



**Research Paper: Determinants of Credit-less Recoveries in the Eastern
Caribbean Currency Union**

Authors: Beverly Lugay and Shernnel J Thompson

Research Department

Eastern Caribbean Central Bank

Table of Contents

1.0	Introduction.....	1
2.0	Stylized Facts.....	3
3.0	Literature Review	8
4.0	Data and Methodology	12
4.1	Data.....	12
4.2	Methodology	14
4.2.1	Identification of Recession (Troughs)	14
4.2.2	Identification of Credit-less Recoveries	14
4.2.3	Model Estimation.....	15
5.0	Regression Results and Analysis.....	18
6.0	Policy Implications	20
7.0	Conclusion	22
	APPENDIX 1.....	25
	APPENDIX 2	27
	Bibliography	29
	Figure 1: Non-Performing Loans in the ECCU	4
	Figure 2: Private Sector Credit to GDP - 2003 to 2009	6
	Figure 3: Private Sector Credit to GDP - 2010-2015.....	6

Research Paper:

Determinants of Credit-less Recoveries in the

Eastern Caribbean Currency Union

ABSTRACT

This paper seeks to understand the factors contributing to credit less recoveries in the Eastern Caribbean Currency Union (ECCU). The identification of credit less recovery episodes, defined as a pick-up in economic growth without an increase in credit, was done using the approach of Abiad et al, 2011. Based on this approach 6 periods of credit-less recoveries were identified in the ECCU using annual data for the period 1986-2015. These recoveries occurred largely in the period 2011-2013, after the 2007/2008 global economic and financial crisis. With the use of logistic regressions, real GDP growth and the ratio of private sector credit to GDP were found to be main determinants of credit-less recoveries. In addition, the change in foreign direct investment and export growth were also found to influence the likelihood of credit less recoveries, though weakly so. One of the implications of the findings is that following a recession linked to the financial system, output could recover without an increase in credit. Therefore, credit growth may not be a necessary condition for an economic recovery. Further, the recovery in the ECCU has been driven mainly by foreign direct investment and services export on account of economic citizenship programs. As such policy makers are encouraged to take a strategic approach to revitalizing growth in the ECCU.

1.0 Introduction

The 2007/2008 global economic crisis which had its roots in the financial system, severely affected the ECCU through its impact on tourism, foreign direct investment and remittances. The contraction in economic activity also filtered into the domestic banking system and contributed to a significant spike in non-performing loans (NPLs) and the subsequent intervention by the Eastern Caribbean Central Bank (ECCB) in three indigenous banks. In 2011-2012 many member countries bottomed out of the recession but with little or no growth in domestic credit yielding what is called a credit-less recovery. A credit-less recovery, also known as a Phoenix Miracle, simply put is a phenomenon in which output recovers without credit growth. For instance, in Anguilla and Antigua and Barbuda domestic credit contracted for five (5) years amid some years of positive GDP growth. While it can be argued that the evolution of domestic credit in those two countries may be associated with the failure of some indigenous banks¹, which may have led commercial banks to tightened credit requirements, a similar pattern of credit contraction was observed over shorter time spans in Grenada, St Kitts and Nevis, and Saint Lucia.

According to Bodnar et al, (2014), credit-less recoveries are not uncommon in developing and emerging markets. In fact, they are most likely to occur after a financial crisis. Additionally, the chances of a recovery of this type may be associated with: imbalances in the credit or real estate market preceding a recession; a large decline in GDP during the crisis period; and a current account deficit. In those credit-less episodes, lending through financial intermediaries is no longer the main pillar for economic growth as growth is being financed through alternative sources; thus, a credit-less recovery is often followed and characterised by lower levels of growth.

Bank credit, which is the dominant source of financing in the ECCU, has facilitated the expansion of the private sector, created employment and financed development for decades. Consequently, bank credit, has been seen as an important element in the generation of

¹ The ECCB intervened in ABI Bank in 2011 in Antigua and Barbuda and National Bank of Anguilla and Caribbean Commercial Bank in Anguilla in 2013.

economic growth in the ECCU. However, there appears to be a weakening in the relationship between growth in real GDP and private sector credit after the recession. Riley (2014), by empirically examining the relationship between the two variables, found that Credit-to-GDP gaps were not unduly large compared to historical standards. Furthermore, the cyclical co-movements between real private sector credit and real GDP were broadly similar to previous cycles and that the absence of a significant increase in real private sector credit despite the resurgence of positive growth in the ECCU was in line with the historical experience. The protracted contraction in private sector credit despite the expansion in GDP growth after the crisis has been a matter of concern for policy makers within the ECCU, especially due to empirical evidence that nominal GDP growth has a positive impact on credit growth, though small (Stowe et al, 2008).

To tackle this concern and facilitate credit growth, the ECCB Monetary Council reduced the Minimum Savings Rate from 3.0 per cent to 2.0 per cent in May 2015. Nevertheless, credit growth has remained depressed in some countries. Moreover, the inability of GDP growth to recover to and beyond pre-crisis levels poses another challenge for policy makers. These issues are the main motivation of this study as understanding the factors that determine the presence of credit-less recoveries in the ECCU could provide policy makers with some insights and solutions. It is also assumed, consistent with the literature, that growth in private sector credit could lead to more robust and higher levels of economic growth in the ECCU.

The ECCU presents a unique case for researchers and policy makers in that it is a group of eight (8) small island developing states (SIDS) which function within a quasi-currency board arrangement. Thus, the study presents a unique perspective on credit-less recoveries within the Caribbean and by extension SIDS. The study seeks to uncover the factors that has led to and determined credit-less recoveries in the ECCU post the global recession. Using logistic regression models based on two definitions of credit-less recoveries, the key factors that are likely to affect the probability of credit-less recoveries were analysed. To our knowledge, this study is the first attempt to examine this issue in the ECCU and it is the first application of rare events logistic regression (relogit) to this subject.

Applying the approach by Abiad (2011) to identify credit-less recoveries, our findings firstly indicate that credit-less recoveries are rare events in the ECCU and its occurrence is strongly linked to the 2007/2008 global recession. The relogit models suggest that credit-less recoveries are mainly preceded by deep economic recessions and high private sector credit to GDP ratios. Change in foreign direct investment and export growth also impacted the probability of occurrence. The results are consistent with previous studies that examined credit-less recoveries. The findings suggest that foreign direct investment and exports of services - on account of the economic citizenship programs - are contributing the most to ECCU economic recovery. Further, policy makers ought to refrain from engaging in a broad based approach to stimulating economic activity and focus on industries which may be sluggish. This approach should contribute to a more robust economic recovery.

The rest of the paper is as follows, Section 2 will provide some stylized facts on the domestic credit and GDP growth relationship. Section 3 provides an overview of the literature, Section 4 will examine the data and provide a suitable methodology for analysis, Section 5 present the regression results and analysis, Section 6 examines the policy implications of the study and finally Section 7 concludes.

2.0 Stylized Facts

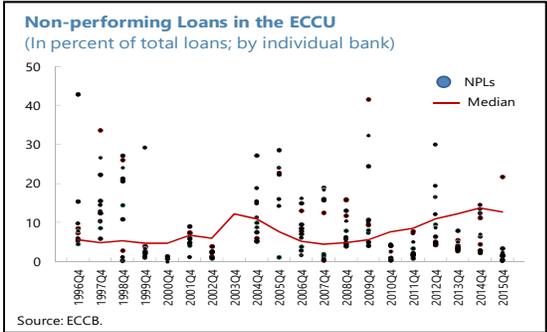
The bursting of the domestic credit cycle on account of the global financial crisis led to the deepest recession recorded by the ECCU since consolidated figures were estimated in 1985. Consequently, the ECCU contracted by at least 5.0 per cent in 2009 and a little less than 3.5 per cent in 2010 and 0.3 per cent in 2011. Prior to the recession of 2009 – 2011, the Monetary Union recorded periods of robust growth, which ranged from 4.4 per cent in 2003 to 5.4 per cent in 2006. Economic growth has been returning to the region as real GDP expanded at an average rate of 2.0 per cent over the period 2012-2015. The performance of the region for the most part has been reflective of improved global macroeconomic performance as well as domestic policies. However, the rate of growth, in comparison to the years prior to the financial crisis has been low influenced by a number of issues including a slow pick up in tourism related and private sector construction; fiscal constraints that hinder

the ability of governments to fuel growth; inert private sector activity; and still low stay-over tourists' arrivals as visitors from advanced economies have had their wealth curtailed.

The corresponding energy required by the domestic economy has not been forthcoming and projects have been mainly driven by external financing – mainly as a result of economic citizenship programs of five (5) sovereign states and the restart of some hotel projects in the member states. The financing for these projects are generated outside the ECCU, and though flowing through the banking system are channelled directly to those projects. Thus, credit to the local economy is low and directed mainly to households and to a lesser extent businesses. This low credit extension may be attributed to supply, demand and other commercial bank balance sheet related factors. On the one hand, banks, especially foreign branch banks may be engaging in credit rationing² – especially towards businesses – and on the other hand, the demand for credit may be low.

The macroeconomy also plays a role in determining whether credit is demanded or supplied.

Figure 1: Non-Performing Loans in the ECCU Banks and businesses both assess the



economic environment in making future decisions. Banks are better able to make this assessment given that they are able to consolidate multiple sources of information into making their economic decisions (Freixas and Rochet 2008). Another possible reason for low credit extension in the ECCU is the high level of NPLs incurred by

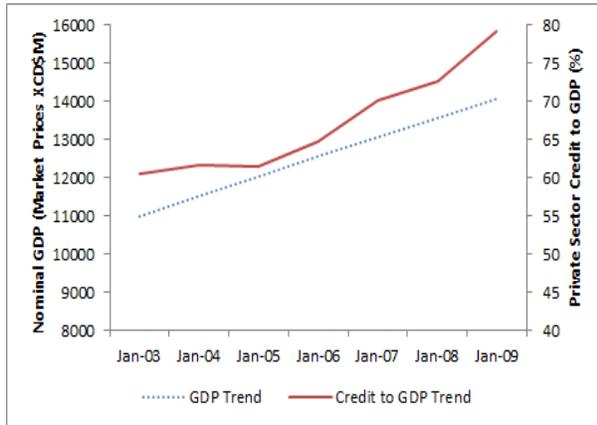
commercial banks following the global financial crisis and the ECCU recession (Figure 1). In advanced economies, monetary policy prescriptions have allowed banks to continue extending credit to businesses and households –even if at lower levels. Following the financial crisis, theory suggests that the presence of monetary policy – specifically quantitative easing allows for the migration of assets and the stimulation of credit in the general economy. In the

² “Equilibrium credit rationing occurs when some borrowers demand for credit is turned down, even if the borrower is willing to pay all the price and non-price elements of the loan contract (Freixas and Rochet 2008).”

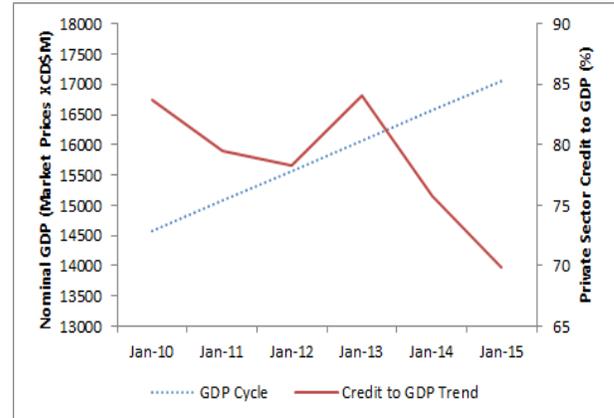
absence of the monetary policy and in the presence of high NPLs – such as in the ECCU – firms demanding credit typically have to await the reduction of NPLs from the balance sheets of banks before receiving access to credit. The result is lower credit extension for prolonged periods, which arguably extends the recession and contributes to the credit rationing behaviour mentioned above.

Examining the relationship between the ratio of private sector credit to GDP and Real GDP growth, provides some insight into the behaviour outlined above and provides further impetus for our discussion. In the first instance there is a positive relationship between the two variables between 2003 – 2009 (Figure 2). This is in keeping with the general understanding associated with the financial crisis. The growth in real economic output was accompanied by an exuberance in the level of credit up to 2009. The converse holds true for the period 2010 to 2015. Following the global financial crisis and subsequent recession in the ECCU, the relationship between the two variables was negative. This suggests that as real economic output expanded the ratio of private sector credit declined (Figure 3). Thus, the level of domestic credit driving economic output within the ECCU has declined over the period. Moreover, the decline in the level of domestic private sector credit is significantly lower in the 2010 to 2015 period than it was during the 2003 to 2009 period. Empirically, Stowe et al (2008), in examining the determinants of credit growth in the ECCU found that past credit growth, bank profitability, deposit and GDP growth had a contemporaneous positive relationship with credit growth. Specifically, a one per cent increase in nominal GDP contributed to a 0.07 per cent expansion in credit growth. They attributed this marginal contribution to credit growth to the fact that the GDP variable captured the demand side effects on the loanable funds market.

**Figure 2: Private Sector Credit to GDP -
2003 to 2009**



**Figure 3: Private Sector Credit to GDP -
2010-2015**



The declines in credit were not just restricted to an overall fall in the stock of credit but a decline in the flows of credit. Recent data from commercial banks within the ECCU suggest that the flow of credit between foreign branch banks and domestic banks have been declining. This data is indicative of either a credit crunch or credit rationing over the period 2008 to 2015. Even as real economic output has been increasing, the overall flow of credit to the economy by domestic and foreign branch banks have fallen (Figure 4). From 2008 to 2011, the flow of credit is estimated to have declined by \$262.4m³. Examining the flow of credit prior to the economic crises reveals that from 2006 to 2008, the flow of credit grew by over 250 per cent for domestic banks and over 512 per cent for foreign branch banks. In a similar manner, the falloff in credit has been greater for foreign branch banks than domestic banks included in the sample.

³ Based on commercial bank data submitted as of 30 September 2016.

Figure 4: Country Breakdown of Credit Flows and Real GDP



Sources: Commercial Banks in the ECCU, ECCB

Indications of the development of a credit-less recovery can be found at the country level, where credit flows declined and real economic output rose. This occurred in all countries included in Figure 4 except St Vincent and the Grenadines. The flow of new loans in each territory was concentrated mainly in the sectors of distribution, acquisition of personal

property, consumer goods, other personal loans, and professional services. The sectoral flows recorded in credit also correspond to the sectoral growth in credit stock following the financial crisis. Domestic credit data reveals that households have taken the bulk of domestic credit while credit to businesses has been reduced. Thus, the domestic demand likely to follow business investment will remain low as businesses bide time or use cash available on balance sheets to finance their activities.

Analysis of the external sector accounts reveals that following the financial crisis, there was a fall-off in foreign direct investment. However, FDI is once again climbing with the economic recovery, largely associated with equity investments in real estate and land sales. Moreover, exports of goods and services are increasing mainly on account of services exports which can be traced to government services attached to the economic citizenship programs in the region. The result has been a reinvigoration of economic activity centred around sectors related to economic citizenship programs, as well as an increase in non-tax revenue in regional fiscal accounts.

3.0 Literature Review

The importance of the financial system for economic growth has been debated widely since the 1800s. The principal function of financial systems is to facilitate the allocation of resources across space and time and in an uncertain environment (Merton and Bodie, 1995). This definition can be further decomposed into the functions of the financial system to include the facilitation of trading, hedging, diversifying and pooling of risk; the allocation of resources, savings mobilization and the facilitation of the exchange of goods and services (Levine, 1997). Furthermore, the relationship between credit and economic growth has also been explored in detail by many authors. Beck (2012) identified several channels between credit and economic growth including entrepreneurship, financial intermediation, exports and development. Though financial systems are able to influence growth through these channels, the relationship is not linear and after certain points may incur diminishing returns (Bodnar et al, 2014).

The link between credit and economic growth, was examined from a closed economy approach by Biggs et al (2009). Within a two sector model of the economy, two types of goods are produced from which income can be derived through their production and sale. Firms in an effort to produce these goods, enlist labour from households in combination with financing from banks. Goods are produced and sold leading to profits, and eventual repayment of loans by firms. The returns to a firms' investment is then shared between consumers through income, which leads to consumption by households. This combination of consumption and investment feeds into overall economic output. Thus, in examining the link between economic growth and credit, we see that the coefficient associated with the change in economic output is significantly larger when compared with the change in the stock of credit. Since GDP growth is a function of the change in the flow and stock of credit, a credit-less recovery can occur where the change in the stock of credit is negative while the flow of credit is positive or GDP may be positive while the stock of credit is negative. Biggs et al (2009) therefore defined a credit-less recovery as a recovery in output without a pick-up in the growth rate of credit instead of the level of credit as defined by Calvo et al, (2006) and Abiad et al (2011). Given the lack of consensus among researchers, several acceptable definitions of credit-less recoveries exist as follows:

1. Three (3) years of consecutive negative annual real credit growth after the trough.
2. Two (2) years of consecutive negative annual real credit growth after the trough.
3. Negative average real credit growth for the 3 years following the trough.
4. Negative average real credit growth for the 2 years following the trough.
5. The level of real credit is higher in the trough year than in the third year after the trough.
6. The level of real credit is higher in the trough year than in the second year after the trough.

Credit-less recoveries are not rare events. This has been highlighted especially in the works of Calvo et al (2006) and Bijsterbosch and Dahlhaus (2011). Calvo et al, (2006) using data for 31 emerging market economies that were integrated into global capital markets over the period of 1980-2004, examined output contractions and their recovery patterns after systemic sudden

stops, identified 22 output collapse episodes. They found that on average although quick V shaped recoveries were typically observed after a crisis they were associated with weak investment pick-ups and no domestic and external credit recoveries. Using the same data as Calvo et al (2006), Biggs et al (2009) argued that it is the flow, not the stock of credit which impacts the recovery. They modelled the relationship between credit and growth and showed that the flow of credit is correlated with growth in domestic demand. Bijsterbosch and Dahlhaus (2011) focusing on 86 emerging and developing countries using a panel probit model found that the incidence of credit less recoveries doubles after banking or currency crises and that recoveries are more likely to be credit-less if they are preceded by large declines in output and financial sector stress as well as high credit to GDP ratio and large capital inflows. Moreover, the frequency of these types of recoveries can double following banking or currency crises. Out of a total of 211 recoveries identified they found that 24 per cent were credit-less.

Coricelli and Roland (2011) based on industry level data for 103 countries and 28 manufacturing sectors from the United National Industrial Development Organization (UNIDO) found that alternative sources of financing such as trade credit, and a reallocation to less credit-dependent sectors were some of the factors that allowed for an economy to recover without credit as they assist firms in raising their output despite stringent credit conditions. Moreover, they found that recovery of credit flow rather than the stock had a greater impact on the recovery of output.

Comparing credit-less recoveries and normal recoveries in a sample of advanced, emerging and lower income countries, Abiad et al (2011), found that one in five recoveries is credit-less. However, in instances of a sudden stop or shock accompanied by a banking crisis, about 80.0 per cent of recoveries were credit-less. Furthermore, they found that these recoveries tend to be weak and output growth was on average a third lower than in normal recoveries. They attributed the differences in output growth between normal and credit-less recoveries to impaired financial intermediation which affected the supply of credit. They also found that the frequency of credit-less recoveries doubled when the downturn was preceded by a credit boom

and more than doubled when the downturn was preceded by or coincided with a banking crisis. In addition, currency and sovereign debt crises had a smaller effect and in the presence of a banking crisis they did not significantly increase the likelihood of a credit-less recovery.

Similarly, Sagawara and Zaldueño (2013) confirmed in their study using data for European and Central Asian countries, that more than 25 per cent of all recoveries were credit-less with more than 45 per cent concentrated in the period 2009-2010. They found that countries with large declines in GDP growth rates were more likely to experience recoveries without bank credit and that countries whose currencies depreciated the most and current account balance improved the most have higher probabilities of experiencing credit-less recoveries. On the external side, they found that economies with higher export to GDP ratios during peak periods reduced the likelihood of credit-less recoveries.

Credit-less recoveries are not limited to country effects. Kannan (2012) examined credit-less recoveries using industry level and firm level data. Using data from the UNIDO, he showed that industries which are dependent on external finance recover at a slower pace following a financial crisis while Abiad et al (2011) indicated the relevance of bank credit to stronger output and capital accumulation. Moreover, credit-less recoveries are not limited to just overall macroeconomic developments, but are necessary for recovery amongst firms. Dagher (2010) using data from three Asian territories finds that in spite of a recovery in sale revenues, firms continued to perform with market values and debt levels similar to their pre-crisis levels. They further noted that the presence of borrowing constraints also affects credit-less recoveries.

Although the research on credit-less recoveries often focuses on the business and macroeconomic view, the contribution by households is also important. From the point of view of households, credit demand may be influenced by several factors. Theoretically, household borrowing decisions are made based on the idea of permanent income hypothesis - smoothing of consumption over the life cycle, Merikull (2012). Thus, household decisions are influenced by the overall level of residential investments, total income (and expected

increases), and the types of loans -mortgage or non-mortgage loans. Merikull (2012) also examined the direct effects of households on overall credit demand. The author found that the debt service ratio and home ownership had an effect on credit demand and mortgage loan demand while savings did not.

In summary, a review of the relevant literature suggests that real GDP growth, the level of private sector credit to GDP, currency depreciation, exports of goods and services, the current account balance and openness to capital/ financial flows were the main factors that influenced the probability of credit-less recoveries.

4.0 Data and Methodology

4.1 Data

The study made use of panel data for the eight (8) ECCU territories for the period 1986-2015, yielding a sample size of 240. The data were sourced from the Eastern Caribbean Central Bank (ECCB). To identify credit-less recoveries using the approach of Abiad et al (2011), the data used were real GDP and real private credit (credit to the private sector divided by the GDP deflator). The stock of private sector credit was captured from the monetary survey data of the ECCB's balance sheet and included only residential credit for households and businesses. The dependent variable credit-less recoveries was constructed as a binary response variable of one or zero, where one reflects the year in which a credit-less recovery episode took place and zero otherwise. The binary response one (1) occurred in 6 years across six (6) countries in the data set according to definition 4 and occurred 7 times across 7 countries according to definition 6. This construct suggests that a credit-less recovery is a rare event in the ECCU.

To estimate the logistic regression, the following covariates were used;

- *Real GDP growth (rgdpg)*: this variable captures a bounce back effect (Sichel, 1994) and is defined as the annual change in real GDP. The steeper the preceding contraction in output, the larger the probability that it will recover due to unused production capacity. Furthermore, according to financial accelerator mechanisms the more severe

the contraction in economic activity, the larger the probability that credit growth could be weak. The expected sign of this variable is negative.

- *Private Sector Credit-to-GDP ratio – natural logs (lpscgl)*: a high ratio indicates that the private sector is highly leveraged and may have to deleverage during a downturn. Therefore, the higher the ratio, the greater is the likelihood for a credit-less recovery. The expected sign of this variable is positive.
- *Change in foreign direct investment (cfdi)*: high levels of financial inflows, sourced from the balance of payment account, increases the probability of a credit-less recovery. This variable is defined as the annual change in the ratio of foreign direct investment to GDP and is expected to be positive.
- *Growth in exports of goods and services (exg)*: this data is sourced from the current account of the balance of payments. It may be a key driver of a credit-less recovery on the assumption that credit intensive domestic expenditure components are depressed, (Bijsterbosch and Dahlhaus (2011)). The expected impact on credit-less recoveries is positive.
- *Banking crisis dummy (cr)*: this crisis dummy captures the ECCB interventions in 2013 in Anguilla, and 2009 and 2011 in Antigua and Barbuda. By limiting the crisis dummy to interventions only, the authors assume implicitly that the effects of the interventions were not transitive and so became constrained to the country of origin. The expected impact on credit-less recoveries is positive.

Other explanatory variables that were considered to be important and relevant included the current account balance as a percentage of GDP and the debt to GDP ratio. A high current account deficit indicates the dependence on foreign capital inflows while the debt to GDP ratio could affect credit available to the private sector. However, due to the presence of multicollinearity and insignificance, these variables were dropped from the models. The descriptive statistics of the dataset is presented in table 1, Appendix 1.

4.2 Methodology

4.2.1 Identification of Recession (Troughs)

A key aspect of the methodology and determining whether credit-less recoveries exist is defining a recession (trough). The National Bureau of Economic Research (NBER) defines a recession as: “*a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP...[beginning] just after the economy reaches its peak...and ends as the economy reaches its trough* (National Bureau of Economic Research 2008).” The definition in this study goes a bit deeper whereby troughs were identified as periods when cyclical GDP is one standard deviation or more below zero⁴ (Braun and Larrain, 2005). Consequently, for each country, data points where the cyclical component of GDP was below a negative one standard deviation were considered as troughs. To avoid a double dip recession, if two or more troughs were identified within two years or less, the one with the lowest cyclical component was chosen. Once the troughs were identified the corresponding peaks were determined. A peak is the highest value between two troughs or in the case of the first trough, the highest cyclical component prior to the first trough. To extract the cyclical component of GDP, the Hodrick-Prescott (HP) filter was used. In using the HP filter, the trend component moves and adjusts continuously thereby leading to a trend which minimizes the sum of squared deviations (Agenor and Montiel 1999). There are, however, several arguments for and against the use of the HP filter. A major criticism has been that it may remove valuable information and introduce spurious patterns into the data thus making it unsuitable for policy analysis⁵ (Agenor and Montiel 1999). The authors sought to correct for the nature of the two-sided filter by using a one sided filter.

4.2.2 Identification of Credit-less Recoveries

The second stage is the identification of credit-less recoveries, employing the methodology of Abiad et al, (2011). The recovery period is defined as the period following the trough ($t+1$), after which the credit-less recovery is identified using the six (6) definitions listed in the literature review. Definition four (4) which defined a credit-less recovery as one with negative

⁴ The cyclical GDP is defined as the difference between the logarithm of real GDP and a trend computed by the Hodrick Prescott Filter (HP Filter).

⁵ St-Amant and Norden (1997) provide a detailed discussion on the use of the HP filter (one/two sided approach).

average real credit growth for the 2 years following the trough and definition six (6) which states that a credit-less recovery occurs when the level of real credit is higher in the trough year (t) than in t+2, are the preferred definitions used in this paper. Consequently, according to the definition 4 there were six (6) episodes identified in all countries except Grenada and St Vincent and the Grenadines and according to definition 6 there were seven episodes with the exception of St Vincent and the Grenadines⁶, (Appendix 1, Figure 1). Episodes based on the other definitions 1, 2, 3, and 5 yielded 3, 4, 5 and 5 observations, respectively. Credit-less recoveries in the ECCU seem to occur primarily in the post crisis period of 2011-2015 with the only exception of 1998 in Montserrat.

4.2.3 Model Estimation

The authors make use of a static panel logistic regression model to estimate the parameters, similar to study done by Bijsterbosch and Dahlhaus (2011). This approach is appropriate as the dependent variable takes a binary form, representing the presence of a credit-less recovery (1) and the absence of it (0), and the errors are not normally distributed (equation 1).

$$y_i = \begin{cases} 1 & \text{if country } i \text{ has a creditless recovery} \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

.....where y_i is the realization of a random variable Y_i that can take the values of one and zero with probabilities of π_i and $1 - \pi_i$, respectively. The logit model binds the values of the probability to the 0 to1 range and when compared with the assumption of linearity, it provides much more robust estimates for analysis. Additionally, a static model makes the simplifying assumption that the probability of a credit-less recovery in period t is independent of all previous credit or GDP trough events within a given country. Hence, the authors assume that the absence of a credit-less recovery or event in prior periods is unlikely to influence a similar type recovery in the current period.

The logistic regression model equates the logit transform, i.e. the natural logarithm of the odds that some event will occur, to the linear component $\rightarrow \pi_i = x_i' \beta_k$ (equation 2).

⁶ One episode per country.

$$\text{Log} \left(\frac{\pi_i}{1 - \pi_i} \right) = \sum_{k=0}^k x_{ik} \beta_k \quad i = 1, 2, \dots, N \quad (2)$$

.....where x_i is a vector which includes a constant and $k - 1$ explanatory variables. The unknown parameter β_k is a $k \times 1$ vector, where β_0 is a scalar constant term and β_1 is a vector with elements corresponding to the explanatory variables. Further transformation yields the generic logistic model (equation 3) which follows a cumulative density function (CDF).

$$\text{Pr}(y = 1|x) = \frac{\exp(x'\beta)}{1 + \exp(x'\beta)} \quad (3)$$

....where the exponential coefficient, $\exp(\beta_k)$, represents the odds ratio and the right hand side is a non-linear function of predictors. Simply put equation (3) indicates that the effect of a predictor variable on the probability of the dependent variable being successful is conditional on the coefficient and the probability value of the other covariates. For logistic regression, the least squares estimates are not capable of producing minimum variance unbiased estimators for the actual parameters, and therefore maximum likelihood estimation (MLE) is used to solve for the parameters that best fit the data (Czepiel, 2002). MLE which is derived from the probability distribution of the dependent variable finds the set of parameters for which the probability of the observed data is greatest.

Two models were estimated using equation 3. The first logistic model was based on a credit-less recovery defined according to definition 4 (CRFR) and the second model reflects definition 6 (CRSX).

- Model 1: $\text{Pr}(\text{credit-less recovery, crfr})_{ik} = \beta$ (real GDP growth - rgdpg; the lag of private sector credit to GDP - lpscg1; change in foreign direct investment - cfdi; export growth - exg; crisis -cr) $_{ik} + \varepsilon_{ik}$

- Model 2: $\Pr(\text{credit-less recovery, crsx})_{ik} = \beta (\text{real GDP growth - rgdpg; the lag of private sector credit to GDP - lpscg1; change in foreign direct investment - cfdi; export growth - exg; crisis -cr})_{ik} + \varepsilon_{ik}$

Those models were subjected to diagnostic tests including those for specification errors, multicollinearity and goodness of fit. The goodness of fit tests presented in table 3, Appendix 2, indicates that the models were well specified and the variables were significant in explaining credit-less recoveries. Based on the Likelihood Ratio statistics, model 1 is slightly superior to model 2, but notwithstanding, we chose to present both models. Furthermore, greater variation is observed using model 1 which indicated the rate of the change in private sector change as opposed to levels.

While these two (2) logistic models passed the diagnostic tests, the rarity of credit-less recoveries in the ECCU biased the estimates, making $\hat{\beta}$ a likely biased estimate of β . This is because the maximum likelihood estimates of the logistic regression suffer from small sample bias and sharply underestimates the probability of infrequent episodes. Furthermore, even if $\hat{\beta}$ was unbiased, the conditional probabilities are likely to be inferior as most rare events applications produce small estimates of $\Pr(Y_i = 1|x_i) = \pi_i$ for all observations (King and Zeng, 2001). As a result, the Rare Events Logistic Regression (relogit) was used to estimate the models. This method, which was proposed by King and Zeng (2001) is considered superior to the normal logistic regression as it corrects for biases in small samples or rare observations and empowers the application of logistic regression. They designed a simulation programme that uses the usual logistic regression with a weighting or prior correction method that corrects the biases in rare events data captured in the constant term. Consequently, rare events logistic regression led to less bias coefficients and standard errors compared to logistic regression⁷. Hence, the model estimation process consisted of two steps: the estimation of a normal logistic regression, followed by the estimation of a relogit regression.

⁷ A weakness of the rare events logistic regression is that it overcorrects the bias in MLEs. As such another approach which is highly recommended to deal with small sample bias is the penalised MLE (PMLE) proposed by David Firth, called Firthlogit. PMLE produces unbiased estimates in cases with small sample size and few events. However, due to software constraints this method could not be used.

Since the coefficients of the relogit model do not allow for inference about the quantitative effects of changes in the explanatory variables, we calculate the marginal effects. The marginal effect measures the change in the probability of the dependent variable as a function of a change in the covariates, such as $\Pr(Y = 1|X = 1) - \Pr(Y = 1|X = 0)$. The first difference is used to estimate the marginal effects, calculated at the means of the explanatory variables. The marginal effects of the covariate k for country i at time t is given by equation (4).

$$\frac{\partial F(X'_{it}\hat{\beta})}{\partial X_{itk}} = f(X'_{it}\hat{\beta})\hat{\beta}_k \quad (4)$$

....where f is the derivative of the cumulative density function of a standard logistic distribution. It is important to note that derivative calculation may not be meaningful in the case of a dummy explanatory variable such as the banking crisis dummy. In this instance the marginal effect of a dummy variable on the predicted probability of y is calculated as in equation 5:

$$\Pr(y = 1|X_l = 1, \bar{X}, \hat{\beta}) - \Pr(y = 1|X = 0, \bar{X}, \hat{\beta}) \quad (5)$$

5.0 Regression Results and Analysis

The summarized regression results are presented in table1, Appendix 2. In model one (1), real GDP growth was found to significantly reduce the odds of a credit-less recovery by 15.0 per cent. This is because of the excess capacity caused by the severe extent of economic contraction which could lead to a quicker rebound in economic activity – the rebound effect. Meanwhile, the ratio of private sector credit to GDP increases the odds of a credit-less recovery by 3.7 times, in sync with aprior expectations as a higher ratio will likely lead firms and households to deleverage during a recession. Furthermore, these two variables are expected to be significant determinants on the mere basis of the definition of credit-less recoveries. Change in foreign direct investment and export growth had no relationship with a credit-less recovery in this model while the banking crisis was not significant in affecting the odds of a credit-less recovery. The banking crisis dummy did not impact the odds of a credit-

less recovery at the regional level. This result is in line with expectations as the bank failures were contained within the countries of origin.

In model 2, real GDP growth maintained the same likely impact on the odds of a credit-less recovery, although at a lesser magnitude (6.0 per cent). However, the external accounts variables such as the change in foreign direct investment and export growth significantly increased the odds of a credit-less recovery, although at very marginal rates. Intuitively, this means that growth in GDP was financed by foreign direct investment and export growth with no need for domestic bank borrowing. This is consistent with the historical effects of FDI investments on GDP as many tourism related construction projects are fuelled by foreign investments. In this instance however, the increase in foreign investments largely reflected inflows related to the Citizenship by Investment programmes, which are highly impactful on the economies in which the programmes exist. Regarding export growth, this was specific to government services, again reflective of inflows related to the Citizenship by Investment programmes. These inflows have allowed governments to influence growth through consumption, salaries and wages of the public sector which further impacts consumption and capital expenditures. Meanwhile, the ratio of private sector credit to GDP did not impact the odds of a credit-less recovery in this model, which is an unexpected outcome and requires further investigation. The banking crisis remained insignificant in affecting the odds of a credit-less recovery in this model.

The estimated marginal effects of changes in the explanatory variables are presented in table 2, Appendix 2. All the coefficients have the expected sign and the results are in sync with the exponential coefficients presented above. Model one indicates that a unit increase in real GDP growth will reduce the probability of a credit-less recovery by 0.2 per cent. Meanwhile, a one per cent increase in real private sector credit to GDP is likely to increase the probability of a credit less recovery by 1.3 per cent. The other variables in the model were not significant in affecting the likelihood of a credit-less recovery. In model 2, real GDP growth, the change in foreign direct investment and export growth were all significant in affecting the probability of a credit-less recovery. The size of the coefficients however indicates weak effects on the probability of a credit-less recovery.

Based on the size of the coefficients, and the Psuedo R-squared, model one better explains the factors that contribute to the credit-less recoveries in the ECCU, which can be summarized as real GDP growth and the level of private sector credit-to-GDP. However, the results of model two are also significant as it highlights the role of export growth and foreign direct investment in the ECCU as critical drivers of growth post the global recession, signifying largely the positive impact of the Citizenship by Investment programme. It is very possible that without these programmes, along with depressed credit growth, the ECCU economies would likely be still stuck in recession. The results of this paper are consistent with earlier studies on this topic. Bijsterbosch and Dahlhaus (2011) found that real GDP growth, a high private sector credit to GDP ratio, and export growth among other factors were significant determinants of credit-less recoveries. Similar results were obtained by Sugawara and Zalduendo (2013) and Abiad et al (2011).

6.0 Policy Implications

The results of the rare events model using the first definition of credit-less recovery suggests that real economic activity reduces the likelihood of a credit-less recovery occurring, while the level of private sector credit to GDP is expected to increase the likelihood of the event occurring. In examining the second model, we see that real economic output has a similar impact on credit-less recoveries, while variables related to the external account such as foreign direct investment and export growth increase the likelihood of a credit-less recovery.

In the first instance, we see that the growth in real economic output may not necessarily be attributed to an increase in lending activity and can reduce the likelihood of a credit-less recovery. This conclusion is similar to that already expressed in the literature by Abiad et al (2011) and Riley (2014). The extension of credit, therefore, may not be a prerequisite for economic activity in the ECCU. Thus, credit acts a sufficient though not a necessary condition for economic recoveries. Therefore, the absence of credit acts as a constraining factor in the recovery – thus rendering the economic recovery weaker and increasing the susceptibility of the ECCU to economic shocks.

The economic recovery at the moment remains attributed to a few specific sectors of activity. This feature of the recovery points to structural short-comings within the region's economies. With a few sectors driving the economy and thus contributing to a less robust economy, a broad based approach to growth policy in the ECCU at this moment may not be the best approach. Instead, policy makers should seek to target industries or sectors which are not contributing significantly to the current growth levels and seek to spur activity in those respective areas. The concentration of growth for the moment remains centred on services due in support of regional economic citizenship programs. Consequently, sectors such as construction and real estate have benefited most. Growth in other sectors such as manufacturing and distribution remain low while emerging sectors such as Information and Communication Technologies and the Creative industries remain largely untapped. As such policy makers ought to foster these industries for development and a greater contribution to the overall economy.

External factors such as export growth and foreign direct investment – as mentioned above – have contributed significantly to the economic recovery. The positive influence of these two variables can be traced to the rise of economic citizenship programs and the returns of these programs to the export of services along with the increase in FDI in the region. The returns to economic citizenship programs have been traced primarily to government services and to a lesser extent professional services such as management and consulting services. Therefore, government revenue (non-tax revenue) and management and consulting fees are (corporate tax revenue) are expected to improve over time in so far as these citizenship programs continue. Additionally, the inflows of funds associated with the program though passing through the banking system are used for real estate development projects and may have positive externalities for other sectors. Further, higher credit extension becomes almost unnecessary as firms are able to keep their balance sheets afloat with inflows from external agents and thus drive domestic economic activity. In a similar manner, the increased external contribution to an economic recovery simply weakens overall activity and a country's ability to withstand economic shocks. Therefore, it is imperative to carefully manage the receipts from the economic citizenship programmes to allow for a maximization of the benefits.

Finally, the significance of external sector variables along with the low credit extension reinforces the hypothesis that credit rationing or credit supply restrictions are perhaps being used by commercial banks in the ECCU. This restriction of credit is partly due to the high levels of non-performing loans on the balance sheets of commercial banks. Commercial banks will, in the absence of active monetary policy seek to reduce the levels of NPLs before extending credit to firms. This contributes further to the lower and weaker economic activity seen in the ECCU. The level of credit being extended to households for the acquisition of property and durable consumer goods is of also concern. The shift from businesses to households is a rational /optimal approach by banks to maintain profitability, low volatility in returns and assets with a longer maturity (e.g. mortgages). The concentration of bank credit to households is also representative of commercial banks' consideration of future cash flows from businesses. Commercial banks will perceive that the ability of businesses to repay will be low and as such will adjust their credit to households. The concentration by banks on this sector is, however, a potential source of instability as it encourages households to increase their indebtedness, thereby encouraging an environment similar to that prior to the financial crisis. Therefore, a policy framework which incorporates the Eastern Caribbean Asset Management Company and a review of foreclosure laws could assist banks in reducing their NPL levels and curtail the credit rationing behaviour.

7.0 Conclusion

The relationship between credit and GDP has been discussed at length by several papers, not only internationally, but also within the ECCU. Following the global financial crisis, the credit to GDP relationship has changed – diverging from its historical relationship (Riley 2014). This divergence in the ECCU has manifested itself in the form of a credit-less recovery. A recovery of this nature is not *bad* in the stereotypical sense but rather reduces the robustness of economic growth and leaves economies more susceptible to exogenous shocks. This research paper, thus sought to provide some insight to the credit-less recovery event currently occurring within the ECCU. The paper reveals even more so that the event in the

ECCU is quite rare, occurring mainly, as the literature suggests following banking and financial crises.

Examination of growth and other indicators suggest that real economic recovery is weak while banks continue to restrict credit to the household sector. The restriction of credit is mainly on account of demand and supply factors faced and influenced by commercial banks in the ECCU. Commercial banks also face higher NPLs on their balance sheets along with lower profitability. This confluence of factors has limited business credit and its potential role in spurring domestic growth. Domestic growth following the crisis can be traced to the influence of economic citizenship programs and their positive externalities in the ECCU. Thus, the structural impediments to economic output can be compounded by the presence of credit-less recoveries and its weakening effect.

The authors conclude that these findings have further implications for policy. Policy makers are minded to resist a broad based approach to growth and instead create incentives for economic growth from a sectoral view. Currently, there are a few specific sectors leading the recovery - mainly on account of the influence of economic citizenship programs on fiscal policy along with the export of services. In ensuring that a robust recovery occurs, policy makers ought to focus on stimulating growth in other less developed sectors. Such an approach also reduces the economy's susceptibility to exogenous shocks.

Policy makers ought to also take note of the levels of credit being extended to households in comparison to the levels being extended to businesses. In as much as banks are seeking to improve profitability and seek assets with a longer maturity (e.g. mortgages), the excessive build up in credit can lead to an overleveraging of households. This overleveraging combined with exogenous shocks – and an already weak recovery- can lead to an environment seen during and immediately following the financial crisis – albeit not at a similar magnitude.

The application of this research to the ECCU and its wider contribution to Caribbean economic literature on the subject cannot be overstated. Its implications for policy, both for

governments and regulators speak to the need for structural reforms in the region and reinforce the concerted efforts already underway.

APPENDIX 1

Figure 1: Economic Downturns amongst ECCU Territories; 1977 - 2015

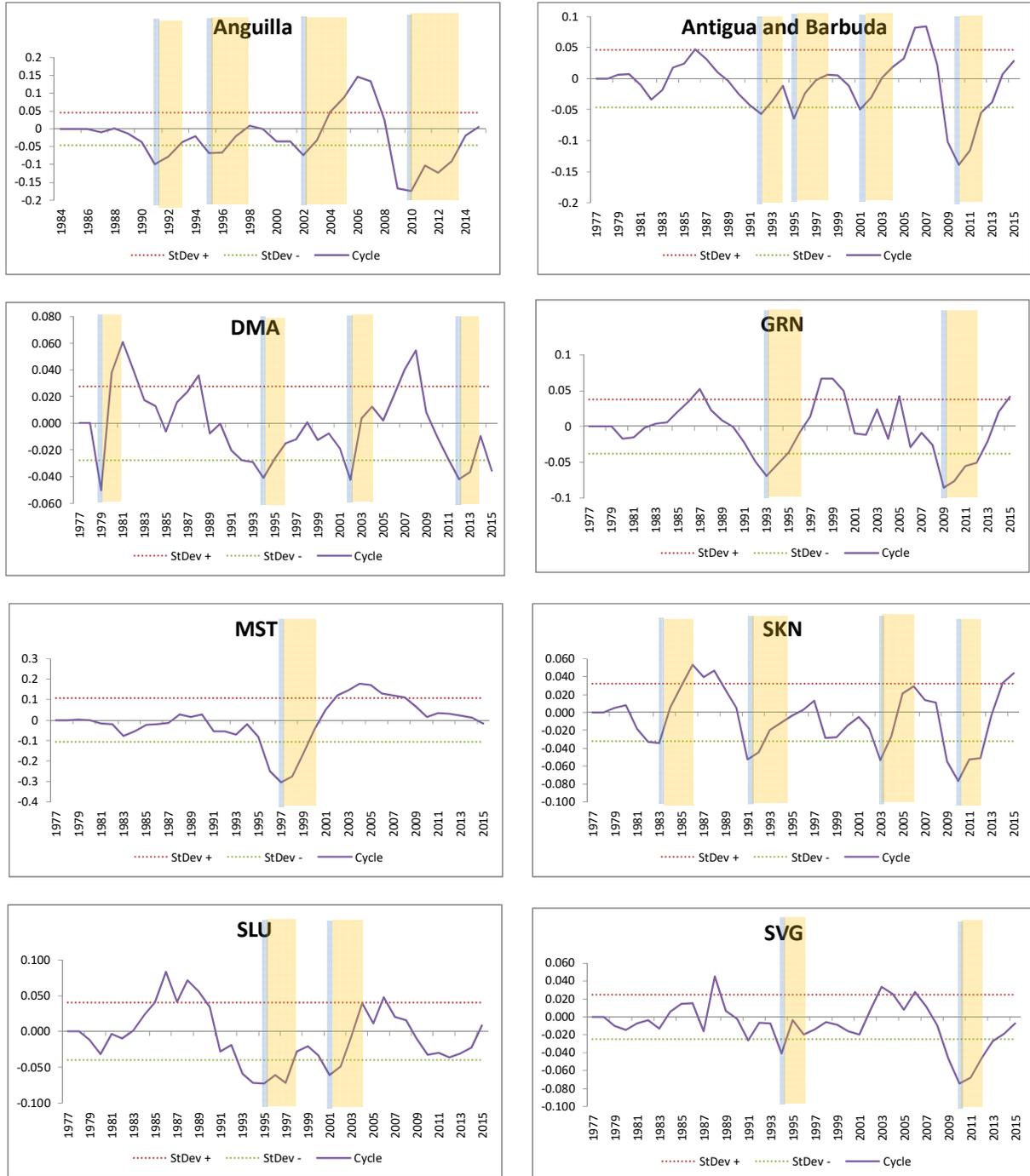


Table 1: Descriptive Statistics of Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
crfr	240	.025	.1564512	0	1
crsx	240	.0291667	.1686252	0	1
rgdpg	240	2.717471	5.421941	-26.76	17.251
lpsc	238	3.985352	.4456429	2.822149	5.27387
cfdi	228	10.03718	96.62784	-1105.704	259.7459
exg	240	6.126746	14.23294	-61.191	65.899
crisis	240	.0375	.1903806	0	1

APPENDIX 2

Table 1: Relogit Regression

Relogit Regression

Variable Name	Model 1	Model 2
rgdpg	0.8451*** (0.607)	0.9390* (0.340)
lpscgl	3.7358* [†] (0.879)	3.2719 (0.920)
cfdi	1.0050 (0.005)	1.0071** (0.003)
exg	1.0004 (0.0281)	1.0524** (0.022)
cr	3.5307 (1.259)	4.2776 (1.455)
constant	0.0001*** (3.813)	0.0001** (3.764)
Observations	6	7
Log Likelihood	-21.943	-25.73
Pseudo R ²	0.2091	0.177

Note: Exponential coefficients; standard errors are in parentheses;
* significant at 10%, ** significant at 5%, *** significant at 1%.

The relogit does not generate summary statistics and the figures reported correspond to an uncorrected logit model in which all coefficients allow for identical substantive interpretation.

Table 2: Marginal Effects

Marginal Effects

Variable Name	Model 1	Model 2
rgdpg	-0.1681** (0.010)	-0.0629** (-0.064)
lpsc1	1.3179** (0.041)	1.1854 (0.198)
cfdi	0.0050 (0.344)	0.0071** (0.035)
exg	-0.0004 (0.989)	0.0511** (0.024)
cr	1.2615 (0.343)	1.441 (0.322)

Note: p values are in parentheses;

* significant at 10%, ** significant at 5%, *** significant at 1%.

Table 3: Goodness of Fit Tests Results

Goodness of Fit Tests

Hosmer-Lemeshow (8 groups)

Null Hypothesis: Model is Correctly Specified

Alternative Hypothesis: Model is Incorrectly Specified

	p-value	Decision
Model 1	0.5474	The null cannot be rejected, hence the model is correctly specified
Model 2	0.7112	The null cannot be rejected, hence the model is correctly specified

LR Statistics

Null Hypothesis: All slope coefficients, except the constant equal to zero

Alternative Hypothesis: All slope coefficients, except the constant are different from zero

	p-value	Decision
Model 1	0.0406	ll cannot be rejected, hence the model significantly predicts the probabilities
Model 2	0.0496	ll cannot be rejected, hence the model significantly predicts the probabilities

Bibliography

- Abiad, Abdul, Giovanni Dell'Ariccia and Bin Li. 2011. "Credit-less Recoveries ." *IMF Working Paper 11/58*.
- Agenor, Pierre-Richard, and Peter J Montiel. 1999. *Development Macroeconomics*. 2nd. New Jersey: Princeton University Press.
- Baltagi, Badi H. 2005. *Econometric Analysis of Panel Data*. 3rd. West Sussex: John Wiley & Sons, Ltd.
- Beck, Thorsten. 2012. *The Role of Finance in Economic Development - Benefits, Risks and Politics in Dennis Muller (Ed)*. Oxford Handbook of Capitalism .
- Biggs, Thomas Mayer, and Andreas Pick. 2009. "Credit and Economic Recovery." *DNB Working Paper*. no. 218. De Nederlandsche Bank, July.
- Bijsterbosch, Martin, and Tatjana Dahlhaus. 2011. "Determinants of Credit-Less Recoveries." *Working Paper Series*. no. 1358. European Central Bank, June.
- Bodnar, Katalin, Zsolt Kovalszky, and Emese Kreiszne Hudak. 2014. "Recovery from crises and lending." *Financial and Economic Review* 13 (4): 57-85.
<http://english.hitelintezetiszemle.hu/letoltes/3-bodnar-en.pdf>.
- Calvo, Guillermo A., Alejandro Izquierdo and Ernest Talvi. 2006. "Suden Stops and Phoenix Miracles in Emerging Markets." *The American Economic Review* 96 (2) 405-410.
- Claessens, Stijn, M Ayhan Kose, and Marco E Terrones. 2009. *Columns: VOX CEPR's Policy Portal* . 22 May . Accessed May 05, 2016. <http://voxeu.org/article/creditless-recoveries-what-do-we-know>.
- Freixas, Xavier, and Jean-Charles Rochet. 2008. *Microeconomics of Banking*. 2nd . Cambridge, Massachusetts: The MIT Press.
- King, Gary, and Langche Zeng. 2002. "Estimating Risk and Rate Levels, Ratios and Differences in Case-Control Studies." *Statistics in Medicine* (21): 1409-1427.
- King, Gary, and Langche Zeng. 2001. "Logistic Regression in Rare Events Data." *Department of Government, Harvarad University* 01-27.
- Levine, Ross. June 1997. "Financial Development and Economic Growth : Views and Agenda ." *Journal of Economic Literature* Vol XXXV 688-726.

- Merikull, Jaanika. 2012. *Households Borrowing During a Creditless Recovery*. Bank of Estonia. Accessed June 20, 2016.
file:///C:/Users/Administrator/Downloads/_wp_212.pdf.
- Merton, Robert C and Zvi Bodie. 1995. "A Conceptual Framework for Analyzing the Financial System." In *The Global Financial System - A Functional Perspective*, Chapters 1-8. Harvard Business School .
- National Bureau of Economic Research . 2008. "The NBER's Recession Dating Procedure." *The National Bureau of Economic Research* . 07 January . Accessed July 04, 2016.
www.nber.org/cycles/jan08bcdd_memo.pdf.
- Riley, Garfield. 2014. "Has the Credit-GDP Relationship Changed?" *ECCB Working Paper Series* 74-85.
- Sichel, D.E. 1994. "Inventories and the Three Phases of the Business Cycle." *Journal of Business and Economic Statistics* 12(3) 269-277.
- St-Amant, Pierre, and Simon van Norden. 1997. "Research-Bank of Canada: Technical Reports." *Bank of Canada*. August. Accessed July 04, 2016.
www.bankofcanada.ca/wp-content/uploads/2010/01/tr79.pdf.
- Sugawara, Naotaka, and Juan Zaldueño. 2013. "Credit-less Recoveries. Neither a Rare nor an Insurmountable Challenge." *Policy Research Working Paper*. no. 6459. The World Bank, May.
- Tomz, Michael, Gary King, and Langche Zeng. 1999. *Rare Events Logistic Regression, Version 1.1*. 1 October. Accessed July 26, 2016. <http://gking.harvard.edu/>.