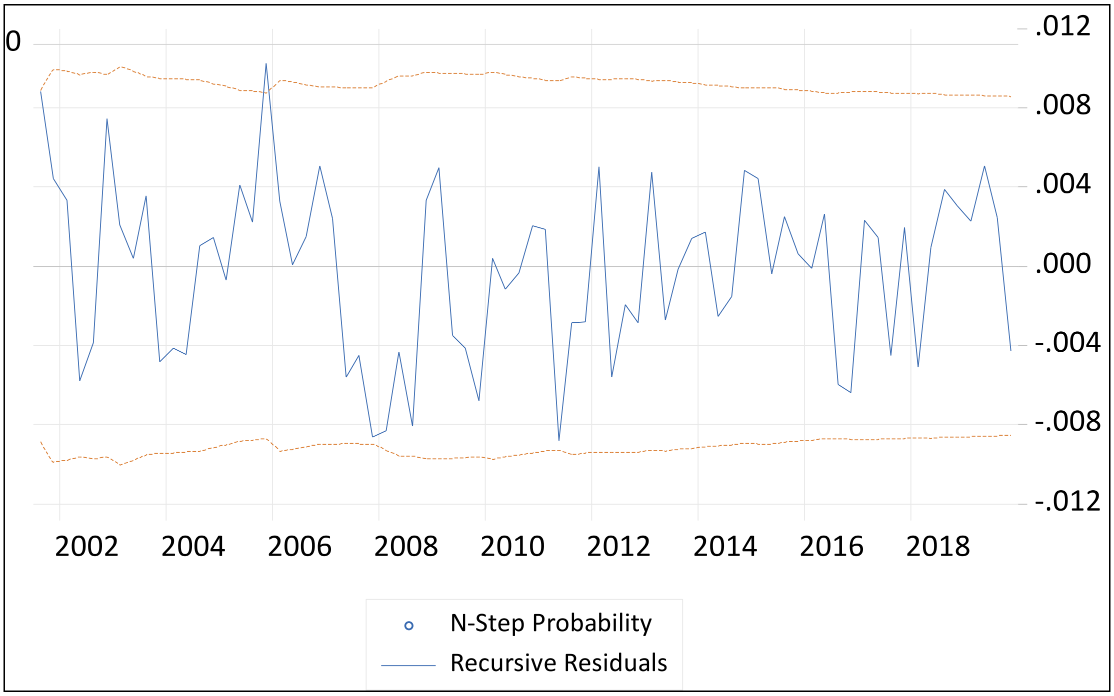

Figure 24: Recursive Least Squares Coefficients Plot for Nondurables

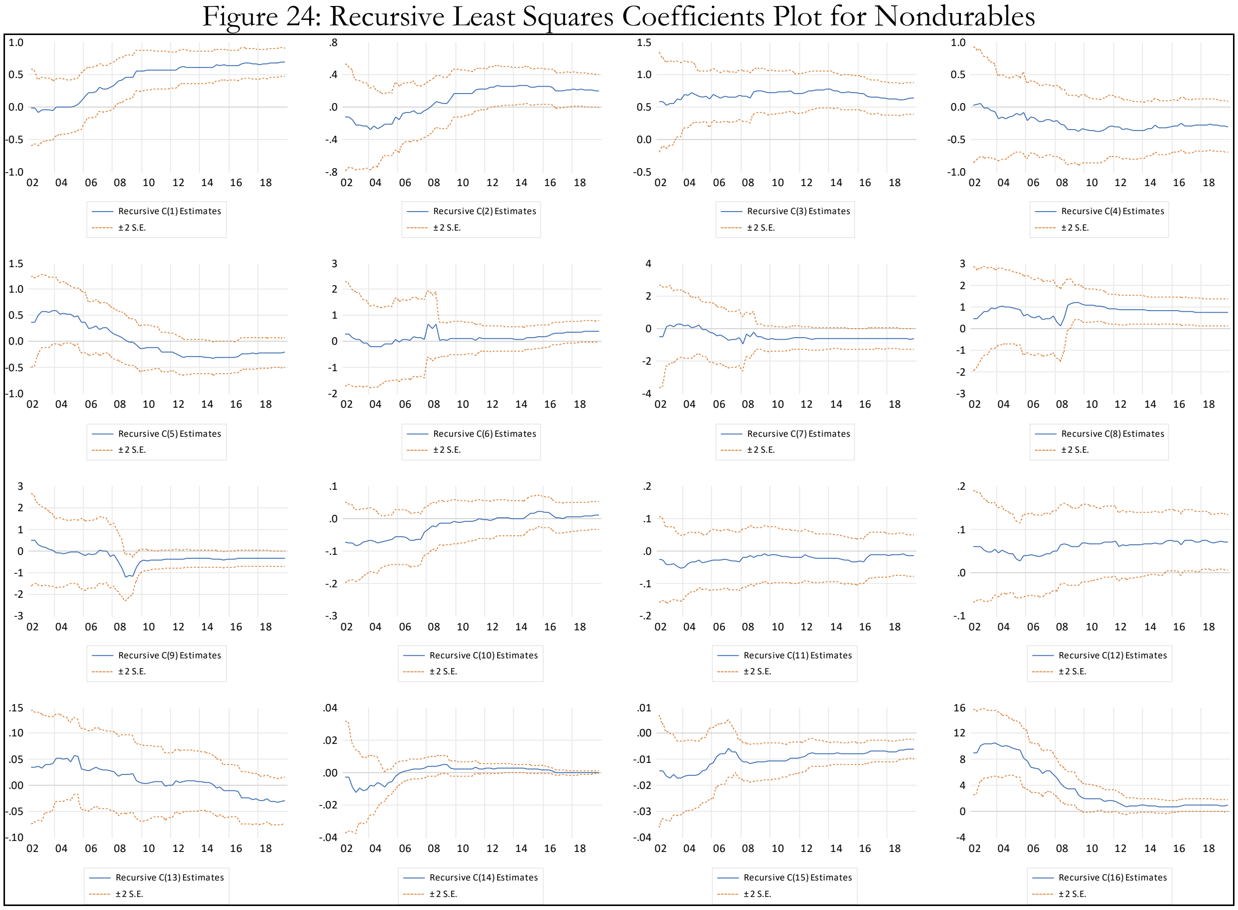

Figure 25: Real Personal Consumption Expenditure: Nondurables

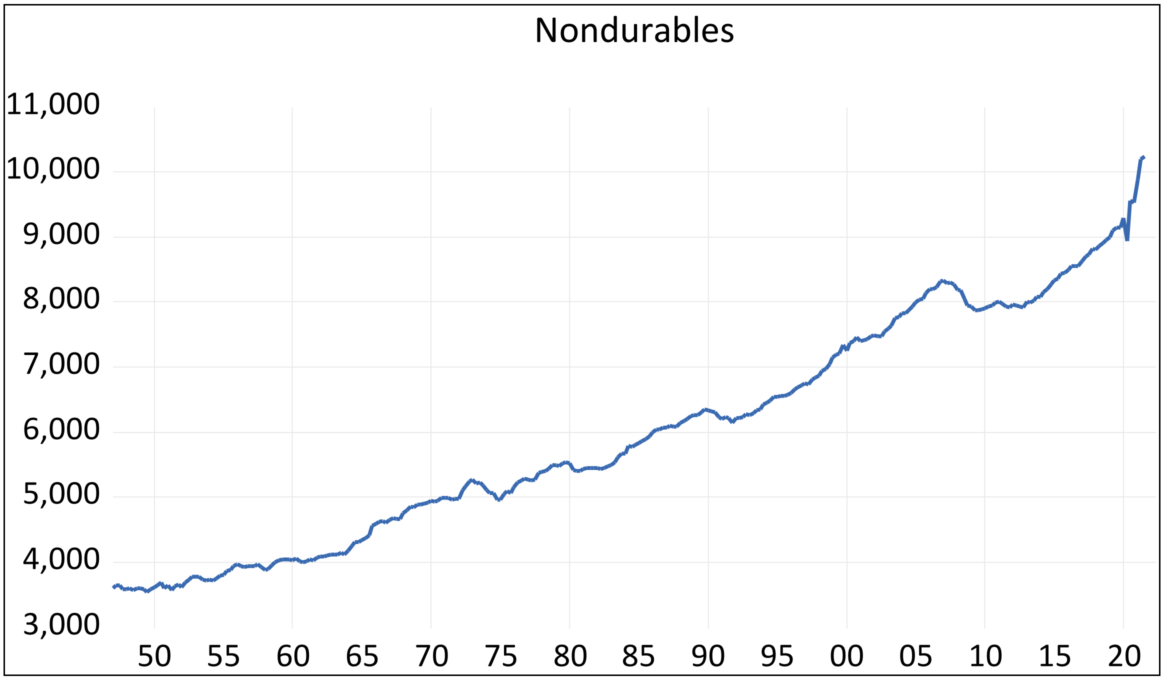

Figure 26: Dynamic Multiplier for Nondurables Consumption

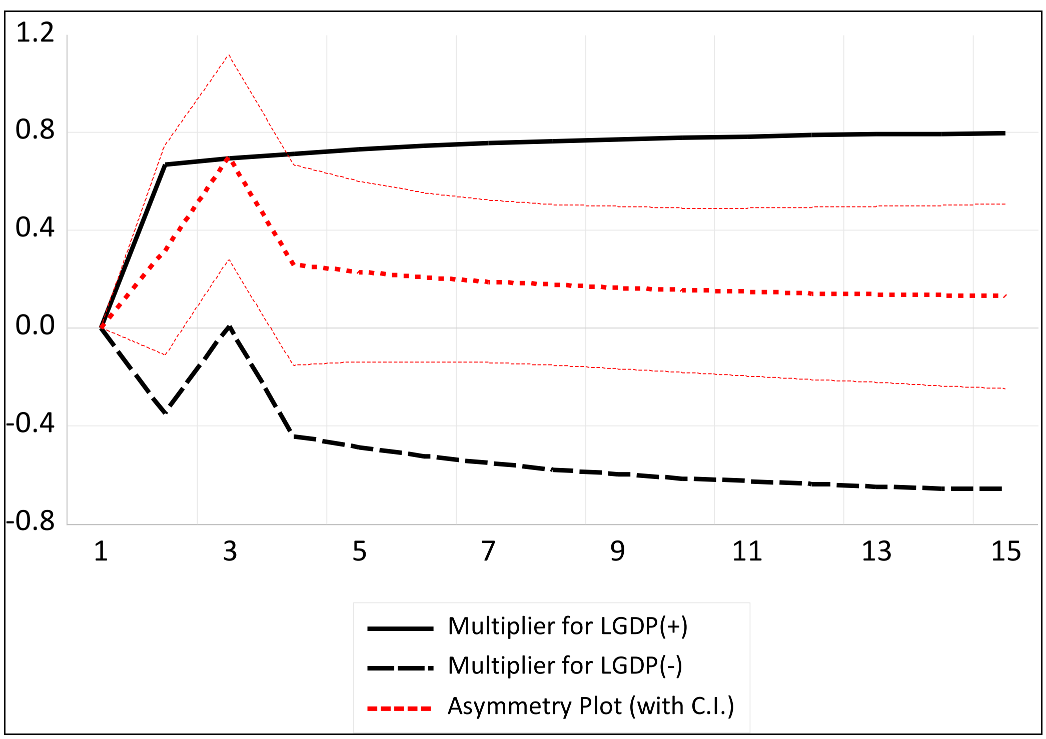

Figure 27: Dynamic Forecasting for Nondurables (Level)

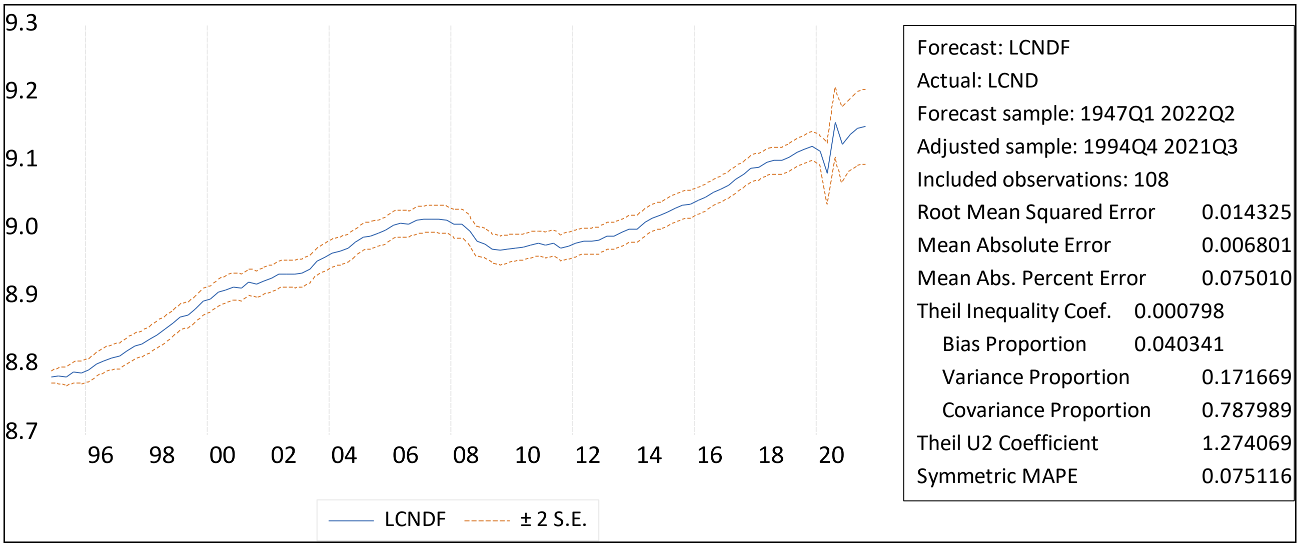

Figure 28: Dynamic Forecasting for Nondurables (First Difference)