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by

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Abstract

This paper innovates by being the first to estimate a consumption function of a monetary union as a single entity. It is also the first empirical consumption research on the Eastern Caribbean Currency Union (ECCU). Due to the open nature of these nations it further adds to the literature by examining open economy variables like the terms of trade and the degree of export orientation. The panel dynamic least squares method employed indicates that private spending is primarily driven by income, financial wealth, the interest rate, terms of trade and the degree of export orientation.

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1. Introduction

Given the prominence of private spending in aggregate demand, consumption functions have been estimated for many individual countries throughout the world. Such empirical models also exist for individual nations that form monetary unions (see, for example, Manitsaris, 2006). However, to the knowledge of the authors of this paper, no research have been undertaken that treat countries of a monetary union as a single entity nor do there exist studies on the small open economies that form part of the Eastern Caribbean Currency Union (ECCU). One rationale for looking at monetary unions as a wholesome is because the Central Banks of these unions often attempt to maintain overall stability by instituting common monetary policies throughout their member states.

This paper, therefore, for the first time, seeks to better understand the factors driving private spending in the ECCU and similar monetary unions. Since the eight nations of the ECCU – Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Vincent and Grenadines, St. Kitts and Nevis, and St. Lucia – are all small open economies, this research also innovates by considering open economy consumption determinants like the degree of export orientation and fluctuations in the terms of trade. The modus operandi of this study is the panel dynamic ordinary least squares (PDOLS) technique of Kao and Chiang (2000). The technique produces unbiased and asymptotically efficient estimates of long-run relationships and allows for co-integration analysis to be conducted irrespective of

whether the explanatory variables are I(0), I(1) or a mixture of both. It is also better at handling small samples and dynamic sources of bias.

2. Model Specification and Data

The consumption function for the ECCU is specified as follows:

$$c_{it} = \alpha_i + x'_{it}\beta + \varepsilon_{it}$$

where c_{it} is real final private consumption expenditure for country *i* and year *t*, x'_{it} is the matrix of proposed determinants, i.e. $x'_{it} = [y, w, r, tot, exor]$. The income and wealth variables, *y* and *w* respectively, are analyzed in natural logarithmic form while the terms of trade (*tot*) and export orientation (*exor*) variables are ratios. Finally, the unit of the real interest rate (*r*) variable is percentage (see Table 1 for details of the construction, definition and source of each variable).

The inclusion of the income, wealth and interest rate variables is well justified by the standard consumption theories. Due to, inter alia, Keynes (1936) and Friedman (957) the commentary will be necessarily brief. It suffices only to say that an increase in either income or wealth is expected to have a positive impact on consumption while the sign on the interest rate variable is ambiguous and depends on the relative sizes of the income and substitution effects.

Maizels (1968) and Lee (1971) argue that because the propensity to save is higher in the export sector, export orientation could influence the private savings (consumption) rate in lesser developed countries primarily

through its influence on resource allocation. Consequently, this paper presumes that a sustained growth in exports relative to GDP will deter private spending.

Table 1: Definitions and Sources of Variables

Variables	Definitions	Source
Consumption, *c*	*c* = ln(final consumption expenditure ÷ population ÷ deflator)	UN
Income, *y*	*y* = ln(GDP ÷ population ÷ deflator)	UN
Wealth, *w*	*w* = ln(Total accumulated financial Assets ÷ population ÷ deflator)	ECCB
Inflation Rate, *i*	*i* = (ln(deflator) - ln(deflatort-1)) × 100	UN
Real interest rate, *r*	*r* = Treasury bill rate - i	WB
Terms of Trade, *tot*	*tot* = Export Prices ÷ Imports Prices	UN
Export Orientation, *exor*	*exor* = Exports ÷ GDP	UN
$Dummy_{1996}$	1 for Montserrat in the year 1996, 0 elsewhere	
$Dummy_{pos}$	1 for positive spikes observed for Anguilla in 1988, Antigua and Barbuda in 1986 and Montserrat in 2000; 0 elsewhere.	
$Dummy_{neg}$	1 for negative spikes observed for Antigua and Barbuda in 2000, 2006, 2008, and 2009, Montserrat in 1997 and 1999, and St Kitts and Nevis in 1988; 0 elsewhere.	

In accordance with the Harberger-Laursen-Metzler effect, a temporary deterioration in the terms of trade may induce a reduction in real income and hence motivates a contraction in private spending. On the

contrary, as Laursen and Metzler (1950) argue, expenditure tends to rise when import prices expand and vice versa, suggesting a negative relation between the terms of trade and consumption expenditure. Therefore, the final impact of the terms of trade on consumer spending is ambiguous as it depends on the relative size of the income and substitution effects that it stimulates.

3. Estimation and Results

The econometric methodology involves a battery of pre and post diagnostic tests, checking for co-integration using the Pedroni (2004) and Kao (1999) statistics and estimating the long-run and short-run co-integrating coefficients by employing the PDOLS method mentioned in the introduction. All computations are done using STATA.

The results of the panel unit root tests of Levin, Lin, and Chu (LLC) (2002), Breitung (2002), Im, Pesaran, and Shin (IPS) (2003), Dickey and Fuller (ADFF) (1979), Phillips and Perron (PP) (1988) and Hadri (2000) indicate that c, y , w and exor are I(1) while r and tot are I(0) (see Table 2). The Pedroni (2004) tests largely conclude that the null hypotheses of no co-integration are rejected (see Table 3). These results are confirmed by Kao's co-integration statistic whose value of $t = -3.4572$ corresponds to a probability value of zero.

Table 2: Summary Results of Panel Unit Root Tests

Variable	Test Statistics					
	LLC	IPS	ADFF	PPF	Breitung	Hadri
c	-0.959	0.850	11.586	18.530	-1.225	3.681***
Δc	-8.613***	-11.854***	148.413***	265.224***	-6.791***	-0.957
y	1.759	1.749	10.899	8.408	3.914	6.447***
Δy	-9.589***	-10.120***	124.900***	134.576***	-1.390*	1.669**
w	-0.380	-1.391*	24.191*	22.860	1.099	2.980***
Δw	-10.770***	-10.263***	113.218***	114.762***	-5.645***	1.178
r	-4.836***	-5.922***	75.564***	157.115***	-1.690**	5.475***
tot	-2.028**	-2.015**	33.356***	31.629**	-2.710***	4.472***
exor	-2.240**	-0.359	16.746	18.687	-0.943	6.770***
Δexor	-14.015***	-13.587***	181.146***	266.530***	-14.657***	1.338*

Notes: ***, **, and * indicate that the statistic is statistically significant at the 1%, 5%, and 10% levels, respectively. c = Real private consumption expenditure, y = Real GDP, w = Real total accumulated financial assets, r = Real interest rate, tot = Terms of Trade, exor = Export Orientation, and Δ is the difference operator. The null for Hadri = Stationarity while the null for the other tests = Non-stationarity.

Table 3: Pedroni Panel Co-Integration Test Results

Statistic	Common AR Coefficients (Within dimension)		
	Individual Intercept	Individual Intercept and Individual Trend	No Intercept or Trend
Panel v	-0.026	0.363	0.265
Panel rho	1.964	1.237	1.532
Panel PP	-1.654**	-5.479***	-1.357*
Panel ADF	-4.188***	-6.159***	-2.854***
	Individual AR Coefficients (Between dimension)		
	Individual Intercept	Individual Intercept and Individual Trend	No Intercept or Trend
Group rho	2.233	2.929	2.196
Group PP	-3.509***	-4.612***	-2.471***
Group ADF	-4.900***	-4.824***	-3.042***

Notes: ***, **, and * indicate that the statistic is statistically significant at the 1%, 5%, and 10% levels, respectively.

Poolability of the data is also assessed. In this regard, the Breusch and Pagan Lagrangian multiplier test gives a value of $\chi^2_{(1)} = 590.47$ with a corresponding *p*-value of zero, implying that there is evidence of statistical differences across countries and that the data should not be pooled. Consequently, the Hausman specification test employed strongly supports a fixed effects model over a random effects framework (see Table 4). Note, a number of abnormal data points were noticed in the residual graph so spike dummies are utilized to mitigate the distorting influences of these outliers (see Table 1 to see how spike dummies are defined).

The residuals of the models are also checked for contemporaneous correlation, normality, heteroskedasticity and autocorrelation. The Pesaran (PSI) and Breusch-Pagan Lagrangian Multiplier (LM) statistics reject cross-sectional dependence while the skewness and kurtosis tests suggest normally distributed residuals. However, the Wald and Wooldridge statistics respectively indicate that the residuals are heteroskedastic and serially correlated (see Table 4). Accordingly, the models are estimated with country robust cluster standard errors.

Overall, the PDOLS estimates are good representations of the data, explaining between 89.81% and 90.87% of the total variations observed in consumption patterns across the sample. Furthermore, the PDOLS method seems to be slightly better at explaining consumer spending patterns within each island and overtime rather than from one island to the other. Nonetheless, about 55% of the variance in contemporaneous private spending and approximately 69% of the variance in long-run household expenditure is due to differences across the ECCU.

The magnitude of the marginal propensity to consume parameter is 0.79, which indicates that the household sector across the ECCU may be inclined to allocate just about 79 cents of every extra dollar increase in per capita national income directly to consumption. In the long-run, the average propensity to consume is expected to rise to just about 83%.

For the marginal effects of wealth, the results suggest that consumers are rather slow in reacting to marginal changes in wealth; a 10%

Table 4: Long-Run and Short-Run Dynamic OLS Models of the Determinants of Consumption Expenditure in the ECCU

Long-run *DOLS* regression equation:

$$c_t = \underset{(0.2268***)}{1.1691} + \underset{(0.0401***)}{0.8278}\, y_t - \underset{(0.0021**)}{0.0042}\, r_t - \underset{(0.0692***)}{0.9804}\, tot_t - \underset{(0.0913**)}{0.2883}\, \Delta w_{t-1} + \underset{(0.0870***)}{0.4328}\, \Delta exor_{t-1} - \underset{(0.1067***)}{1.1628}\, Dummy_{1996} - \underset{(0.0397***)}{0.5283}\, Dummy_{negative}$$

Long-run *DOLS* model diagnostics:

$Obs = 195$	$R^2_{within} = 0.8981$	$Wald_{\chi^2(8)} = \underset{[0.0000]}{1060.69}$	$LM_{\chi^2(287)} = \underset{[0.7525]}{22.606}$
$Countries = 8$	$R^2_{between} = 0.8907$	$Ser_{F(1,7)} = \underset{[0.0299]}{7.3840}$	$rho. = 0.6914$
$Years_{min} = 20$	$R^2_{overall} = 0.8920$	$Hausman_{\chi^2(7)} = \underset{[0.000]}{116.76}$	$PSI = \underset{[0.5274]}{-0.632}$
$Years_{max} = 25$	$F_{(7,180)} = \underset{[0.0000]}{226.67}$		$Norm = \underset{[0.1235]}{4.18}$

Short-run *DOLS* regression equation:

$$\Delta c_t = \underset{(0.1027***)}{0.7935}\, \Delta y_t - \underset{(0.0339***)}{0.1373}\, \Delta w_{t-1} - \underset{(0.1313***)}{0.4792}\, \Delta exor_{t-1} - \underset{(0.0627***)}{0.9651}\, tot_t + \underset{(0.0627***)}{0.9888}\, tot_{t-1} - \underset{(0.0334**)}{0.0764}\, \Delta hc_{t-2} - \underset{(0.0589***)}{0.4757}\, ecm_{t-1} - \underset{(0.0228)}{0.0112} - \underset{(0.0244***)}{1.2864}\, Dummy_{1996} - \underset{(0.0144***)}{0.2886}\, Dummy_{negative} + \underset{(0.0172***)}{0.2727}\, Dummy_{positive}$$

Short-run *DOLS* model diagnostics:

$Obs = 195$	$R^2_{within} = 0.9087$	$Wald_{\chi^2(8)} = \underset{[0.0000]}{226.55}$	$LM_{\chi^2(287)} = \underset{[0.3842]}{29.567}$
$Countries = 8$	$R^2_{between} = 0.1010$	$Ser_{F(1,7)} = \underset{[0.0001]}{56.149}$	$rho. = 0.5492$
$Years_{min} = 20$	$R^2_{overall} = 0.8202$	$Hausman_{\chi^2(7)} = \underset{[0.000]}{66.62}$	$PSI = \underset{[0.2201]}{-1.226}$
$Years_{max} = 25$			$Norm = \underset{[0.3874]}{1.90}$

Notes: The income and wealth variables are in logarithmic form. Cluster heteroskedasticity and autocorrelation robust standard errors are shown in ( ) while *p*-values are shown in [ ]. ***, **, and * indicate that the coefficient is statistically significant at the 1%, 5%, and 10% levels, respectively. R^2 is the fraction of total variance of the dependent variable that is explained by the model while *rho* is the fraction of the variance that is due to differences across panels. F is the F-statistics for the joint significance of all the explanatory variables. *Obs.* is the number of observations included in the reduced PDOLS model after adjustments (i.e. N×T), *Wald* is the modified Wald test for groupwise heteroskedasticity and *Ser* is Wooldridge test for auto correlation in panel data. *LM* is the Breusch-Pagan Lagrangian Multiplier test statistic for cross-sectional independence and *PSI* is Pesaran's test statistic for cross-sectional independence. *Norm* is the Skewness/Kurtosis tests for normality of the residuals. Finally, Hausman is a specification test used to determine between the fixed and random effects models.

increase in per capita financial wealth in any particular year may actually induce the consumer to save more and slightly contract spending following year by approximately 1.4% the. There is no statistical evidence of an impact of wealth on consumer spending in the long run.

Also, the growth of private expenditure is found to depend negatively on export orientation. However, as with wealth, its effect is lagged by one year. This result is consistent with the Maizels-Lee hypothesis discussed earlier. As it relates to interest rates, there is no support for an immediate effect on household spending. However, in the long run, a 10 percentage point appreciation of the real interest rate may cause an overall 0.04% decline in equilibrium spending by the household sector. This implies that the substitution effect of rising interest rates dominates the income effect in the ECCU.

Finally, consistent with the assertions of Laursen and Metzler (1950), the results imply that a deterioration of the terms of trade within the ECCU may actually encourage real private expenditure in both the long and short-run. Furthermore, in the short run, there is a lagged positive effect of the terms of trade that is of a slightly greater magnitude than the initial immediate negative impact. This may be reflective of the substitution effect associated with this variable. This finding implies that replacing more expensive imports with cheaper national products may actually take effect a year after the initial increase in import prices. An estimated error correcting term of 0.4757 infers that private spending in the ECCU takes just over two years to adjust back to equilibrium after a shock to any of its determinants.

Conclusions

This paper finds support for a consumption function of the ECCU that contains traditional regressors like income, wealth and the interest rate as well as open economy determinants such as the terms of trade and the degree of export orientation. The statistical significance of the trade variables hints at the relative importance of trade in monetary unions and possibly how, through it, welfare gains can be generated and thereby stimulate increases in consumption.

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