



**FINANCIAL DEVELOPMENT, REMITTANCES, AND
ECONOMIC GROWTH: EVIDENCE FROM GHANA,
1979-2020**

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Abstract

Over the last 40 – 50 years, there has been growing research interest in the role of remittances on developing countries' economic growth. Remittances, a source of foreign capital inflow, have grown tremendously given the rise in globalisation and the increase in international migration, mainly out of African countries. In Ghana, the value of remittances has been growing and is emerging as an important source of capital. Additionally, Ghana has the second highest magnitude of remittance inflows in Sub-Saharan Africa; however, the effects of this on economic growth are still contested in the literature and need to be further understood. At the same time, Ghana has experienced developments in its financial system, resulting in increased financial inclusion and potentially improved economic performance. However, there is no clarity on the relationship between financial development and economic growth in Ghana. As globalisation and technology lead to advances in the financial system, and as remittances into Ghana through the financial system continue to increase, it is important to examine the effect that remittances which pass through the financial system have on economic growth in Ghana.

This study therefore examines the relationship between financial development, remittances, and economic growth in Ghana over the period 1979 – 2020 using four financial development proxies, namely, domestic credit to the private sector by banks and M2 money supply as the banking sector proxies, gross domestic savings as the financial market proxy, and a composite financial development index by Svirydzenka (2016) to give an overall view of the Ghanaian economy. The study employs various specifications of an augmented Solow (1957) model and estimates them by employing the ARDL Approach to Cointegration method (Pesaran et al., 2001).

The study finds that financial development does not significantly impact economic growth and that remittances alone negatively affect economic growth. However, the combined effect of financial development and remittances on economic growth in Ghana is positive when remittances pass through the banking sector but negative when remittances pass through the financial market. Therefore, this study suggests that policymakers should ensure that the banking sector increases efficiencies and access to services and encourage remittance inflows through the formal banking sector to amplify its benefits to economic performance.

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Chapter 1: Introduction

Over the last 40 – 50 years, many countries have experienced growth in their international migration patterns mainly due to globalisation and technological advancements, which have made migration more accessible and efficient than it was in the past. This trend is particularly prevalent in African countries as, according to the Migration Policy Institute (2022), in 2020, 10% or 30.84 million of the global migrant population originated from an African country. Furthermore, over the same period, African countries have seen notable developments in their financial systems driven by technological advancements and their desire to improve financial inclusion, savings, and economic growth. For example, in 1998, 153 foreign deposit-taking banks were operating in African countries. By 2006, this had increased to 203 banks due to reforms which resulted in the opening up of the financial system and the entrance of more foreign banks into the continent (Allen, Otchere & Senbet, 2011). The development of stock markets in Africa is another example of financial sector development on the continent. In the early 1990s, there were only five active stock exchanges in Sub-Saharan Africa, and as of 2020, there were over 25 exchanges which involved 38 countries, with market capitalisation and the number of domestic companies listed increasing annually (Allen, Otchere & Senbet, 2011).

Increases in migration and the developments in the financial systems have led to a dramatic increase in remittances, providing an economic link between the migrant and their home country. The World Bank (2022a) describes remittances as current personal transfers in cash or in kind to resident households from non-resident households. Internationally, remittances have been growing rapidly since the 1970s and have become an important source of external financing for developing countries (Sayan, 2006; Mazzucato, Nsowah-Nuamah & van den Boom, 2008). In 2019, the value of remittances worldwide amounted to US\$719 billion (Batalova, 2022; World Bank, 2022a), but the value of the overall impact of remittances on the economies of the recipient countries may be larger than US\$719 billion due to its potential to impact economic growth (Adams & Klobodu, 2016). Remittances may therefore have an important role to play in developing countries' growth, especially if they have experienced significant developments in their financial systems.

Generally, countries with developed financial systems, particularly developed banking sectors, could attract remittances into the home country, given the lower transfer costs of remittances (Ackah, Lambon-Quayefio & Quartey, 2019; Asomani, Ofori & Pephrah, 2019). The increased

flow of remittances through the formal financial system could be invested into productive sectors of the country, which help the economy grow (Giuliano & Ruiz-Arranz, 2006; Asomani, Ofori & Peprah, 2019). Remittances could also positively impact economic growth in countries with poorly developed or weak financial systems as they provide an alternative way to finance investments and overcome liquidity constraints (Fayissa & Nsiah, 2010). However, if most remittance inflows are through informal and unregulated channels, remittances can negatively affect the financial system with adverse or minimal economic effects (Adamba & Quartey, 2015). Finally, remittances could be used to substitute loans which could hamper the development of the financial system (Giuliano & Ruiz-Arranz, 2006; Antwi & Koranteng, 2017).

Despite the potentially important role that remittances and financial development could play in the growth pattern of developing countries, very few studies have attempted to provide a comprehensive analysis of the issue (Mundaca, 2009; Fayissa & Nsiah, 2010; Kipyegon et al., 2012; Hysa & Rehman, 2021). Additionally, there is still a lack of consensus on how remittances and financial development affect economic growth in developing countries. The lack of consensus is particularly the case for Ghana. Although it is a country that has been receiving many remittances and has seen many financial developments over the last 40 years, very few studies have attempted to investigate the relationship between remittances, financial development, and economic growth (Adusei, 2013; Antwi & Koranteng, 2017; Asomani, Ofori & Peprah, 2019).

Ghana, a Sub-Saharan African country, is a particularly interesting case study to investigate the economic effects of remittances and financial development as it is the second highest remittance-receiving country in the region after Nigeria, recording more than US\$32 billion of remittance inflows between 2005 and 2020 (World Bank, 2022a). In Ghana, the value of remittances has been growing and, over the years, has been as large or larger than other external sources of capital such as official development assistance (ODA) or foreign direct investment (FDI) (Adams & Klobodu, 2016). According to data from the World Bank (2022a), the highest value of remittance inflows into Ghana was US\$4.98 billion in 2015, compared to US\$2.2 billion in ODA in 2020, US\$3.88 billion in FDI in 2019 and US\$535 million in portfolio equity in 2009.

Furthermore, Ghana's financial system has experienced several sector reforms since the 1980s. Before these reforms, the financial system was shallow and repressed (McKinnon, 1973a;

Shaw, 1973a; Prah & Quartey, 2008). Due to the reforms, the financial system adopted more market-orientated policies; M2 money supply as a percentage of GDP grew from 14.2% in 1991 to 26.7% in 2004, and the number of banks had increased from 20 with 405 branches in 1988 to 27 with 696 branches in 2009 (Baffoe, 1993; Prah & Quartey, 2008; Adu, Marbuah & Mensah, 2013). Additionally, by the end of 1990, the Ghana Stock Exchange (GSE) began trading with 12 listed companies and, as of 2020, now lists 37 companies (Owusu-Antwi, 2009; Huq & Tribe, 2018; Ghana Stock Exchange, 2022).

Despite the potentially important role that remittances and financial development may have on economic growth in Ghana, very few studies have attempted to analyse this topic comprehensively. The relationship between remittances, financial development and economic growth in Ghana has only been examined thrice by Adenutsi (2011), Antwi and Koranteng (2017) and Asomani et al. (2019). A noteworthy limitation of these studies is that they only use financial development proxies from the banking sector and not the financial market, even though the GSE opened in 1990 and has seen developments since then.

1.1 Research questions and objectives

Given the limited work and lack of consensus on the relationship between financial development, remittances, and economic growth, this study aims to provide empirical evidence on the issue focusing on Ghana over the period 1979 – 2020. This study aims to answer the following questions: i) does financial development promote economic growth in Ghana, ii) do remittance inflows promote economic growth in Ghana, and iii) does financial development coupled with remittance inflows promote economic growth in Ghana?

This study makes four contributions to the literature. The first is by employing 42 years of data which is longer than previous studies on Ghana in this field. The second is that this study improves on the variables used in the literature by employing a financial development proxy for the stock market, which has not been considered in a study on Ghana. The study also employs the latest financial development composite index by Svirydzenka (2016), which has only been previously employed by Asomani et al. (2019) and Alagidede and Ibrahim (2020). This index provides a comprehensive overview of the economy and information on aspects of the financial system that the other proxies cannot provide. The third contribution is that this

study provides a more comprehensive analysis of the relationship between financial development, remittances, and economic growth than previous studies by also analysing the finance growth nexus and the relationship between remittances and economic growth. The final contribution is that this study employs an advanced time series method, the Autoregressive Distributed Lag Approach (ARDL) to cointegration, which has not been used in many previous studies due to insufficient data.

1.2 Model, data, and method

This study employs the Solow (1957) growth model augmented by four financial development proxies, remittances and interaction terms between the proxies and remittances. The Solow (1957) model is augmented to examine the different relationships. The Solow (1957) model is the most appropriate model as it encompasses the key elements of a production function, namely human capital and physical capital, can be easily augmented to study various relationships, and has economic output as its dependent variable, which is represented by GDP per capita in this study (Solow, 1957).

This study uses data from the World Bank's (2022a) World Development Indicators (WDI) and the Penn World Table (Feenstra, Inklaar & Timmer, 2015) over the period 1979 to 2020. The study employs four proxies of financial development: domestic credit to the private sector by banks and M2 money supply for the banking sector, and gross domestic savings for the financial market to answer the first question. The composite index of Ghana's financial system by Svirydzenka (2016) is employed as the fourth proxy to gain a broader understanding of the entire financial system in Ghana. To answer the second question, the Solow (1957) model is augmented with remittances as a percentage of GDP to answer the second question. Third, the Solow (1957) model is augmented with a financial development proxy, remittances and an interaction term between the two to determine the combined effect of financial development and remittances on the economy to answer the third question. Finally, the regressions include dummies to examine the effects of major political and economic events in Ghana on the three relationships. The model specifications are estimated within the ARDL approach to cointegration by Pesaran et al. (2001) that allows for the estimation of the three relationships mentioned above in the long and short-run.

1.3 Thesis structure

The rest of the thesis is structured as follows: Chapter 2 provides an overview of the relevant literature and is split into three parts: the finance growth nexus, the relationship between remittances and economic growth and the relationship between financial development, remittances, and economic growth. Each relationship is examined at a theoretical and empirical level, where the empirical analysis first explores international and African studies and then focuses on Ghanaian studies. Chapter 3 considers Ghana's political and economic history and how changes in political regimes and poor economic performance led to the beginning of large-scale migration out of Ghana and the implementation of reform programs by the International Monetary Fund (IMF) and World Bank which transformed the financial system. Chapter 4 specifies the Solow (1957) model employed in the study and describes the data used and the measurement issues associated with some variables. It then highlights why the ARDL approach to cointegration (Pesaran et al., 2001) is the preferred method for this study and provides the conditions that need to be met before these methods can be applied. The diagnostic and post-estimation tests that are employed are also described. Chapter 5 discusses the empirical findings in the context of the theories presented in Chapter 2 and Ghana's history in Chapter 3. Chapter 6 concludes the study and summarises the main findings, provides policy implications arising from these results, discusses any shortcomings of the study and provides suggestions for future studies.

Chapter 2: Literature Review

2.1 Introduction

The relationship between financial development, remittances, and economic growth is not simple, nor can it only be considered from one point of view. Previous studies on developing countries and Ghana, in particular, argue that financial development and remittances have a positive impact on economic growth (Adenutsi, 2011; Kipyegon et al., 2012), while others argue that financial development and remittances have a negative effect on economic growth (Asomani, Ofori & Peprah, 2019). This Chapter therefore reviews the theoretical and empirical arguments and findings on the finance growth nexus, the relationship between remittances and economic growth and finally, the relationship between remittances, financial development and economic growth based on empirical studies from developed countries, African and non-African developing countries, and Ghana as the focal country.

2.2 Review of the finance-growth nexus

2.2.1 Theoretical views of the finance growth nexus

A well-functioning and well-performing financial system is expected to attract savings to boost economic growth. However, the empirical evidence on whether its development leads to or inhibits economic growth or vice-versa is mainly inconclusive and still widely debated (Adenutsi, 2011; Alagidede & Ibrahim, 2020). Thus, further guidance needs to be given as to whether financial sector development is a necessary and sufficient condition for improved economic growth in developing countries (Esso, 2010a).

Levine (2005: 869) defines financial development to have occurred when “*financial instruments, markets, and intermediaries ameliorate – though do not necessarily eliminate – the effects of information, enforcement, and transactions costs and therefore do a correspondingly better job at providing the five financial functions.*” These five functions are to produce ex-ante information about investments and allocate capital, monitor investments, facilitate the diversification, trading, and management of risk, pool savings, and allow for the

easier exchange of goods and services (Alagidede & Ibrahim, 2020; Beck et al., 2000; Levine, 2005).

The theories underlying the relationship between financial development and economic growth are conceptualised by Schumpeter (1934), who explains that a well-functioning and well-developed financial system can boost innovation and lead to economic growth. If the financial sector is robust and provides efficient services ahead of the demand for these services, the non-financial sectors of the economy will grow. The economy grows through the efficient allocation of resources from unproductive to productive economic sectors where the return on investment is the highest, as funds can easily move through the financial sector at a high volume due to decreased asymmetry of information and lower transaction costs in the financial sector (Mazzucato, Nsowah-Nuamah & van den Boom, 2008). This also increases national savings mobilisation and liquidity and diversifies assets in the economy by converting short-term assets into long-term loans (Shaw, 1973b; Adenutsi, 2011). Eso (2010a) shares the sentiment by stating that “*a healthy financial system is integral to the fundamentals of an economy. A more efficient financial system provides better financial services, and this enables an economy to increase its gross domestic product (GDP) growth rate.*” (Eso, 2010a: 36).

Patrick (1966) calls this the ‘supply-leading’ hypothesis, which is supported by McKinnon (1973b) and Shaw (1973b). They argue that financial development also increases the volume of investments in a country by offering a higher interest rate. Therefore, they advocate for financial sector liberalisation, increases in long-term loans and reduced transaction costs to improve the efficient allocation of funds. King and Levine (1993) support this by arguing that financial development leads to economic growth by increasing the rate of capital accumulation and improving the efficiency of the use of capital. Economic growth may decrease if the financial sector is too underdeveloped and inefficient. However, if the financial sector develops and becomes more efficient, it can spur economic growth given its functions in the economy (Alagidede & Ibrahim, 2020; Inoue, 2017). If the business environment is sound and corruption in the public sector is low, the financial sector is secured, and investments to increase the country’s economic growth is encouraged (Antwi & Koranteng, 2017). Agbélénko and Kibet (2015) add a different dimension to this discussion by suggesting that the impact of financial development on economic growth in a country depends on that country’s level of economic growth, thereby indicating some interdependent relationship between financial development and economic growth.

In opposition to the points raised by McKinnon (1973b) and Shaw (1973b), Morisset (1993) argues that increases in real interest rates may not necessarily lead to improvements in financial savings and, therefore, to increases in economic growth. This is particularly the case for low-income countries where households cannot afford to save as they must spend their entire household income on necessities. This makes the marginal propensity to consume approximately one, rendering the marginal propensity to save approximately zero, which suggests that the points raised by McKinnon (1973b) and Shaw (1973b) may be more relevant to high-income countries (Adenutsi, 2011).

Contrary to the ‘supply-leading’ hypothesis is the hypothesis put forward by Robinson (1952), which suggests that the increase in demand for financial services stems from investors and savers, meaning that economic growth is the driving force behind financial development in a country (Esso, 2010a; Agbélénko & Kibet, 2015). Patrick (1966) named this the ‘demand-following’ hypothesis.

Patrick (1966) argues that the relationship between financial development and economic growth is both ‘supply-leading’ and ‘demand-driven’, or bi-directional, especially in the case of underdeveloped countries and calls this the ‘stages of development’ hypothesis. He posits that the financial sector will channel scarce resources from savers to investors in the earlier stages of economic growth based on the highest rate of return they can receive, which is the ‘supply-leading’ hypothesis. As the economy grows, the demand for new financial services is met by the financial sector, which is the ‘demand-following’ hypothesis (Patrick, 1966; Adeyeye et al., 2015; Agbélénko & Kibet, 2015).

Lucas (1988), on the other hand, posits that both the ‘demand-following’ and ‘supply-leading’ hypotheses are incorrect and that there is no causal relationship between financial development and economic growth. He argues that firstly, economists over-stress the importance of financial factors in the process of economic growth and that, secondly, for a theory to be considered a theory, the mechanics of it need to be consistent with sustained growth levels and the diversity in income levels found between countries (Agbélénko & Kibet, 2015). He, however, finds that “*there is no one pattern of growth to which all economies conform.*” (Lucas, 1988, p. 41). Agbélénko and Kibet (2015) challenge Lucas’ (1988) conclusion by citing the 2008 Global Financial Crisis (GFC) and the slow economic growth in the USA due to the financial sector crash. The effects of this crash negatively affected the economic performance of other countries

due to globalisation which suggests that, to an extent, there are commonalities in different countries' patterns of economic growth.

2.2.2 Review of empirical work on the finance growth nexus

The empirical literature on the finance growth nexus is vast. As such, the way studies are conducted also differs depending on the author's research question. The studies in the literature can be broadly categorised into three groups: cross-sectional studies, time-series studies, and panel studies. Each type of study has unique characteristics, which, together with the dataset used, dictate the type of model and method adopted in the study. These are vital to the study because the results will be unreliable if the model is specified incorrectly or if a poor method is chosen. There are a vast number of studies which attempt to explore the finance growth nexus. Some of these simply conduct a granger-causality test to establish the direction of causality between financial development and economic growth (Calderon & Liu, 2003; Soukhakian, 2007; Adamopoulos & Dritsakis, 2010; Ađır, Kar & Nazlıođlu, 2011). However, most studies employ formal growth models based on the neoclassical Solow (1957) growth model and the endogenous growth model (Mankiw et al., 1992; Romer, 1989), which is derived from a Solow-type model.

i. Growth models used in the finance growth nexus

The Solow model encompasses the key elements of a production function, namely physical capital and human capital (Solow, 1956, 1957). Mankiw et al. (1992) term these the 'proximate' determinants of economic growth and argue that these depend on 'fundamental' factors of growth, such as culture, religion, colonial origin, financial development, geography and institutions. Neoclassical theories argue that countries with fewer capital resources and an open capital account will attract foreign capital from countries with more resources for domestic investment, leading to economic growth as they will complement domestic resources and savings (Adams & Klobodu, 2016; Baidoo & Duodu, 2020). Therefore, developing countries such as Ghana should be able to use various forms of external financing, such as portfolio equity, FDI, foreign debt, and remittances to grow their economy (Baidoo & Duodu, 2020).

Romer (1989) and Mankiw et al.'s (1992) endogenous growth model incorporate technological change, innovation and knowledge into the Solow (1956) model as they stress the importance

of technology as they argue that technology and innovation are linked to increases in productivity and therefore economic growth. Abor et al. (2018) make the critical observation that in many studies, these key factors are often omitted in empirical models, leading to biased estimates. In contrast, the effects of physical and human capital on economic growth are not debated in the literature due to the cemented understanding that both variables positively impact economic growth (Ho & Iyke, 2018).

The difference between these two growth models is that the Solow (1957) model assumes that long-run economic growth is exogenously determined. In contrast, in the endogenous growth model, economic growth is determined endogenously (Adenutsi, 2011). The endogenous growth model improves on the Solow (1957) model because the long-run growth path is balanced in the endogenous growth model, and the important variables exhibit constant growth rates. It is therefore better at showing how policy changes can affect long-run economic growth than the Solow (1957) model (Romer, 1989; Adenutsi, 2011). However, the distinction between human and physical capital in endogenous growth models is not always clear, a problem that the Solow (1957) model does not encounter. The Aggregate Production Function (APF) and Cobb-Douglas production function are based on the Solow (1957) model and include labour, capital, and technology. These are the most common models used to show the relationship between production inputs and output, as they can be augmented to suit a study's particular objectives (Asomani, Ofori & Pephrah, 2019). The APF, however, has shown to lack explanatory power in its ability to predict long-run growth; it requires the log-transformation of all variables to minimise potential issues of non-linearity and heteroscedasticity (Asomani, Ofori & Pephrah, 2019; Adjei, Awuni & Oteng-Abayie, 2020).

ii. Types of studies in the finance growth nexus

Cross-sectional studies are conducted when the data is from several countries but only for one year. These studies are rare in the finance growth empirical literature even though they are a descendant of the finance growth theoretical literature (King & Levine, 1993; Levine & Zervos, 1998; Beck, Levine & Loayza, 2000b). Beck et al. (2000b,c), Catrinescu et al. (2008), Chami et al. (2005), and Jung (1986) conduct cross-sectional studies on the finance growth nexus. According to the theoretical literature, these are useful in determining if there is cross-country variance in economic growth and if the exogenous sources of growth hold (Beck, Levine & Loayza, 2000b,c). However, because several countries are considered at one point, any

country-specific and significant economic and political events would be unobserved in the results, thus making them biased and unreliable. Furthermore, it does not satisfactorily deal with the problems caused by omitted variable bias (Beck, Levine & Loayza, 2000c).

While cross-sectional studies consider different countries at one point in time, time series studies consider one country over a defined period. They are thus quite common in the finance growth literature. It is generally an improvement on cross-sectional studies as it allows the researcher to understand the effects of specific economic events and time on economic growth in one country.

Panel studies are a combination of cross-sectional and time-series studies as they consider multiple countries over a defined period. Panel studies are thus used to study groups of countries such as developed and developing countries (Beck, Levine & Loayza, 2000a,b; Rioja & Valev, 2004; Chami, Fullenkamp & Jahjah, 2005; Giuliano & Ruiz-Arranz, 2006; Catrinescu et al., 2008; Aggarwal, Demirgüç-Kunt & Pería, 2011; Sobiech, 2015; Inoue, 2017), countries in a specific continent (Adenutsi, 2011; Alagidede & Ibrahim, 2020; Fayissa & Nsiah, 2010; Gupta et al., 2009; Lartey, 2013), or countries in a regional or economic union (Esso, 2010a; Agbélénko & Kibet, 2015; Ajide & Raheem, 2016; Hysa & Rehman, 2021). A general problem with panel studies is that they cannot display the unique characteristics of the individual countries in the study. Some studies use instrumental variables to minimise this issue, which increases the likelihood that the chosen method will produce consistent results. However, this is not foolproof, as the instruments chosen must be valid to avoid issues of endogeneity and bias (Rioja & Valev, 2004; Aggarwal, Demirgüç-Kunt & Pería, 2011; Lartey, 2013). Additionally, reverse causality and omitted variable bias could result in endogeneity bias in panel studies. It is therefore important to pick an estimation method where it is possible to test for endogeneity (Adenutsi, 2011).

iii. Types of methods employed in the finance growth nexus

The Vector Autoregressive (VAR) framework is a popular method used in time-series and panel studies for examining the finance growth nexus because of its flexibility and ease of use (Stock & Watson, 2001). It allows for two-way causality and feedback within the model, which is particularly useful for examining if there is a bi-directional relationship in the finance growth nexus as the empirical literature is still uncertain on the direction of the relationship between financial development and economic growth (Prah & Quartey, 2008; Esso, 2010a; Siddique,

Selvanathan & Selvanathan, 2012). However, because of the simultaneous nature of the VAR framework, it is difficult to use to estimate the complex nature of the economy as only a few variables can be used, meaning that there are potential relationships in the error term which are unaccounted for in the results. It therefore does not provide any insight into the underlying structure of the economy (Stock & Watson, 2001).

Ordinary Least Squares (OLS) is another method commonly used in the empirical literature; however, it cannot adequately control for endogeneity issues and risks model overfitting. It is also weak in the presence of non-stationary time series variables that are not cointegrated. This leads to the biased and spurious estimation of parameters (Agbola, 2013; Atiga & Nyeadi, 2014; Mintah & Nikoi, 2015). Fully Modified OLS (FMOLS) improves OLS by accounting for the endogeneity inherent in endogenous growth models. It is generally robust as it overcomes omitted variable bias, sample bias, measurement errors, and serial correlation. It also allows for heterogeneity in the long-run but fails to account for non-stationary variables that may result in spurious results (Adusei, 2013; Agbola, 2013). Another method that attempts to overcome OLS's shortcomings is the quasi-maximum likelihood for dynamic panel data with fixed effects (QML-FE). It enables the results to capture individual country effects and heterogeneity and is more efficient in finite samples than OLS. However, fixed effects methods could still result in biased estimates (Kripfganz, 2016; Hysa & Rehman, 2021). Thus, results from studies that use OLS must be interpreted cautiously as they are inconsistent and unstable (Catrinescu et al., 2008).

Empirically, time-series studies are more commonly represented by cointegration methods, implying that short-term disturbances in the model will not distort the overall long-run relationship among the variables (Adams & Klobodu, 2016). These are the Autoregressive Distributive Lag (ARDL) method by Pesaran et al. (2001), Engle and Granger (1987) methods, Johansen (1988; 1990), the Vector Error Correction Model (VECM), and the Error Correction Model (ECM).

The ARDL method is used by Adams and Klobodu (2016), Adjei et al. (2020), Adu et al. (2013), Alagidede and Ibrahim (2020), Asomani et al. (2019), Baidoo and Duodu (2020), and Diabah et al. (2017) for Ghanaian studies. This method has many benefits over other commonly used methods. The first is that it can deal with the typical problems arising from macroeconomic data typically used in the literature, such as small sample sizes and is still able to produce efficient estimates due to its superior statistical properties (Sakyi, 2011; Diabah,

Ofori-Abebrese & Pickson, 2017; Ho & Iyke, 2018; Asomani, Ofori & Peprah, 2019; Adjei, Awuni & Oteng-Abayie, 2020). This is crucial for studies focusing on an African country as it is common to have missing data for periods of time. Thus studies are typically restricted to shorter periods where data is available, such as Sakyi's (2011) study, which only had 24 observations for Ghana from 1993 - 2007. The VECM and OLS, on the other hand, are two methods that particularly struggle to produce reliable and consistent estimates when a small finite sample is used and are therefore unsuitable for studies considering African countries (Adjei et al., 2020; Ezzo, 2010a; Pesaran et al., 2001). Secondly, it is applicable regardless of whether the underlying regressors are purely stationary, purely integrated, or mutually cointegrated. This is unlike the Engle and Granger (1987) or Johansen (1988; 1990) cointegration techniques, which require all variables to be integrated of the first order or not integrated (Sakyi, 2011; Diabah, Ofori-Abebrese & Pickson, 2017; Baidoo & Duodu, 2020). If the study has a mix of stationary and non-stationary variables, the Engle and Granger (1987) method can produce spurious and unmeaningful results (Antwi & Koranteng, 2017).

Thirdly, the ARDL method easily provides efficient and reliable long- and short-run cointegrated tests and estimates within a single OLS estimate. This is unlike the Engle and Granger (1987) and Johansen (1988) cointegration techniques, which only produce efficient and reliable results if there are no structural breaks in the data which is not always possible (Sakyi, 2011; Asomani, Ofori & Peprah, 2019; Adjei, Awuni & Oteng-Abayie, 2020). Finally, and perhaps most importantly, ARDL is applicable even when the model includes endogenous variables (Sakyi, 2011). This is particularly important because the literature is still generally uncertain on the direction of the finance growth nexus, and a method that considers this can provide the author with more clarity and confidence in the results of their study.

The Engle and Granger (1987) method or Engle causality test can be used with the ARDL method to verify a causal relationship between the explanatory and dependent variables and allows for two-way causality tests over time which is desirable (Adjei, Awuni & Oteng-Abayie, 2020). It also has attractive features such as correcting for the errors that may arise from using cointegrated variables and accounting for the non-stationarity of variables (Antwi & Koranteng, 2017). However, authors using this method have still not come to a consensus on the direction of the finance growth nexus (Prah & Quartey, 2008).

Johansen's (1988; 1990) cointegration techniques are dynamic equilibrium methods (Nkrumah & Sackey, 2012) and are used by Baidoo and Duodu (2020) in their study on Ghana. However,

their results were inconsistent when compared to studies by Adu et al. (2013) and Alagidede and Ibrahim (2020), who use the same financial development proxy but different estimation methods. It is still an improvement over the Engle and Granger (1987) techniques because the Johansen (1988; 1990) techniques are not sensitive to the choice of the dependent variable. They assume all variables are endogenous, do not rely on arbitrary normalisations, and do not assume the existence of at most one cointegrating factor (Johansen & Juselius, 1990; Atiga & Nyeadi, 2014; Baidoo & Duodu, 2020). The ECM method is often used in addition to the above methods to determine the existence or non-existence of a long-run relationship between the variables in the model (Diabah, Ofori-Abebrese & Pickson, 2017). It also provides short-run results without losing any long-run information, is efficient in handling smaller samples and allows for the use of OLS (Bhatta & Shrestha, 2018; Baidoo & Duodu, 2020).

The Dynamic Generalised Methods of Moments (GMM) is the most used method in panel studies and is employed by Adenutsi (2011), Aggarwal et al. (2011), Agbélénko and Kibet (2015), Ajide and Raheem (2016), Alagidede and Ibrahim (2018), Beck et al. (2000b,a), Giuliano and Ruiz-Arranz (2006), Inoue (2017), Lartey (2013), Orzell (2013), Rioja and Valev (2004), and Sobiech (2015). It can also be used as a robustness check for time-series studies and is specifically designed to address the econometric issues induced by unobserved country-specific effects (Beck, Levine & Loayza, 2000b; Sobiech, 2015; Ajide & Raheem, 2016).

The Dynamic GMM estimator method can deal with issues of endogeneity, omitted variable bias, and heteroscedasticity; it is therefore a robust method for panel studies (Lartey, 2013; Ajide & Raheem, 2016; Inoue, 2017). It can also produce consistent estimates as it accounts for unobserved country-specific effects that other methods used in panel studies cannot do (Beck, Levine & Loayza, 2000a; Adenutsi, 2011). However, this method requires many cross-sections over a relatively short period (Ajide & Raheem, 2016).

Despite the various empirical studies on the finance growth nexus, there is still no consensus in the literature on this relationship partly due to the models and estimation methods used, as discussed above, and the different financial development proxies employed which is discussed in more detail below.

iv. *Different financial development proxies employed in the finance growth nexus and review of empirical work on the finance growth nexus internationally*

Stock market prices or market capitalisation indices are commonly used as financial market proxies in countries where stock markets exist to capture the effects of stock market developments on economic growth. It is employed by Arestis et al. (2001) and Morris et al. (2001). Capital and stock markets promote economic growth through increasing liquidity because when there is easy access to capital markets, savings and investments increase as more people use capital markets as a savings mechanism which ultimately enhances long-term economic growth (Arestis, Demetriades & Luintel, 2001). However, too much liquidity can also reduce savings because of market uncertainty's ambiguous effect on savings. More certainty in the market due to increased liquidity could also decrease the demand for precautionary savings (Arestis, Demetriades & Luintel, 2001; Demirgüç-Kunt & Levine, 2008). Many Sub-Saharan African and other developing countries do not have stock markets at all or have stock markets that are not as well-established and active as those of developed countries. Therefore, stock market indices are hardly employed as a financial development proxy for developing countries. Hassan et al. (2011, 2012) use gross domestic savings as a proxy for the financial market in their studies that consider developed and developing countries because it indicates the magnitude of financial intermediaries such as a stock exchange.

Bank credit is a banking sector-based measure of financial development as it separates loans issued by private commercial banks from those issued by central banks and other financial institutions. Financial systems that allocate more credit to the private sector are more likely to mobilise savings, provide risk management control, and exert corporate control, all of which require a high degree of financial development (Levine & Zervos, 1998; Morris, Shan & Sun, 2001). Again, this is a proxy employed mainly for developed country studies and not developing countries (Hassan et al., 2011).

Arestis et al. (2001) examine the finance growth nexus for five developed countries from 1972 to 1998. Morris et al. (2001) also examine this relationship for nine OECD countries from 1960 to 1998, while Jung (1986) examines this relationship for 19 developed and 37 developing countries from 1941 to 1981. For developed countries, there is consensus in the empirical literature that interest rate and financial liberalisation result in an effective banking system which increases economic growth (Hysa & Rehman, 2021). Arestis (2001) finds that increased bank and stock market activity promote economic growth. In contrast, Morris et al. (2001) find

that most OECD countries did not have a causal Granger relationship between financial development and economic growth in either direction.

Another proxy in the banking sector that is commonly used in developing country studies is domestic credit to the private sector by banks. It is used by Hassan et al. (2011), Agbélénko and Kibet (2015), Aggarwal et al. (2011), Alagidede & Ibrahim (2018), Beck and Levine (2002), Esso (2010b), Inoue (2017), and Hysa and Rehman (2021). It is associated with the mobilisation of savings to facilitate transactions, the provision of credit to businesses and consumers, and the assessment of financial assets (Esso, 2010b). Furthermore, increased domestic credit indicates a higher degree of dependence on the banking sector for financing based on the five functions they provide (Hassan et al., 2011; Levine, 1997). Most Sub-Saharan African countries have a natural endowment in agriculture and many economies are heavily dependent on agriculture for employment. The agriculture sector however creates difficulties for financial institutions due to its spatial and risk characteristics. Therefore financial institutions are still unwilling to lend to the agricultural sector due to concerns of profitability and probabilities of default (Alagidede & Ibrahim, 2018). Since the agricultural sector of the economy is inadequately represented in this proxy, it brings into question whether it is the most suitable financial development indicator particularly for developing Sub-Saharan African countries.

M1, M2, and M3 are the monetary aggregates that can be used as financial development proxies (Beck & Levine, 2002; Inoue, 2017). According to Jung (1986), M1 money supply represents the complexity of a country's financial structure, and M2 money supply measures the depth and size of the financial sector. An economy with M2 money supply is considered to have a deeper financial system than a country that only has M1 money supply (Beck, Levine & Loayza, 2000a; Inoue, 2017; Hysa & Rehman, 2021). Finally, M3 money supply measures a country's liquid liabilities and banking system (Hassan et al., 2011; Keen & Mallett, 2012) and is used for studies on developed countries. It is not generally used for studies on developing countries because developing countries are primarily cash-based and, therefore, more in line with the M1 and M2 definitions of money supply compared to developed countries.

There has, however, been doubt raised on the validity of monetary aggregates to analyse the finance growth nexus because GDP is a component of both the explanatory variable (monetary aggregate) and the dependent variable (GDP) (Hassan et al., 2011). Additionally, M1 and M2 money supply are poor proxies in developing countries with underdeveloped financial systems

because they are more related to the financial system's ability to transact rather than its ability to channel funds from savers to borrowers, which the literature notes as a critical function of banks (Hassan et al., 2011). Finally, for developing countries, a large part of M2 is made up of currency that is held outside of banks, therefore increases in M2 may reflect increased use of currency as opposed to an increase in deposits, and therefore this measure provides a weak indication of the level of financial intermediation by formal banking institutions (Levine & Zervos, 1998; Esso, 2010a).

2.2.3 Review of empirical work on the finance growth nexus in Sub-Saharan Africa

Esso (2010a,b) and Agbélénko and Kibet (2015) explore the finance growth nexus for the Economic Community of West African States (ECOWAS) countries from 1960 – 2005 and for countries in the West African Economic and Monetary Union (WAEMU) from 1981 – 2005, respectively. Alagidede and Ibrahim (2018) studied the same relationship for 29 Sub-Saharan African countries in a panel study from 1980 – 2014, and finally, Hassan et al. (2011) examine this relationship for 128 developing countries from 1980 – 2007.

Using the ratio of credit to the private sector to GDP as a financial development proxy, Esso (2010a,b) finds that financial development granger-causes economic growth in Cape Verde, Ghana, Guinea, Liberia, Mali, and Sierra Leone in the long-run, therefore suggesting that these countries follow the 'supply-leading' hypothesis proposed by Schumpeter (1934). However, he also finds the 'demand-following' hypothesis posited by Robinson (1952) to be true for Cape Verde, Cote d'Ivoire and Sierra Leone. This ultimately suggests that there is bi-directional causality in the relationship between financial development and economic growth for Cape Verde and Sierra Leone. The study concludes that the success of financial and economic policies is country-specific and dependent on the quality of institutions implementing them. Agbélénko & Kibet (2015) find a bi-directional relationship between financial development and economic growth in WAEMU countries, using credit to the private sector as the only financial development proxy. Alagidede and Ibrahim (2018) also only use domestic credit to the private sector and conclude that economic growth depends on the speed of growth in the financial sector. More importantly, they find that financial sector development negatively impacts economic growth if an increase in real sector output does not accompany this development, and therefore, financial booms tend not to be growth-enhancing. Finally, unlike other authors who only make use of one proxy (Agbélénko & Kibet, 2015; Alagidede

& Ibrahim, 2018; Esso, 2010), Hassan et al. (2011) make use of four: gross domestic savings, M3 money supply, domestic credit provided by the banking sector, and domestic credit to the private sector. For Sub-Saharan African countries, they find that the financial development proxies employed only explain a low proportion of the variation in economic growth. They conclude that financial development is a necessary but insufficient element of sustainable growth.

2.2.4 Review of empirical work on the finance growth nexus in Ghana

The relationship between financial development and economic growth is widely studied in Ghanaian literature. It is examined by Adu et al. (2013) from 1961 – 2010, Diabah et al. (2017) from 1970 – 2013, Adusei (2013) from 1971 – 2010, Ho and Iyke (2018) from 1974 – 2014, Alagidede & Ibrahim (2020) from 1980 – 2016, and Prah and Quartey (2008) from 1980 – 2014. All studies use annual time series except for Nkrumah and Sackey (2012), who use quarterly time series data from 2000 – 2009. The Solow (1957) model is the most widely adopted model specification as it includes the essential growth inputs (Frimpong & Oteng-Abayie, 2006; Antwi & Koranteng, 2017; Ho & Iyke, 2018; Asomani, Ofori & Peprah, 2019; Adjei, Awuni & Oteng-Abayie, 2020).

The most widely used financial development proxy is domestic credit to the private sector by banks (Prah & Quartey, 2008; Adenutsi, 2011; Adu, Marbuah & Mensah, 2013; Adusei, 2013; Atiga & Nyeadi, 2014). The literature predicts that as the financial sector develops, domestic credit to the private sector increases as more funds flow into productive sectors of the economy (Adenutsi, 2011). Adu et al. (2013) find that this proxy accelerates economic growth, whereas Adusei (2013) finds that it undermines economic growth. Antwi & Koranteng (2017) use a similar proxy and find uni-directional causality from total credit to economic growth. M2 money supply is the most commonly used monetary aggregate for Ghanaian studies (Prah & Quartey, 2008; Nkrumah & Sackey, 2012; Adu, Marbuah & Mensah, 2013; Adusei, 2013) and Nkrumah and Sackey (2012) find that it has a positive and significant impact on economic growth, whereas Adusei (2013) finds that it undermines economic growth. Adu et al. (2013) find that it has no association with economic growth. M3/GDP is also used by Adenutsi (2011), Adu et al. (2013), and Antwi and Koranteng (2017) as it offers an indication of the efficiency of financial resource mobilisation by formal financial institutions.

Adu et al. (2013) and Prah and Quartey (2008) only use bank-based indicators in their study and therefore miss out on several other important parts of the financial sector such as financial market-based indicators (Alagidede & Ibrahim, 2020). These studies are criticised by Alagidede and Ibrahim (2018) and Asomani et al. (2019), who argue that M1 and M2 money supply and total deposits only consider the overall depth of the financial system without considering access to and efficiency of financial services. Alagidede and Ibrahim (2020) also point out that while the Ghanaian financial system is still primarily bank-based, “*financial systems have grown in several aspects in a way that permits agents to diversify their savings and for firms to raise funds through the capital markets.*” (Alagidede & Ibrahim, 2020, p. 5), which suggests that there should be more studies in the Ghanaian literature that consider financial markets. Alagidede and Ibrahim (2020) and Asomani et al. (2019) improve on the issues raised above by making use of the recently developed financial development composite index that has been generated by Svirydzenka (2016). It includes bank-based and financial market-based indicators of the overall financial system (Alagidede & Ibrahim, 2020) and considers the access, efficiency, depth and stability of the financial system of a country; therefore, it is a “*comprehensive measure of financial development.*” (Asomani, Ofori & Peprah, 2019: 6).

As shown above, the various proxies that are used to determine the finance growth nexus are a point of contention in the Ghanaian literature, because the extent to which financial development causes changes in economic growth is highly dependent on the choice of financial development proxies used in the study (Adu et al., 2013; Alagidede & Ibrahim, 2020; Prah & Quartey, 2008). It is therefore important to use various measures of financial development to attain more reliable results (Adu et al., 2013; Alagidede & Ibrahim, 2020). Despite this, Antwi and Koranteng (2017), Alagidede and Ibrahim (2020), Ho and Iyke (2018), and Nkrumah and Sackey (2012) only employ one financial development proxy in their studies, Diabah et al. (2017) use two, Adusei (2013) use three, Prah and Quartey (2008) use five, and Adu et al. (2013) make use of eight.

Prah and Quartey’s (2008) study on Ghana supports the ‘demand-following’ hypothesis that economic growth causes financial development. However, the extent to which this is the case depends on the financial indicators used. Adu et al. (2013) and Diabah et al. (2017) reach the same conclusion in their Ghanaian studies but also find the ‘supply-leading’ hypothesis to be true. Nkrumah and Sackey (2012) find a positive and significant relationship between financial

development and economic growth for Ghana from 2000 – 2009 based on M2 money supply. However, using the same proxy, Adu et al. (2013) come to the opposite conclusion for Ghana.

Contrary to some of the above findings, Ho and Iyke (2018) and Adusei (2013) find that in Ghana, financial development hinders economic growth, both in the short- and long-run and they attribute this to the country's implementation of financial regulations not matching the pace of financial liberalisation. Antwi and Koranteng (2017) fail to find a robust relationship between Ghana's financial development and economic growth. Similarly, Asomani et al. (2019) conclude that the finance growth nexus in Ghana has not been consistent, although most times, it appears that financial development drives economic growth. They find that the effect of financial development on economic growth is positive and significant in the short-run, and positive, but statistically insignificant in the long-run. Likewise, Alagidede and Ibrahim (2020) find that there are asymmetric long- and short-run relationships with both positive and negative effects of financial development on economic growth in Ghana. Furthermore, they find that the effect of the financial sector on economic growth is conditional on the nature of the shock experienced by the sector.

Overall, the finance growth nexus gives insight into one aspect of the relationship between financial development, remittances, and economic growth. To gain a thorough understanding of the relationship between the three, the relationship between remittances and economic growth also needs to be unpacked and examined.

2.3 Review of the relationship between remittances and economic growth

2.3.1 Theoretical views of the relationship between remittances and economic growth

There is no consensus on the relationship between remittances and economic growth at a country or cross-country level (Atiga & Nyeadi, 2014; Antwi & Koranteng, 2017; Abor, Amidu & Issahaku, 2018), even though remittances are considered the largest international flow of financial resources to Africa (Ajide & Raheem, 2016). Despite the increasing flow of remittances globally, the magnitude of the relationship between remittances and economic growth has not been adequately studied, nor has it received much policy attention (Fayissa & Nsiah, 2010; Agbola, 2013; Ho & Iyke, 2018).

Whether remittances enhance or diminish economic growth depends mainly on what the remittances fund; in other words funding investment as opposed to consumption, traded as opposed to non-traded goods and the type of activity they stimulate, leisure as opposed to employment (Adarkwa, 2015). At a macroeconomic level, remittance receipts have proposed positive effects on economic performance as they can increase national income and savings through the multiplier effect, increase foreign exchange reserves, and finance trade deficits. Remittances also tend to be more stable and counter-cyclical compared to other forms of private inflows, which assists in sustaining consumption and investment during economic downturns caused by financial crises, health pandemics, and climate change (Adamba & Quartey, 2015; Ahenkan et al., 2018; Ackah, Lambon-Quayefio & Quartey, 2019). There are, however, less optimistic views of this relationship. Firstly, if remittances lead to increases in consumption alone, then the positive effect of remittances on economic growth will only be in the short-run as there would be no increases in productive capacity that would have a long-term effect (Agbola, 2013). Secondly, for less economically developed countries, the potential positive impacts that remittances could have on economic growth are not often felt because of the absence of good quality political institutions and sound economic policies (De Haas, 2012; Adjei, Awuni & Oteng-Abayie, 2020).

The ‘developmentalist view’ argues that adopting Western culture, traditions, values, and industrialisation would accelerate the developmental process of developing countries. From this, Developmentalists posit that when labour migration occurs, those who migrate and their families back home are exposed to “*more rational and liberal ideas*” (Adarkwa, 2015: 182) through remittances, thus aiding the developing country’s overall development (De Haas, 2012).

Contrary to the ‘developmentalist view’, the ‘structuralist view’ or ‘dependency view’ argues that foreign capital inflows could crowd out the domestic market and domestic production of tradeable goods and therefore have a detrimental impact on the economic growth of recipient countries. It also widens the income differentials between countries and within countries, especially if remittances are spent on consumer goods. It also entrenches a foreign-dependency mentality in developing countries and encourages a corrupt government (Lipton, 1980; Adams & Klobodu, 2016; Baidoo & Duodu, 2020). Overdependence on remittances can also cause moral hazards in the recipient country, which could disincentivise labour in the recipient country in the long run. The excessive demand and supply of remittances can lead to inflation due to an over-appreciation of the domestic currency, thus discouraging and decreasing the

export sector's competitiveness. These further repress innovation, creativity, and entrepreneurship, and adversely affect the recipient country's long-run economic growth (Chami, Fullenkamp & Jahjah, 2005; Yaseen, 2012; Adarkwa, 2015).

The New Labour Economics of Migration (NLEM) theory attempts to link the 'developmentalist' and 'dependency' views by arguing that migration and remittances can positively and negatively affect economic growth (Adarkwa, 2015; Lucas & Stark, 1985; Taylor, 1999). The effect that prevails depends on the circumstances of the recipient country, and the importance of 'human agency' of the recipient households is stressed in this theory (Adarkwa, 2015). Contrary to the 'dependency view', Sisenglath (2009) suggests that in the long-run, households and communities will become less dependent on external sources of financing, such as remittances, as they become more self-reliant and autonomous.

2.3.2 Review of empirical work on the relationship between remittances and economic growth in developing countries

One way to examine the relationship between remittances and economic growth is through political institutions and the effectiveness of economic and social policies (Sachs & Warner, 1997; Ajide & Raheem, 2016; Abor, Amidu & Issahaku, 2018; Baidoo & Duodu, 2020). Baidoo and Duodu (2020) argue that poor-quality institutions could impede economic growth because they do not adequately facilitate remittance inflows into the country. Additionally, remittance inflows lack complementarities from the domestic institutions and their policies. In agreement with this, Ajide and Raheem (2016), Catrinescu et al. (2008), and Ratha (2003) posit that remittances are more likely to generate long-term economic growth if there are good quality economic and political institutions and policies in place, as these countries are likely to have lower transactions costs which would increase the volume and value of remittance inflows into the country. Abor et al. (2018), who study the relationship between remittances and economic growth for 106 developing countries between 1996 and 2013, also posit a positive relationship between remittances and economic growth but for different reasons. Instead of strong policies driving the positive impact of remittances on growth, they argue that because of poor quality institutions and policies, remittance recipients in developing countries are motivated to invest their remittances into productive projects to circumvent their hardships due to their country's poor institutions. Institutional quality is therefore an important determinant in the relationship between remittances and economic growth as there is no consensus how

institutional quality and remittances interact to affect economic growth (Chami, Fullenkamp & Jahjah, 2005).

Abor et al. (2018) present two hypotheses on the relationship between remittances and growth: the ‘growth importation hypothesis’ and the ‘urgency hypothesis’. The ‘growth importation hypothesis’ states that if a country has weak or poor institutions, it will ‘import’ economic growth in the form of remittances to make up for any losses in economic growth arising from institutions by attracting foreign capital inflows and technological transfers. The ‘urgency hypothesis’ states that “*the value of the interaction between weak institutions and remittances will be positive due to the fact that the urgency to apply remittances efficiently in countries with weak institutions is high because of limited alternatives.*” (Abor, Amidu & Issahaku, 2018: 29). Abor et al. (2018) find statistically significant evidence supporting both hypotheses for low-income and lower- to middle-income countries. Specifically, they find that remittances stimulate economic growth for these countries, which is not the case for upper-middle-income and high-income countries.

Adarkwa (2015) examines the effect of remittances on economic growth for four West African countries from 2000 – 2010, however, the 11-year time period examined for a study of this nature is too short. Adarkwa (2015) justifies this by stating that between 2000 and 2010, the number of people who emigrated from their home countries was at its greatest compared to before 2000 and after 2010. However, using a longer period, perhaps 25 years with 2000 to 2010 included in the dataset would have given more insightful results as one would have been able to study how changes in emigration and subsequent remittance inflows did or did not impact economic growth as opposed to only considering this relationship at the point where emigration is at its highest.

Hysa and Rehman (2021) use an indicator variable for the GFC because they argue that the GFC caused macroeconomic indicators to deteriorate. Additionally, because remittances are counter-cyclical, Orzell (2013) posits that the GFC did not cause a significant change in remittances' effect on economic growth. To this end, an interaction term of the GFC and remittances is included in their model to assess the combined effect of remittances and the GFC (Orzell, 2013).

Hysa and Rehman (2021), who study the effect of financial development on remittances and economic growth for six Western Balkan countries from 2000 – 2017, find that remittances positively affect economic growth and conclude that they are an essential source of financing

to trigger economic growth. However, Fayissa and Nsiah (2010) and Giuliano and Ruiz-Arranz (2006) find that remittances negatively impact long-run economic growth in broader studies on African countries and 100 developing countries, respectively.

Ajide and Raheem (2016) find that for ECOWAS countries, economic growth encourages remittance inflows. Barajas et al. (2009) could not achieve robust results and therefore ultimately conclude that remittances have either a negative or non-existent impact on economic growth for African countries. Research by Haacker et al. (2010), Chami et al. (2005), and Sobiech (2015) presents more concrete findings than the three studies above; they find that remittances negatively affect economic growth for Sub-Saharan African and developing countries, respectively. Overall, the empirical literature on remittances and economic growth is conflicting. Abor et al. (2018) attribute the contradictory findings in the literature to the variations in the absorptive capacity of the recipient country and the quality of their institutions.

2.3.3 Review of empirical work on the relationship between remittances and economic growth in Ghana

The relationship between remittances and economic growth in Ghana is studied by Adjei et al. (2020) from 1790 – 2016, Adams and Klobodu (2016) from 1970 – 2014, Agbola (2013) from 1965 – 2008, Atiga and Nyeadi (2014) from 1980 – 2021, and Baidoo and Duodu (2020) from 1984 – 2018. Ahenkan et al. (2018), Asomani et al. (2019), Antwi and Koranteng (2017), and Adenutsi (2011) from 1987 – 2004. Reliable remittance data is generally limited as data on remittances that do not pass through the formal banking system is generally unavailable and, therefore not included in studies. As such, only formal remittances are used (Sobiech, 2015). This means that the true effects of remittances on economic growth are likely to be underestimated, a limitation that is common in studies that focus on remittances (Asomani et al., 2019).

The Ghanaian literature has identified two ways in which remittances can spur growth: poverty eradication through access to credit to build small-to-medium scale enterprises and investment in interest-bearing assets (Asomani, Ofori & Peprah, 2019). However, the impact of remittances on economic growth in Ghana also depends on the proportion of remittances received and consumed, the quality of institutions, and the level of financial development (Antwi & Koranteng, 2017). However, models capturing the quality of institutions and level

of financial development are present in only a few Ghanaian studies (Agbola, 2013; Atiga & Nyeadi, 2014).

A study by Adjei et al. (2020) and Asomani et al. (2019) find that remittances alone have a negative and positive effect on economic growth in the long- and short-run, respectively. Adjei et al. (2020) additionally find that there is no granger-causality between remittances and economic growth, which is most in line with the NLEM theory, which posits that remittances can have both positive and negative effects on economic growth (Lucas & Stark, 1985). According to Adjei et al. (2020) and Siddique et al. (2012), a possible explanation for the lack of causality between remittances and growth is the lack of good quality political institutions and sound economic policies to channel remittance inflows into potential growth areas of the economy, therefore limiting the full potential that remittances could have on the Ghanaian economy. Baidoo and Duodu (2020) find that remittances have a positive and statistically significant (statistically insignificant) effect on economic growth in the long-run (short-run) when interacted with a quality of institutions variable. They conclude that the quality of institutions in Ghana are vital complements for ensuring that the sources of external financing are adequately channelled to ensure economic growth.

Adjei et al. (2020) and Asomani et al.'s (2019) findings are contrary to those of Antwi and Koranteng (2017), Adenutsi (2011), Atiga and Nyeadi (2014), Adams and Klobodu (2016), and Baidoo and Duodu (2020) who find a positive uni-directional causal relationship from remittances to economic growth mainly through the multiplier effect of remittances being spent on consumption and investment (Taylor, 1999). This is the case even though Ahenkan et al. (2018) find that remittance inflows are spent more on consumption than investments in Ghana. Evidence also supports the counter-cyclical benefits of remittances in Ghana (Blankson & Quartey, 2004), which implies that remittances assist in sustaining consumption and investment during economic downturns (Adamba & Quartey, 2015; Ahenkan et al., 2018; Ackah, Lambon-Quayefio & Quartey, 2019).

After examining the finance growth nexus and the relationship between remittances and economic growth, the following sub-section will examine the theoretical and empirical relationship between financial development, remittances, and economic growth to clarify this relationship given the two sets of relationships discussed above.

2.4 Review of the relationship between financial development, remittances, and economic growth

2.4.1 Theoretical views on the relationship between financial development, remittances, and economic growth

The sources of economic growth for African countries and Ghana, in particular, are still unclear, and little empirical attention has been paid to the role that remittances play in the relationship between financial development and economic growth (Asomani, Ofori & Peprah, 2019).

Generally, the relaxation of credit ceilings, liquidity constraints on recipients, and greater autonomy in the banking sector could attract more remittances into the home country (Antwi & Koranteng, 2017; Ackah, Lambon-Quayefio & Quartey, 2019; Asomani, Ofori & Peprah, 2019). Financial development and improvements in the financial system's infrastructure lower the transfer cost of remittances, therefore facilitating increased remittance transfers through the formal financial sector (Antwi & Koranteng, 2017). The 'complementarity hypothesis' suggests that an efficient financial system which can channel funds from remittances into productive projects with high returns through the banking sector will increase economic growth (Giuliano & Ruiz-Arranz, 2006; Inoue, 2017; Asomani, Ofori & Peprah, 2019). In a developed and formalised financial sector, remittances would pass through the banking sector before reaching the intended household. This implies that remittances are effective in a well-functioning financial sector and that the combined pass-through effect of remittances through the financial sector on economic growth could be greater than the individual effects of remittances and financial development on economic growth. This is because remittance receipts deposited at banks increase commercial banks' financial reserves, increasing the number and magnitude of loans that can be granted (Adamba & Quartey, 2015; Inoue, 2017; Hysa & Rehman, 2021).

Similarly, if remittance funds are not used for productive projects or if the financial sector is underdeveloped and plagued with inefficiencies and high transaction costs, the combined effect of financial development and remittances on economic growth is likely to be negative (Kipyegon et al., 2012). Fayissa and Nsiah (2010), however, provide a different argument. They argue that remittances have the greatest positive impact on economic growth in countries with poorly developed or weak financial systems as remittances provide an alternative way to

finance investments and overcome liquidity constraints. This highlights the importance of including an interaction term of financial development and remittances in an empirical analysis.

Recipients of remittances may also have access to financial products they did not have due to this increased income, even if the money is not directly deposited in a bank (Antwi & Koranteng, 2017; Ackah, Lambon-Quayefio & Quartey, 2019). As much as remittances could be used to seek more loans, they could also be used as substitutes in place of loans which could hamper the development of the financial sector. This is known as the ‘substitutability hypothesis’ (Giuliano & Ruiz-Arranz, 2006; Mundaca, 2009; Antwi & Koranteng, 2017). However, if most remittance inflows are through informal and unregulated channels, remittances can adversely affect the financial sector (Adamba & Quartey, 2015).

2.4.2 Review of empirical work on the relationship between financial development, remittances, and economic growth in developing countries

The relationship between financial development, remittances, and economic growth is studied by Hysa and Rehman (2021) for Western Balkan countries, Mundaca (2009) for Latin America and Caribbean countries, and Fayissa and Nsiah (2010) and Kipyegon et al. (2012) who both study this relationship for 36 African countries from 1980 – 2014. They find that remittances ultimately have a positive effect on economic growth. Therefore, remittance inflows through the formal financial sector should be encouraged. Fayissa and Nsiah (2010), Kipyegon et al. (2012), and Mundaca (2009) come to the same conclusion for selected African countries and Latin American and Caribbean countries. In their findings, Fayissa and Nsiah (2010) note that remittances are a source of small-scale savings. Therefore, they expect that remittance inflows will pave the way for formal financial sector development. For financially developed countries, there are other sources of financing besides remittances, which significantly impact financial development and growth, meaning that economic growth is less associated with remittances. Thus, the empirical literature on this topic for developed countries is scarce (Jung, 1986).

2.4.3 *Review of empirical work on the relationship between financial development, remittances, and economic growth in Ghana*

The relationship between financial development, remittances, and economic growth in Ghana is studied by Asomani et al. (2019) from 1984 – 2015, Adenutsi (2011) from 1987 – 2007, and Antwi and Koranteng (2017) from 1990 – 2014.

Adenutsi (2011) hypothesises that financial development leads to economic growth in Ghana due to the financial sector's increased ability to attract international remittances into the country. Asomani et al. (2019) argue that in Ghana, the belief that financial development and remittances can boost economic growth generally comes from public discourse without empirical backing. Asomani et al. (2019), Antwi and Koranteng (2017), and Adenutsi (2011) all find that financial development promotes economic growth through its capacity to attract remittances into the country in the short- and long-run. Antwi and Koranteng (2017) further unpack this by finding that financial development causes an increase in remittance inflows, which then causes an increase in economic growth, thereby supporting Adenutsi's (2011) hypothesis. While Adenutsi (2011) finds that there is uni-directional causality between remittances and endogenous economic growth, he also finds that there is bi-directional causality between financial development and remittances as he posits that increased financial deepening shows an improvement in public confidence in the financial system which attracts the inflow of remittances into the formal financial system. Asomani et al.'s (2019) finding, however, come with the caveat that financial booms are not growth-enhancing and could decrease economic growth in the long-run. Furthermore, the combined effect of financial development with remittances could further worsen this negative long-term effect. This caveat is further echoed by Adenutsi (2011), whose study revealed that even though financial development granger-causes remittance inflows into Ghana, it is in itself "*directly detrimental to endogenous economic growth*" (Adenutsi, 2011: 1).

Asomani et al. (2019) and Adenutsi (2011) argue that the effect of financial development on economic growth in the short-run is positive and significant because an efficient and well-functioning financial sector has lower transaction costs which will, firstly, attract more remittance inflows through the formal sector and secondly, improve the rate at which remittance inflows are invested into projects which are growth enhancing for the economy. Furthermore, as capital markets develop, more remittances will flow through formal financial channels rather than being accumulated and uninvested in the recipient household. Additionally, as remittance inflows through formal financial channels increase, they become

an important source of investment financing and therefore act as a supplement to credit and insurance products offered by the banking sector (Schumpeter, 1934; Taylor, 1999; Asomani, Ofori & Peprah, 2019).

2.5 Insights from the literature

Ghana is a developing country with various sources of capital inflows (Asomani, Ofori & Peprah, 2019), and this has encouraged studies that aim to increase the understanding of these sources of capital on economic growth in Ghana (Adenutsi, 2011; Ho & Iyke, 2018; Asomani, Ofori & Peprah, 2019). With remittances being one of these sources of capital, it has also prompted studies on the impact of remittances on economic growth (Atiga & Nyeadu, 2014; Adjei, Awuni & Oteng-Abayie, 2020) and, more importantly, on the combined effect of remittances and financial development on economic growth. Since there are not many studies on this, the true extent of this relationship is unknown (Antwi & Koranteng, 2017; Asomani, Ofori & Peprah, 2019).

The Solow (1957) model adequately captures the parts of the economy that, according to the theoretical literature, are vital for examining the relationship between financial development, remittances and economic growth. The literature further highlights that the ARDL approach to cointegration is the preferred method for annual time-series studies and this study due to its limited downside risks and many benefits compared to other methods. Among other benefits, the ARDL approach to cointegration can be used on small sample sizes and still produce efficient estimates, which is important for studies focusing on an African country or African countries which typically suffer from small sample sizes and missing data (Sakyi, 2011; Ho & Iyke, 2018; Asomani, Ofori & Peprah, 2019). It is also applicable regardless of whether the underlying regressors are purely stationary, purely integrated, or mutually cointegrated which provides greater flexibility than the Engle and Granger (1987) and Johansen (1988) methods (Sakyi, 2011; Diabah, Ofori-Abebrese & Pickson, 2017; Baidoo & Duodu, 2020).

The existing studies have various limitations. The first is that some studies use a limited time frame (on average, 33 observations), which is considered inadequate for attaining reliable results. Second, previous studies use outdated data starting in the 1960s or 1980s and ending in the first decade of the 2000s. Third, most Ghanaian studies only use between one and three

financial development proxies which all happen to be in the banking sector and not from the financial market (Adusei, 2013; Alagidede & Ibrahim, 2018; Antwi & Koranteng, 2017; Diabah et al., 2017; Ho & Iyke, 2018; Nkrumah & Sackey, 2012). Fourth, the quality of institutions and economic policies has been identified as an important determinant of economic growth in Ghana; however, most studies examining the relationship between financial development, remittances, and economic growth have not included it as an explanatory variable.

This study makes four contributions to the literature. The first is by employing 42 years of data which is longer than previous studies on Ghana. Although Ghana is a developing country, and financial market development proxies are not typically used in studies considering developing countries, the GSE has been operating and developing for 33 years. To this point, Alagidede and Ibrahim (2020) argue that while the Ghanaian financial system is still largely bank-based, financial systems in Ghana have developed to a point where firms can raise funds through capital markets. However, this aspect of financial development has not been included in Ghanaian studies. The latest financial development composite index by Svirydzienka (2016) has only been previously employed by Asomani et al. (2019) and Alagidede and Ibrahim (2020). This proxy provides a comprehensive overview of the economy and information on aspects of the financial system that the other proxies in this study cannot provide. Therefore, the second contribution to the literature is improving on the variables used in previous studies by employing a financial development proxy for the stock market. The third contribution is that this study provides a more comprehensive analysis of the relationship between financial development, remittances, and economic growth than previous studies by also analysing the finance growth nexus and the relationship between remittances and economic growth. The final contribution is that this study employs an advanced time series method, the ARDL approach to cointegration, which has not been used in many previous studies due to insufficient data. Although the quality of political institutions and policies has been highlighted as an important determinant in Ghana's economic growth, reliable data for the period examined in this study is not available. Therefore, this is not included in the study. Regardless, the abovementioned improvements should clarify the relationships examined in this Chapter. The next Chapter provides an overview of Ghana's political and economic history and migration, which, together with the literature review, provides context and meaning to the empirical results discussed in Chapter 5.

Chapter 3: Ghana's Political and Economic Environment and Migration Patterns

3.1 Introduction

This Chapter provides an overview of Ghana's political economy, which can best be described using two periods, 1957 – 1983 and 1983 onwards. The leaders during these two periods significantly shaped the economy with the policies implemented during different government regimes. The period between 1957 – 1983 saw a downfall in Ghana's economy, with a turning point experienced after 1983. The changes in the political and economic environment of the country over time coincided with emigration and remittance patterns.

3.2 Political economy and economic background

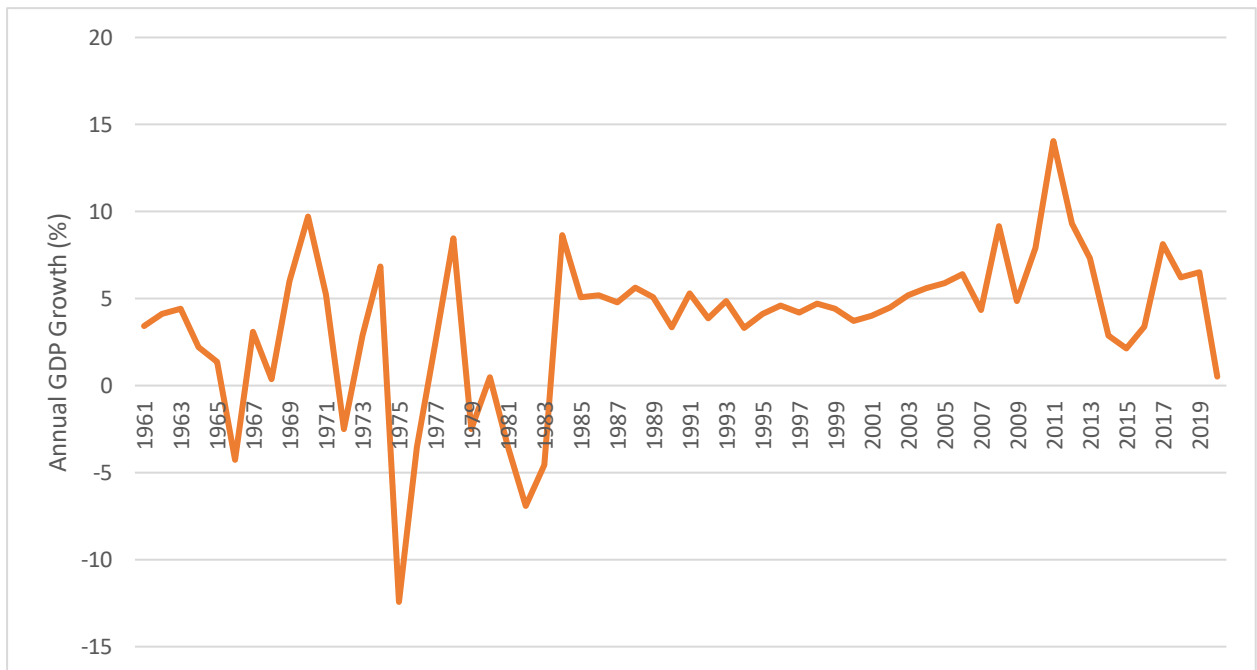
3.2.1 *The 1957 – 1983 period*

Ghana was the first African country to gain independence from colonial rule (Baffoe, 1993; Aryeetey & Fosu, 2008; Killick, 2010). Ghana's independence from British colonial rule in 1957 led to the beginning of periods of military coups and political instability in the country up until 1992 (Aryeetey & Fosu, 2008; Jedwab & Osei, 2012). With every political regime came new policies very different from those of the prior regime. After independence, the Convention People's Party, under Kwame Nkrumah's democratic leadership, governed the country. Nkrumah's tenure ended in 1966, but not before several policies were implemented (Resnick, 2016). For example, the Seven-Year Development Plan from 1963/4 – 1970/71 was implemented during his tenure. This was a set of capital-intensive import-substitution industrialisation policies to drive the country's modernisation through surplus from the cocoa agricultural sector and a less open economy (Aryeetey & Fosu, 2008; Killick, 2010; Jedwab & Osei, 2012). This, however, was more damaging than helpful because labour costs were still

high, and labour was mostly unskilled and, therefore, unsuitable to support import-substitution industrialisation-type policies (Agyeman-Duah, 2008; Jedwab & Osei, 2012).

In February 1966, the National Liberation Council (NLC), which comprised army and police officers, overthrew Nkrumah and took over Ghana's leadership (Aryeetey & Fosu, 2008; Jedwab & Osei, 2012). At this point, Ghana first experienced negative economic growth, with its lowest at -12% in 1975 (Aryeetey & Fosu, 2008), as shown in Figure 1 below. The NLC was in power until Kofi Busia became the democratically elected President in 1969. Busia's government introduced the Alien Compliance Orders Act, which led to the expulsion of migrant cocoa workers on sharecropping contracts and severely undermined cocoa production in the Brong-Ahafo and Ashanti regions (Ababio et al., 2003). Colonel Acheampong overthrew Busia in a coup in 1972 and became the new President of Ghana until 1978 (Jedwab & Osei, 2012). During his tenure, more than 20 million Cedis was allocated to Operation Feed Yourself, which aimed to increase the production of rice, maize, and other goods for domestic consumption. However, deficient rains were an obstacle to achieving the policy's desired results (Resnick, 2016).

Figure 1. Annual GDP Growth (1961 – 2020)



Notes for Figure 1: Source: World Development Indicators (World Bank, 2022a), author's construct

Every post-independence political regime interfered with the country's major productive sectors through its policies. By 1975, the cocoa sector had collapsed, and the currency was overvalued, meaning Ghana had to import most of its food. However, the country's lack of foreign currency liquidity largely prevented importation (Agyeman-Duah, 2008; Jedwab & Osei, 2012). In 1981, Jerry Rawlings took over the country's leadership after two coups in 1979 and 1981. Still, it was not until 1983 that the country began to experience a turning point in its economic and political situation (Agyeman-Duah, 2008).

3.2.2 The 1983 – 2020 period

By 1983, the Nigerian government had removed more than one million Ghanaians out of Nigeria who had moved there to find better employment because of the 1973 oil boom in Nigeria and the worsening economic conditions and poor living standards in Ghana (Ababio et al., 2003; Aryeetey & Fosu, 2008; Baffoe, 1993; World Bank, 2018). While Nigeria benefited from the oil price boom, Ghana's terms of trade had decreased by 52% due to most Ghanaian cocoa farmers being unable to produce cocoa because of the high prices (Price, 1984; Baffoe, 1993). Cocoa exports decreased from 382 000 metric tonnes in 1974 to 159 000 metric tonnes in 1983 (Aryeetey & Fosu, 2008). During this time, Ghana also experienced a severe drought that led to a food supply shortage, preventing the growth of food for consumption and export.

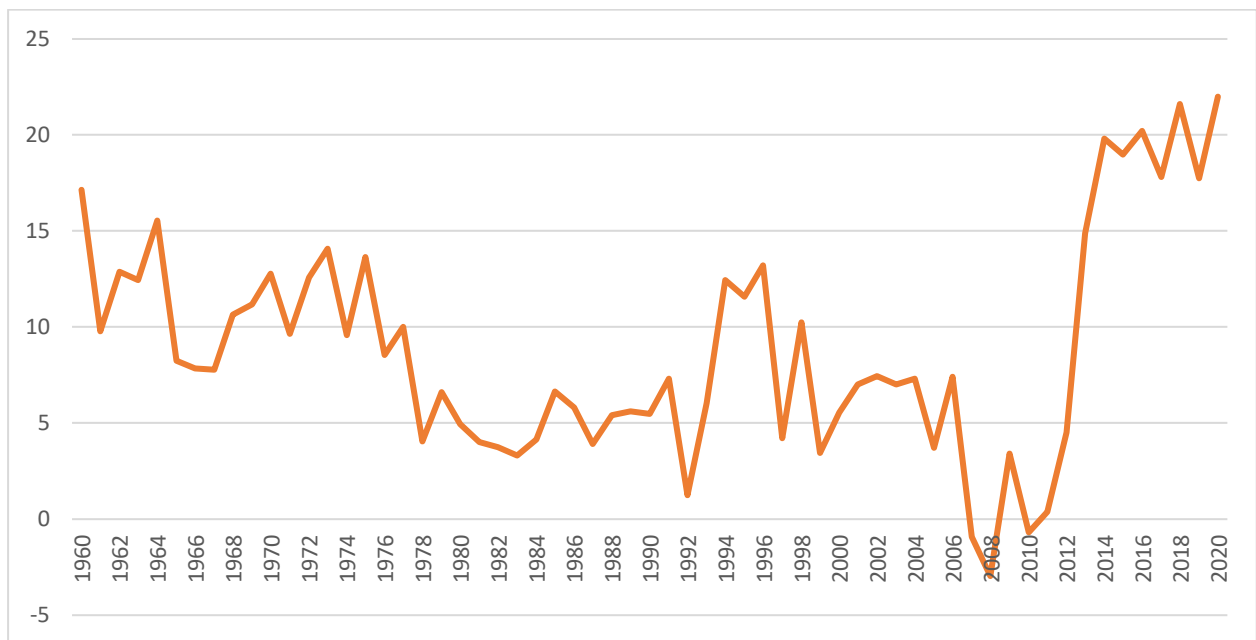
The lack of food and foreign currency liquidity for imports, high inflation, imbalanced government budgets, and deteriorating infrastructure prompted Rawlings to agree to the IMF and World Bank's Structural Adjustment Program (SAP) and Economic Recovery Program (ERP) in order to receive much-needed credit for the country (Adu et al., 2013; Alagidede et al., 2013; Baffoe, 1993; IMF, 2022). The six programs were split into two phases and were intended to assist Ghana's economy in undergoing structural adjustments between 1983 and 1992 to improve economic performance (Resnick, 2016). The ERP's broad focus areas were reducing government expenditures, creating private sector production and investment incentives, liberalising the financial sector, strengthening infrastructure, and developing human resources. The ERP therefore adopted a market-orientated approach to the restructuring of the fiscus and the economy (Baffoe, 1993; World Bank, 1994; IMF, 2022).

The first phase of the ERP program was signed in April 1983, with its implementation being from 1984 to 1987 (World Bank, 1994; Aryeetey & Fosu, 2008; IMF, 2022). The first phase aimed to reduce government expenditure and improve internal and external balances (Baffoe,

1993). Ghana's economy was deteriorating because policies did not focus on the significant development that was achievable through policy stabilisation that would prevent Ghana's commodity exports and industrial production from declining (Baffoe, 1993). The IMF emphasised creating a foreign exchange auction that would help export rehabilitation via the devaluation of the currency leading to the restoration of external balances (Huq & Tribe, 2018). Other aims of the program involved protecting cocoa production in Ghana and therefore increasing cocoa producer prices, reducing Ghana Cocoa Board's marketing costs, and removing price controls and subsidies (Frimpong & Oteng-Abayie, 2006). The first phase also restricted public sector employees' pay increases, introduced user fees which helped with cost recovery in the education and health sectors, liberalised trade, and divested from state-owned enterprises (IMF, 2022). The Agricultural Services Rehabilitation Project in the first phase attracted the support of the World Bank, which assisted with the policy planning, monitoring, and evaluation that would allow the Ministry of Food and Agriculture to improve its capacity to implement future agricultural projects (IMF, 2022). Revenues from projects in the first phase of the ERP would help improve infrastructure such as the quality of water, electricity, roads, and highways, especially in rural regions.

The main aim of the second (1987 – 1998) and third (1989 – 1990) ERP phases was to deepen the set of policies that would improve the economy by following market-orientated policies and allowing market forces to set prices in the economy (Baffoe, 1993). The IMF provided the Ghanaian government with foreign aid ranging from US\$370 million to US\$488 million (IMF, 2022). The funds disbursed were used to rehabilitate the timber, cocoa, and mining industries. During the second phase, the government increased the minimum guaranteed price of maize and rice, improved the agricultural inputs supply, and reduced fertilisers and machinery subsidies. By the end of 1990, the Ghana Stock Exchange (GSE) began trading with one government bond and 12 listed companies, which would help attract FDI into Ghana (Owusu-Antwi, 2009; Huq & Tribe, 2018). The development of the GSE through gross domestic savings is shown below in Figure 2.

Figure 2. Gross Domestic Savings (% of GDP) (1960 – 2020)



Notes for Figure 2: Source: World Development Indicators (World Bank, 2022a), author's construct

Within ten years of the first phase of the ERP, FDI had increased from US\$2 million to US\$22.5 million (IMF, 2022). To further increase FDI inflows, the government repealed more restrictive decrees and established a new investment code, and by 2003, investments into the country were at 23% of GDP (Aryeetey & Fosu, 2008). Foreign investors were also attracted to the mining sector, providing joint venture opportunities for locals and foreigners. Gold production had increased due to the changes implemented under the program, surpassing cocoa exports. The economy also experienced disinflation from 142% to 10% ten years after the implementation of the first phase of the ERP in 1983 (IMF, 2022). Furthermore, the average GDP growth per capita at the beginning of the ERP was at -3.5% but improved to 2.2% by 1993. Declines in agricultural taxation also allowed more farmers to benefit from their production. (Frimpong & Oteng-Abayie, 2006).

The benefits of the three phases of the ERP in Ghana were significant because Rawlings was committed to achieving the desired outcomes and did not interfere with the implementation of the program, as he believed that Ghana's economic situation was due to poor management rather than poor policies (Haynes, 2002; Agyeman-Duah, 2008; Jedwab & Osei, 2012). The program ultimately benefitted more people from rural areas than from urban areas, primarily because of the rural manifesto by Rawlings' party (Ababio & Ofosu, 2014).

While Rawlings had helped most rural cocoa farmers, those living in the urban areas of Ghana suffered from lower wages, rising import costs, user service fees, and retrenchments (Haynes, 2002). The wage of a person living in the urban centre was about 460 Cedis, with the price of petrol averaging 1600 Cedis (Frimpong & Oteng-Abayie, 2006). The introduction of the value-added tax further increased the cost of living for urban dwellers, which led to protests in the country in 1995 that compelled the Rawlings government to change its decision to introduce the tax (Haynes, 2002). The worsening economic situation led to a government deficit of 13.6% of GDP, a negative current account balance of more than US\$320 million, a depreciating local currency, and a rise in national debt (Haynes, 2002; IMF, 2022).

Additionally, the political business cycle has involved the government increasing its spending during the election campaign period for the incumbent party to try and gain re-election and later reduce spending after the elections (Resnick, 2016). In 1996, Rawlings used a considerable sum of the public finances to win the elections by increasing spending on hospitals and roads, nurses, doctors, and cocoa board workers' salaries after successive strikes in the country's rural areas. Therefore, the overall government expenditure deficit in 1996 reached 9.5% of GDP (Resnick, 2016). The deficit and reckless government spending resulted in the IMF and the World Bank halting their disbursements to the country as the political budget cycle eroded all ERP program gains made within the first decade of its implementation and reintroduced fiscal imbalances into the economy (IMF, 2022). Soon after, the government began negotiations for debt forgiveness. However, this spending cycle continued with successive governments. Due to dissatisfaction with the Rawlings regime in the urban areas, John Kufour was elected President in 2001 (Aryeetey, Harrigan & Nissanke, 2002).

i. Financial Sector Reforms

Before the 1988 financial system reforms in Ghana, the financial system had experienced financial repression and shallowing (McKinnon, 1973a; Aryeetey & Fosu, 2008; Killick, 2010), which prevented the allocation of funds to real economic sectors such as manufacturing and agriculture. M2 money supply had fallen from 24% in 1977 to 12% in 1984 (Adu, Marbuah & Mensah, 2013). The economy also experienced negative real interest rates during this period. The real GDP growth averaged 3.04% between 1961 and 1970 and declined to 0.52% from 1971 to 1980 (Adu et al., 2013; Aryeetey & Fosu, 2008). Other indicators that showed a persistent decline between 1977 and 1984 include domestic credit (38.8% to 15.6%), demand deposits (11.6% to 4.6%), and savings and time deposits (7.1% to 2.6%).

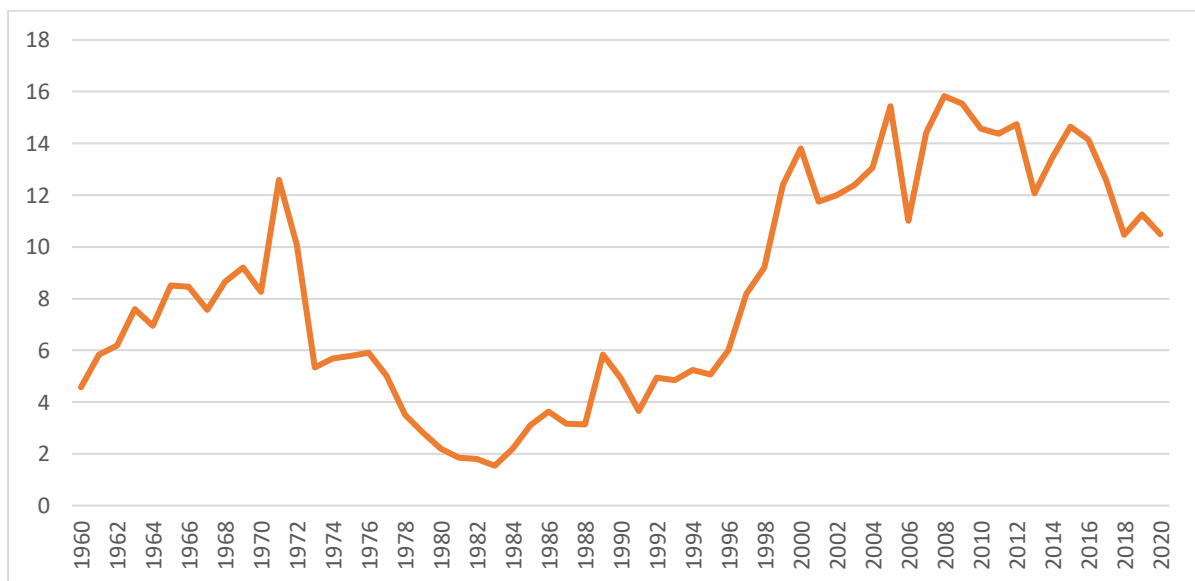
The inefficient and underdeveloped financial system resulted from direct administrative manipulations and government controls. The repressive monetary policies discouraged savings, retarded private investment growth, resulted in high and volatile inflation and ultimately inhibited economic growth (Owusu-Antwi, 2009; Nkrumah & Sackey, 2012). Additionally, during Colonel Acheampong's regime (1972 – 1978), all commercial banks had significant or complete state shareholding and were subject to corrupt and inefficient state-owned enterprises. Various state-owned banks, such as the National Investment Bank, Ghana Commercial Bank, Bank for Housing and Construction, and the Agricultural Development Bank, directed credit to the economy's unproductive sectors. Therefore, these banks became an instrument for channelling funds to state-owned enterprises that were highly inefficient (Owusu-Antwi, 2009; Adu, Marbuah & Mensah, 2013).

Without clear guidelines from the Banking Act of 1970, proper supervision, and regulatory enforcement of Ghana's commercial banks, the banking sector experienced significant problems in the 1970s and 1980s. Little attention was paid to the provision of required capital and reserve requirements, which resulted in the ongoing non-performance of bank assets and, ultimately, the insolvency of many banks (Owusu-Antwi, 2009). By the 1980s, banks needed to be recapitalised because of the ongoing non-repayment of personal loans and poor asset management (Nkrumah & Sackey, 2012). Until this point, financial sector reforms and policies were only focused on price and interest rate liberalisation and financial sector policies. Therefore, the country's banking system had been neglected (Owusu-Antwi, 2009).

The Financial Sector Adjustment Program (FINSAP), introduced in 1988, was part of IMF's ERP (Adu, Marbuah & Mensah, 2013). The program restructured distressed banks by cleaning up their non-performing assets to restore the banking system's viability and profitability. Other policy tools in the program included regulatory and supervisory framework improvements, money and capital markets development, credit controls and direct credit abolishment, structural reform initiation, and privatisation. The Financial Sector Strategic Plan (FINSSP) of 2001 was the successor of FINSAP and sought to consolidate the gains made by the FINSAP and further improve financial service delivery to encourage financial sector deepening (Owusu-Antwi, 2009). The FINSAP and FINSSP positively impacted the financial and banking system; by 2009, the number of banks in Ghana had increased to 27 with 696 branches from 20 banks with 405 branches in 1988. The total value of assets in the banking system also increased from 0.31% in 1993 to 0.66% of GDP in 2008 (Adu, Marbuah & Mensah, 2013). Other notable FINSAP and FINSSP improvements include capital adequacy, asset quality and concentration,

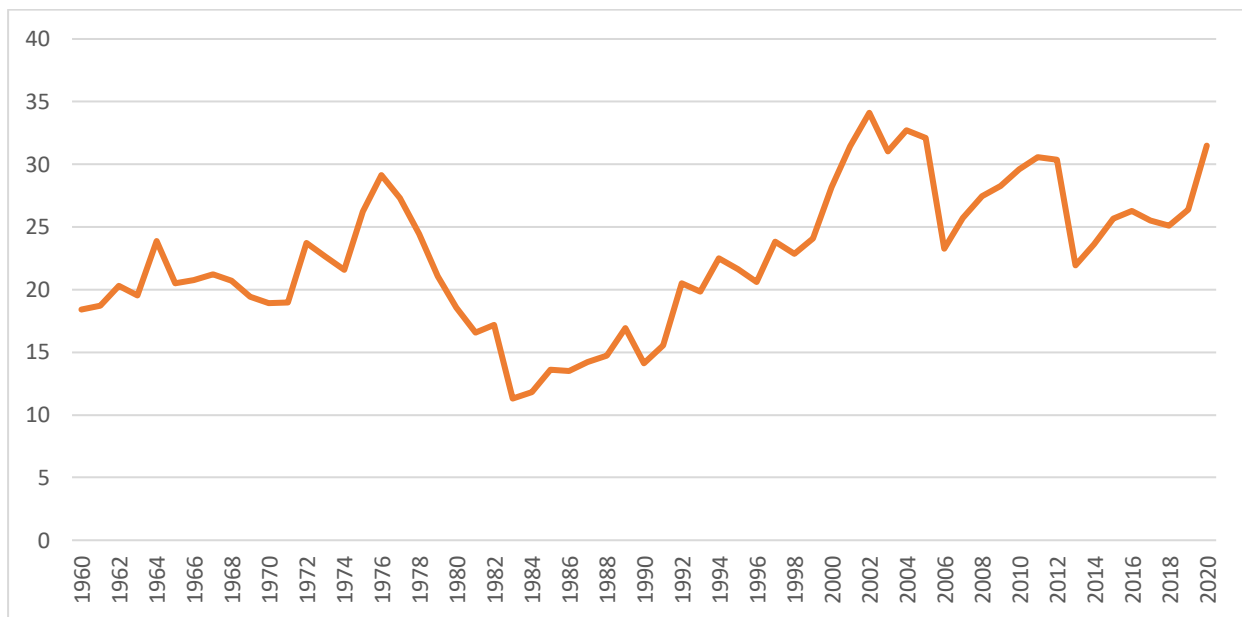
efficient sectoral credit allocation, savings mobilisation, financial deepening, and interest liberalisation. Banks had now become more efficient in allocating credit and stimulating savings, which led to increased economic growth. Figures 3 and 4 below show the movement of domestic credit to the private sector by banks as a proxy for credit allocation and financial deepening and M2 money supply as a proxy for financial deepening, respectively.

Figure 3. Domestic Credit to the Private Sector by Banks (% of GDP) (1960 – 2020)



Notes for Figure 3: Source: World Development Indicators (World Bank, 2022a), author's construct

Figure 4. M2 Money Supply (% of GDP) (1960 – 2020)



Notes for Figure 4: Source: World Development Indicators (World Bank, 2022a), author's construct

The financial crisis in the United States of America (USA) in July 2007 developed into a GFC by 2008 (Gockel, 2010). The GFC significantly reduced money supply and credit creation globally (Gockel, 2010; Karley, 2011; Kumah et al., 2018). However, Ghana's GDP growth rate was not significantly impacted by the GFC compared to more developed counties (Gockel, 2010). Additionally, Ghana's cocoa, gold, and timber exports increased in volume and value from 2007 to 2008; the country's total export earnings increased by 26.4% to US\$5.275 million in 2008 (Gockel, 2010). This is possibly because, in 2008, Ghana's financial exposure to the global economy was limited. However, there were direct links to the global economy through Ghana's private banking sector (Gockel, 2010). This was through the banks' exposure to global counterparties through correspondent deposits and placements. Therefore, the GSE was negatively affected by decreased trading volumes as international investors decided to liquidate their shares (Gockel, 2010), as seen between 2008 and 2010 in Figure 2, where gross domestic savings is negative and volatile. However, Tullow Oil's listing on the GSE in 2011 resulted in a significant boost in the development of the financial sector because the listing doubled the market capitalisation of the GSE. Total market capitalisation went from US\$17.2 billion to US\$35.35 billion, an increase of 136.59%, which reflected an improvement in the stock market (Karley, 2011; Bokpin, Mensah & Owusu-Antwi, 2016). The sharp increase in gross domestic savings in 2011 in Figure 2 reflects this.

The introduction of FINSAP and FNSSP brought significant changes in Ghana’s financial and banking sectors, which seem to have improved the economy’s performance. The liberalisation of the financial sector increased credit to the private sector by banks and M2 money supply, most of which was fuelled by an increase in demand and savings deposits. There was also a significant increase in the real GDP per capita growth from 0.47% to 5.50% from 1961 to 2010 (Owusu-Antwi, 2009). Table 1 below further illustrates the financial deepening from 1960 to 2020, indicating how the FINSAP and FINSSP changed the financial and banking sector.

Table 1. Economic growth, remittances, and indicators of financial development in Ghana (1960 – 2020)

Indicators	1960 – 1983	Trend (1960 – 1983)	1984 – 2008	Trend (1984 – 2008)	2009 – 2011	Trend (2009 – 2011)	2012 – 2020	Trend (2012 – 2020)
Real GDP growth (%)	0,90		5,04		8,93		5,13	
Remittances received (% of GDP)	0,03		0,38		2,10		5,61	
Domestic credit to the private sector by banks (% of GDP)	6,08		8,21		14,84		12,65	
M2+ (% of GDP)	20,87		22,26		29,47		26,27	
Gross domestic savings (% of GDP)	9,62		5,94		1,04		16,83	
Composite financial sector development index by Svirydenka (2016)	0,01		0,03		0,04		0,06	

Notes for Table 1: Sources: World Development Indicators (World Bank, 2022a); authors’ construct.

Today, the banking sector operates with more functional autonomy and operational flexibility, enhancing production efficiency and profitability in the various sectors of the economy. Banks can now accumulate sufficient reserves and capital according to financial regulations. Lending has also increased, with many banks holding their liquid assets in the Bank of Ghana (BoG) securities which have been a secure source of income for the banks through the introduction of treasury bills (World Bank, 1994; Owusu-Antwi, 2009).

3.3 International migration out of Ghana and remittance inflows into Ghana

Until 1965, international migration out of Ghana involved very few people, mainly professionals and students (Ababio et al., 2003). Most people moved to countries such as the UK and the USA or other African countries such as Botswana, Gambia, and Sierra Leone to pursue careers in law, education, administration, and the public sector after their independence (Ababio et al., 2003). Large-scale emigration of unskilled and semi-skilled such as fishermen, began in the early 1980s to neighbouring countries due to poor economic conditions and the increasing cost of living in Ghana as well as relatively better prospects in neighbouring countries such as Côte d'Ivoire, Benin, and Burkina Faso, and an increase in demand for labour from these countries (Ababio et al., 2003; Migrants & Refugees, 2020). Today, the motivations for international emigration include better employment, income, education, and quality of life prospects in countries such as the UK, Canada, and the USA (Ababio et al., 2003; ISSER, 2003; Migrants & Refugees, 2020).

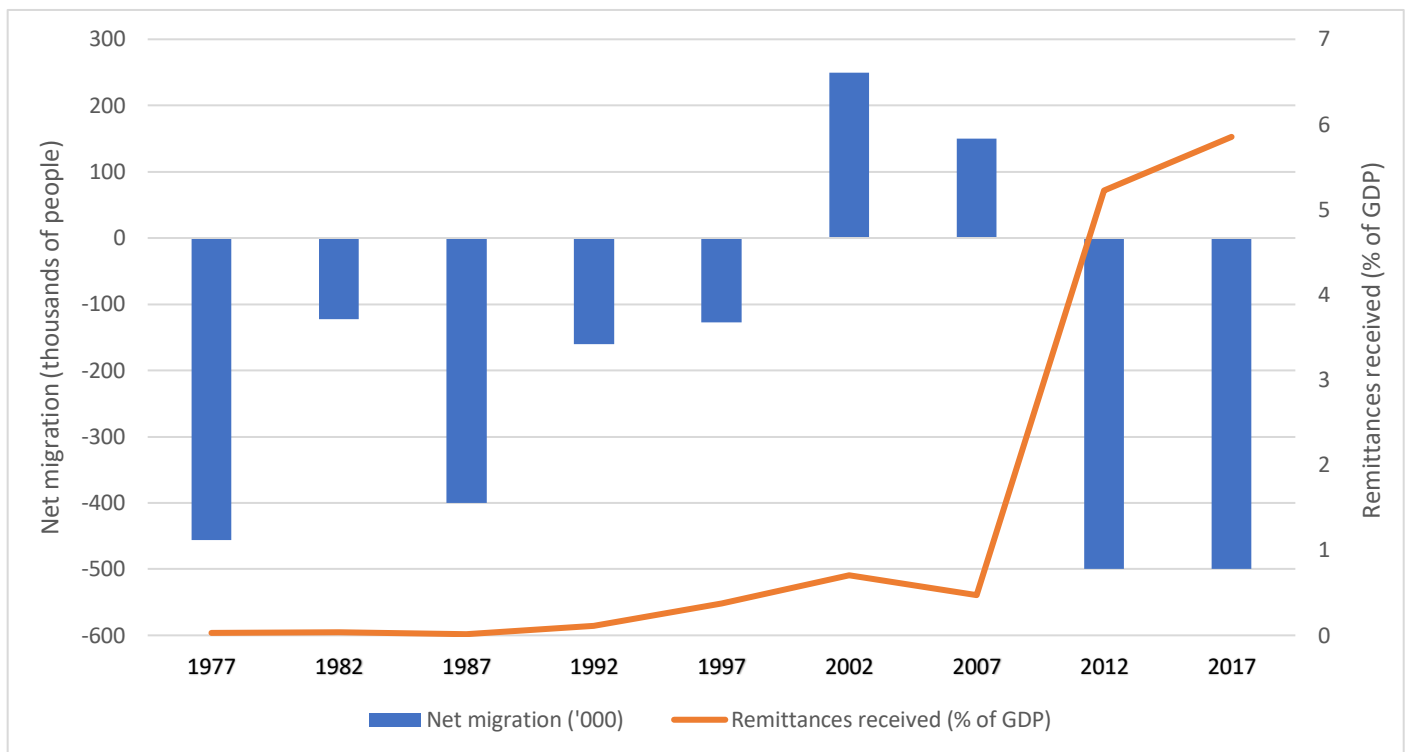
The formation of ECOWAS in 1975 further increased the international emigration rate out of Ghana. One of the objectives of ECOWAS was to ease the movement of people between West African countries, which many Ghanaians utilised (Ababio et al., 2003; Ajide & Raheem, 2016). Ghana lost several professionals to other countries, and the brain drain was and continues to be a concern for politicians and policymakers. For example, approximately 14 000 teachers emigrated from Ghana between 1975 and 1981. Furthermore, between 1995 and 2002, between 23% and 69% of Ghana's medical professionals, dentists, pharmacists, medical laboratory technicians, and environmental specialists emigrated (Ababio et al., 2003; ISSER, 2003).

Five years before the 1987 financial sector reforms, the remittances remained stagnant and low (Adenutsi, 2011). However, between 1983 and 1993, financial sector reforms seem to have contributed to the rise of international migrant remittances; Between 1983 and 1990, Ghanaian international emigrants remitted a total of US\$24.6 million back to Ghana, possibly because of the relaxation of exchange control laws due to the SAP (Ababio et al., 2003; Mazzucato et al., 2008). The BoG highlighted the importance of remittance inflows in Ghana, noting that in the early 1980s, remittance inflows influenced economic policies and strengthened the economic fundamentals in the SAP. Most remittance inflows were used for agriculture, business creation, housebuilding, purchasing houses, consumer goods, health, and education (Karley, 2011). The

GFC heavily negatively affected remittance inflows in developing countries due to a considerable rise in unemployment in more developed countries (Gockel, 2010; Karley, 2011).

Today, globalisation has made it cheaper for migrants to remit through formal financial sector channels, leading to increased remittance inflows in Ghana, with approximately 92% of incoming international remittances being channelled through banks and the formal financial sector (Addison, 2004). The most popular methods are electronic funds transfer, account-to-account transfers, and bank overdrafts, according to remittance service providers (RSPs) (Addison, 2004; Quartey, 2011; Sahoo & Sethi, 2020). Apart from cash, remittances are also often sent to Ghana in the form of goods such as clothing, vehicles, household appliances, and equipment and machinery for family-owned businesses. Some of these items are sold by the remittance recipients in Ghana, and then the cash is used for living expenses. This is to avoid suspicion of the migrant carrying money or to avoid paying tax or other charges, such as service charges on the transfer of money, which can range from 2% to 3.5% of the remittance value. This depends on whether the RSP is a commercial bank or nonbank operator such as Western Union and whether the money is sent in local currency (Cedis) or foreign currency (Ababio et al., 2003; Addison, 2004). Another reason this is done is due to the identification requirements when using RSPs (Quartey, 2011). Identification documents have prevented the poor from using formal RSPs and channels to receive remittances as they often cannot afford, nor do they have the time to apply for and collect passports or drivers' licences as proof of identification. However, new voter identification cards introduced for the December 2008 election, which have been largely adopted countrywide, have reduced the burden of proof of identification (Quartey, 2011). Figure 5 below shows the change in net migration and remittance inflows into Ghana from 1977 – 2017, with most remittance inflows coming from the UK (between 18% and 26%), European Union (between 13% and 15%), USA and Canada (between 55% and 76%), ECOWAS (between 2% and 3%), and the rest of Africa (between 1% and 2%) (Addison, 2004; Quartey, 2011; Bank of Ghana, 2022).

Figure 5. International net migration and remittances received in Ghana (1977 – 2017)



Notes for Figure 5: Sources: World Development Indicators (World Bank, 2022a); Global Bilateral Migration (World Bank, 2022b); author’s construct. A negative net migration value indicates net migration out of Ghana for the year (emigration), whereas a positive net migration value indicates net migration into Ghana for the year (immigration).

Remittance inflows are typically used for recurrent expenditures in Ghana, such as hospital bills, school fees, and debt repayments. They are also used to invest in the formation of small businesses and to encourage self-employment, which has been recognised by the government and international organisations, who now have targeted programmes to further boost investments into these small businesses (Addison, 2004).

3.4 Conclusion

The 1960s to 1980s shaped Ghana’s political landscape and economy. While political leaders introduced new policies leading to an economic crisis, the IMF and World Bank’s policies seem to have placed the economy in a better position than it was. Ghana experienced increases in FDI, GDP, and gold production and declines in inflation during their implementation (Frimpong & Oteng-Abayie, 2006; IMF, 2022). Ghana also had to undergo financial sector

transformation and restructuring; the introduction of the FINSAP and FNSSP reforms brought significant changes to Ghana's financial and banking sector, including increases in the number of commercial and rural banks, the availability of private sector credit and the opening of the GSE (Adu, Marbuah & Mensah, 2013; Bokpin, Mensah & Owusu-Antwi, 2016). All the changes to make the banking system sound were enhanced by improved bank supervision and proper regulatory framework. The 1980s reforms not only improved the financial system but also increased the remittance inflows into Ghana and made it easier for migrants to send money back home through the formal financial sector as international emigration increased. Chapters 2 and 3 lay the theoretical, empirical, and historical foundation for understanding Ghana's potential relationship between financial development, remittances, and economic growth. The following Chapter outlines the model, data and method employed to estimate the three relationships of interest in this study before the results are presented and discussed.

Chapter 4: Model Specification, Data, and Method

4.1 Introduction

This Chapter outlines the model, data, and methodology employed to estimate the impact of remittances and financial development on economic growth in Ghana. Within this, the finance growth nexus and the relationship between remittances and economic growth are also examined.

4.2 Model Specification

This study makes use of an augmented Solow (1957) growth model, which has been employed by Diabah et al. (2017), Chiumia et al. (2012) and Abdul-Mumuni and Quaidoo (2016). The Solow (1957) model allows for the addition of various parameters and can be used for a study on any country. For instance, Diabah et al. (2017) and Chiumia et al.'s (2012) studies only consider the relationship between financial development and economic growth in Ghana and Malawi, respectively and did not include remittances. Abdul-Mumuni and Quaidoo's (2016) study considered the effect of international remittances in Ghana, and all three studies employed the Solow (1957) model. The final model is specified as follows:

$$LGDP = \beta_0 + \beta_1 LREMIT + \beta_2 LFD + \beta_3 LFD * LREMIT + \beta_4 LGFCF + \beta_5 LPOPG + TREND$$

Where:

LGDP: Log of GDP per capita in constant US\$ 2005 prices

LREMIT: Log of remittances received as a percentage of GDP

LFD: Log of financial development proxied by:

LDCPS: Log of domestic credit provided to the private sector by banks as a percentage of GDP

LM2: Log of M2 money supply as a percentage of GDP

LGDS: Log of gross domestic savings as a percentage of GDP

LCI: Log of composite financial sector development index by Svirydzenka (2016)

*LFD * LREMIT*: Interaction term of LREMIT received and LFD

LGFCF: Log of gross fixed capital formation as a percentage of GDP

LPOPG: Log of population growth

TREND: Time trend

To examine the effects of the 1973 oil boom, financial liberalisation in the mid-1980s, and the 2008 GFC on economic growth in Ghana, the dummy variables OIL, FINLIB, and GFC08 are considered individually in each model. The complete derivation of the final model is in Appendix 1.

4.3 Data

This study examines the relationship between financial development, remittances, and economic growth from 1979 – 2020 (42 years). All of the data used in this study is from the World Bank's WDI (2022a) except for the financial sector development composite index by Svirydzenka (2016) and gross fixed capital formation, which were obtained from the IMF (2022) and the Penn World Table version 10.0 (Feenstra, Inklaar & Timmer, 2015), respectively. GDP per capita is based on constant US\$ 2005 prices while remittances received, domestic credit to the private sector, M2 money supply, and gross domestic savings are all expressed as a percentage of GDP.

The World Bank describes remittances as current personal transfers in cash or in kind to resident households from non-resident households (World Bank, 2022a). It is, however, likely that this data does not capture total remittance inflows into Ghana as reliable remittance data is generally limited as not all remittances pass through the formal banking system (Ababio et al., 2003; Sobiech, 2015). Therefore, the likely fact that this variable does not provide a complete view of remittance inflows is acknowledged as a limitation in this study. This study uses population growth as a proxy for the labour force due to the lack of reliable data on the

Ghanaian labour force as is done in Diabah et al.'s (2017) study. Domestic credit to the private sector by banks and M2 money supply as a percentage of GDP are proxies for the banking sector side of financial development. Domestic credit to the private sector is defined by the World Bank (2022a: 1) as “*financial resources provided to the private sector by other depository corporations (deposit taking corporations except central banks), such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment.*”. M2 money supply is defined as “*the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveller's checks; and other securities such as certificates of deposit and commercial paper.*” (World Bank, 2022a: 1).

Gross domestic savings as a percentage of GDP is employed as an indicator of movements and developments in the GSE. It is defined by the World Bank (2022a: 1) as “*GDP less final consumption expenditure (total consumption).*” and indicates the level of intensity of financial intermediaries such as a stock exchange (Hassan et al., 2012). More direct data on activity on the stock exchange was unattainable in sufficient amounts to ensure reliable results. The value of stocks traded as a percentage of GDP is a variable directly related to the stock exchange; however, observations were only available from 1993 to 2003, which is insufficient for a study of this nature. This is one of the reasons why the financial development composite index designed by Svirydzenka (2016) is employed in this study. The overall index accounts for stock market capitalisation to GDP and stocks traded to GDP. Therefore, by using the gross domestic savings and composite index variables, this study should still be able to provide some insight into the development of the Ghanaian stock market.

An explanatory variable measuring Ghana's political and institutional quality is a new variable that has emerged in the literature. Thus far, it has only been employed in studies by Adams and Klobodu (2016) and Baidoo and Duodu (2020). According to the Government Effectiveness Index from the World Bank Governance Indicators, data on government effectiveness is defined as capturing the “*perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.*” (World Bank, 2022c: 1). This index was to be employed in this study because Chapter 2 highlighted its suggested importance in the relationship between remittances and economic growth, specifically in Ghana and because it has not been adequately studied in

Ghana. The World Bank, however, only has data available for 1996 – 2020 (World Bank, 2022c), and using a dataset with such few observations would have materially impacted the reliability of the results; therefore, this index is excluded from the study.

4.4 Method

This study makes use of Pesaran et al.'s (2001) ARDL bounds test approach to cointegration, which has been employed by Adams and Klobodu (2016), Adjei et al. (2020), Adu et al. (2013), Alagidede and Ibrahim (2020), Asomani et al. (2019), Baidoo and Duodu (2020), Diabah et al. (2017), and Eso (2010a) for various macroeconomic studies on Ghana. It shows whether there is a long-run relationship between the variables in the model (Adjei et al., 2020; Asomani et al., 2019; Pesaran et al., 2001). The ARDL method has two important benefits; the first is that it is applicable irrespective of whether the underlying regressors are purely stationary at $I(0)$, purely integrated in the first order at $I(1)$, or mutually cointegrated. The second is that it can deal with the typical problems arising from the type of macroeconomic data typically used in this study due to its superior statistical properties. The ARDL method produces valid short- and long-run estimates and a cointegration test in a single OLS estimate. Its bounds test results are also efficient, even for small sample sizes, which is crucial for studies focusing on African countries as most data does not have many observations.

4.4.1 Stationarity

In econometric theory, it was typically assumed that the underlying time series in a model used to determine the relationship between variables was stationary and exhibited a long-run relationship. However, recent econometric developments show that this is not always the case (Nkoro & Uko, 2016). It is therefore important to test the stationarity of the time series before the relationships between the variables are examined, and a unit root test can be used to determine the stationarity of a time series (Bhatta & Shrestha, 2018).

The Augmented Dickey-Fuller (ADF) unit root test is the most common when testing for a unit root, and for ARDL to be used, the unit root needs to be $I(0)$ or $I(1)$ as the ARDL process breaks down if it is $I(2)$ (Choong & Chan, 2001; Bhatta & Shrestha, 2018). Either the Akaike Information Criterion, Schwarz Bayesian Criterion (SBC), or Hannon and Quinn Criteria are

used to determine the lag selection criteria in the ADF test, which will ultimately be used to determine the integrated order of the variables in the model (Ramirez, 2014). In this study, the SBC ensures that none of the variables are I(2). Typically, the model with the smallest SBC estimates performs best and produces the most reliable estimates, and this is the process followed (Nkoro & Uko, 2016).

Perron (1989) shows that in the presence of a structural break, a unit root test such as the ADF test may show a time series to be non-stationary when it is stationary and has therefore allowed for known structural breaks in ADF tests to overcome this issue (Bhatta & Shrestha, 2018). According to Bhatta and Shrestha (2018), if there is a series, Δy_t , then the ADF test for the unit root would be as follows:

$$\Delta y_t = \mu + \delta y_{t-1} + \sum_{i=1}^k \beta_i \Delta y_{t-1} + e_t$$

Where:

$$\delta = \alpha - 1$$

α = coefficient of y_{t-1}

Δy_{t-1} = the first difference of y_t

Therefore, the null hypothesis of the ADF is $\delta = 0$ against the alternative hypothesis that $\delta < 0$. If the null hypothesis is rejected, the series is stationary, and if it is not rejected, then the series is non-stationary (Bhatta & Shrestha, 2018).

4.4.2 ARDL Approach to Cointegration

The ARDL method is an OLS-based method applicable for non-stationary and mixed-order integration time series. The F and W statistics from the bounds test will show whether there is a long-run relationship or cointegration between the variables in the model (Bhatta & Shrestha, 2018). Lower and upper bound critical values for the bounds test are provided at 1%, 2.5%, 5%, and 10% levels (Pesaran et al., 2001). The result is inconsistent if the F-statistic is between the lower and upper critical values (Nkoro & Uko, 2016). If the F-statistic is greater than the upper bound critical value, then H_0 is rejected, meaning there is cointegration between the

variables in the model. Likewise, if the F-statistic is below the lower bound critical value, then H_0 cannot be rejected, meaning there is no cointegration between the variables.

The ECM is then used to confirm the existence or non-existence of cointegration based on the statistical significance of the error correction term. For an error correction term (ECT) to have meaning and suggest convergence to a long-run trend, it should be negative, statistically significant, and less than 1, which implies convergence in the model. If it is positive, then there is divergence in the model (Arshed, 2014; Nkoro & Uko, 2016; Pesaran et al., 2001). If this is not the case, there is no cointegration in the model. While the bounds test indicates the existence of cointegration, it has limited power as it does not consider the regression results. The ECT is provided after the regressions are run and therefore are more concrete and superior than the results from the bounds test (Nkoro & Uko, 2016; Pesaran et al., 2001; Pesaran & Shin, 1995). The ECM is derived from the ARDL to provide short-run estimates on the model without losing any long-run information on the variables (Ramirez, 2014; Nkoro & Uko, 2016; Bhatta & Shrestha, 2018). “*The result of the error correcting model (ECM) indicates an adjustment to the equilibrium state after a shock.*” (Diabah, Ofori-Abebrese & Pickson, 2017: 293). More specifically, it shows the speed of adjustment of the model back to equilibrium. Additionally, if the ECT is 1, then the entire adjustment back to the long-run equilibrium occurs within the period of the study or the adjustment is instantaneous. If the term is 0.5, the adjustment takes place every year, and if the term is 0, there is no adjustment (Nkoro & Uko, 2016).

4.4.3 Diagnostics and post-estimation tests

Once the results and existence and non-existence of long- and short-run relationships between the parameters have been established, various diagnostic tests are conducted to determine the robustness, reliability, and stability of the results across different data sub-samples (Bhatta & Shrestha, 2018). This study makes use of the Durbin Watson (DW) statistic and the Breusch-Godfrey Lagrange Multiplier (LM) for serial autocorrelation (Bhatta & Shrestha, 2018). The Breusch-Godfrey LM test is also used to examine the presence of heteroscedasticity using the LM and F test statistics.

The DW statistic ranges from 0 to 4, where values less than 2 indicate negative serial autocorrelation in the model. Values greater than 2 indicate positive serial autocorrelation in the model, and finally, a DW statistic of 2 or close to 2 indicates no serial autocorrelation in the model (Park, 1975; Williams, 2015). The LM test tests for residual serial correlation.

According to Williams (2015) and Choi (2008), serial correlation affects the efficiency of the regression coefficients but not the unbiasedness or consistency. Therefore, when there is negative serial correlation, the estimates of the standard errors will be bigger than the true standard errors, leading to the conclusion to not reject the null hypothesis when it should be rejected, and vice-versa for positive serial correlation.

Heteroscedasticity occurs when there is a large difference between the smallest and largest values in a dataset. The LM test for heteroscedasticity is based on the regression of squared residuals on squared fitted values. It is crucial to ensure that there is no heteroscedasticity in the models as it can result in less precise estimates of the coefficients and p-values that are lower than they should be, therefore potentially leading to incorrect conclusions, although the unbiasedness of the estimates is not affected by heteroscedasticity (Choi, 2008).

Finally, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests are applied to check the structural stability of the regression coefficients over time and therefore validate the findings (Choong & Chan, 2001; Pahlavani, Wilson & Worthington, 2005; Chiumia et al., 2012). If the blue line does not cross the red and green boundary lines in the CUSUM graph, then there is no issue of recursive residuals regarding the mean. Similarly, for the CUSUMSQ graph, if the blue line does not cross the red and green boundary lines, there is no issue of recursive residuals in terms of the variance (Arshed, 2014). The CUSUM and CUSUMSQ tests are appropriate in time series when there is uncertainty when potential structural changes have occurred (Pahlavani, Wilson & Worthington, 2005). While this Chapter laid the empirical foundation for the study, the next Chapter provides the descriptive statistics, regression results and discussion of results in the context of the literature review and Ghana's political and economic history.

Chapter 5: Descriptive Statistics, Regression Results and Discussion

5.1 Introduction

This study aims to answer the following questions: i) does financial development promote economic growth in Ghana, ii) do remittance inflows promote economic growth in Ghana, and iii) does financial development coupled with remittance inflows promote economic growth in Ghana? This Chapter therefore analyses and discusses the descriptive statistics of the data and the regression results based on the models and ARDL approach to cointegration method presented in Chapter 4 to answer the three questions above.

5.2 Preliminary Data Analysis

Table 2: Descriptive Statistics (1979 – 2020)

	GDP	REMIT	DCPS	M2	GDS	CI	POPG	GFCF
Mean	1202.00	1.58	8.90	23.00	7.75	0.04	0.03	0.27
Median	1034.51	0.41	10.48	23.45	5.93	0.03	2.55	0.26
Maximum	2053.60	10.08	15.83	34.11	21.60	0.08	0.03	0.42
Minimum	757.92	0.01	1.54	11.31	-2.96	0.01	0.02	0.14
Sum	50485.6273	66.3513	373.8075	965.9367	325.6086	1.5393	7.0165	11.3813
Standard deviation	391.34	2.45	4.93	6.38	6.17	0.02	0.00	0.07
Sum of squares deviation	6278968.01	246.07	995.14	1668.45	1560.40	0.02	10281.06	0.19
Skewness	0.92	1.72	-0.14	-0.14	0.75	0.29	0.18	0.23
Kurtosis	-0.56	2.06	-1.58	-1.03	-0.27	-1.18	-1.11	-0.52
Jarque-Bera Test	6.82	33.05	4.76	1.90	4.32	3.09	3376.99	0.60
Observations	42	42	42	42	32	42	42	42

Notes for Table 2: Sources: World Development Indicators (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022c); authors' construct.

Table 2 above shows the descriptive statistics of the variables employed in this study. It shows that the average GDP per capita for the period 1979 – 2020 is US\$1 202 a year, while the value of remittance inflows into Ghana was, on average, 1.58% of GDP over the period. This is unexpected given that remittances are considered one of Ghana's largest sources of capital inflow (Adams & Klobodu, 2016). M2 money supply holds the largest percentage of GDP compared to the other measures of financial development. Between 1979 and 2020, the value of GDS is 7.75% of GDP on average. Hassan et al. (2011) find that for the 40 Sub-Saharan African countries they examine, GDS is 7.8% of GDP on average; therefore, it seems that the GSE is on par with other African stock exchanges. The average value for the CI is 0.04. The average value of the index for other developing and emerging market economies is 0.15 (Svirydzenka, 2016), which suggests that Ghana's overall financial development is lower than that of most developing and emerging market economies.

The skewness considers whether the data is symmetrical or not symmetrical. DCPS, M2, CI, POPG and GFCF have a skewness of between -0.5 and 0.5 and therefore are symmetrical. GDP, remittances, and GDS have a skewness value that is either between 0.5 and 1 or greater than 1 and are therefore positively skewed, indicating that most of the data for these variables are clustered towards the left-tail of the distribution. Kurtosis measures whether data is heavy or light-tailed compared to a normal distribution. All variables have a kurtosis value of less than 3, and therefore most of the data is within high proximity of the mean. Finally, the Jarque-Bera test is a measure of the goodness of fit. It measures whether the data has a skewness and kurtosis complementary to a normal distribution. A Jarque-Bera test statistic of between 0 and 3 indicates a normal distribution, while a test statistic of greater than 3 rejects the null hypothesis of a normal distribution (Bera & Jarque, 1987; Brys, Hubert & Struyf, 2004). The results of the Jarque-Bera tests on the variables therefore confirm the skewness and kurtosis of the data discussed above.

5.3 Empirical Findings

For the ARDL method to provide reliable results, the ADF tests need to show that the unit roots are either stationary, $I(0)$ or $I(1)$. The ADF tests reported in Appendix 2 show that all variables are either stationary, $I(0)$, or $I(1)$. Therefore, the ARDL approach to cointegration can be employed. The results of the regressions are analysed and discussed below. The full results, including the bounds tests, regression results, and diagnostic tests for all models, are reported in Appendix 4 to 52.

This sub-section first examines the relationship between each financial development proxy and economic growth, then the relationship between remittances and economic growth, and finally, the relationship between financial development, remittances, and economic growth for Ghana from 1979 - 2020. Tables 3, 4.1 and 4.2¹ below show the long- and short-run results of the chosen regressions.

The bounds test and ECT for the Solow (1957) model augmented with LDCPS in Appendix 4 shows that there is no cointegration in the model. This result is contrary to the findings of Adusei (2013), Adu et al. (2013), Diabah et al. (2017), Esso (2010a), and Ho and Iyke (2018), who all find that there is cointegration between domestic credit to the private sector and economic growth in Ghana. However, Prah and Quartey (2008) corroborate this study's findings, as they find that credit and economic growth are independent.

Appendix 6 shows that when the Solow (1957) model is augmented with LDCPS and OIL, the bounds test and ECT show there is cointegration in the model². Model 1 in Table 3 suggests that in the long-run, a 1% increase in LDCPS is associated with a 0.02% increase in LGDP, *ceteris paribus*. However, this result is statistically insignificant. The effect of OIL on LGDP is positive and significant at 1% in the long-run. This finding is somewhat corroborated by Esso (2010a) who finds that when the effect of the oil price boom is included in their model, the long-run effect of domestic credit to the private sector on economic growth is positive and statistically significant for Ghana.

Model 1 in Table 4.1 below shows the short-run results of this model. Similar to Esso's (2010a) findings, the coefficient on LDCPS indicates that a 1% increase in LDCPS is associated with a 0.10% decrease in LGDP in the short-run, *ceteris paribus* and this result is statistically

¹ The full version of Table 4.1 and 4.2 are shown in Appendix 3.

² Full results are shown in Appendix 6.

significant at 1%. Like in the long-run, OIL has a positive and statistically significant effect on growth at 1%, ceteris paribus, which is contrary to what is expected given the deteriorating economic conditions in Ghana at the time (Baffoe, 1993). The ECT shows that approximately 63.46% of the deviations from long-run economic growth caused by shocks in the prior period converge to equilibrium in the current period (Adu, Marbuah & Mensah, 2013; Nkoro & Uko, 2016). The diagnostic tests show that there is no serial-autocorrelation or heteroscedasticity in the long- and short-run models and that they are structurally stable³. The R-squared value suggests that the variables explain almost 80% of the variation in LGDP in the model.

Table 3. Long-Run Estimates of GDP per Capita

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
	LDCPS & OIL	LGDS only	LCI & GFC08	LREMIT only	LREMIT & FINLIB	LREMIT, LDCPS & Interaction Term	LREMIT, LDCPS, Interaction Term & FINLIB	LREMIT, LM2 & Interaction Term	LREMIT, LGDS & Interaction Term	LREMIT, LCI & Interaction Term
LREMIT				-0.12 (0.11)	-0.01 (0.04)	-0.14*** (0.04)	-0.33*** (0.05)	-0.03 (0.07)	0.04 (0.02)	0.32*** (0.05)
LDCPS	0.02 (0.05)					-0.02 (0.05)	0.09 (0.06)			
LREMIT*LDCPS						0.05*** (0.03)	0.11** (0.02)			
LM2								-0.23*** (0.05)		
LREMIT*LM2								0.02 (0.02)		
LGDS		-0.04* (0.01)							-0.05* (0.02)	
LREMIT*LGDS									-0.03** (0.01)	
LCI			-0.00 (0.03)							0.43*** (0.06)
LREMIT*LCI										0.15*** (0.02)
LPOPG	4.10*** (0.77)	4.00** (1.21)	4.02*** (0.86)	4.61*** (1.62)	5.28*** (1.22)	1.20 (1.18)	-0.47 (0.86)	1.19** (0.44)	0.81 (0.57)	-5.11*** (1.44)
LGFCF	-0.60*** (0.16)	-0.15 (0.08)	-0.26*** (0.04)	-0.21*** (0.06)	-0.07* (0.04)	-0.07 (0.05)	-0.16 (0.07)	-0.07** (0.03)	0.01 (0.04)	0.12* (0.06)
FINLIB					-0.19*** (0.04)		0.26* (0.06)			
OIL	0.45*** (0.08)									
GFC08			0.65*** (0.21)							
CONS	16.83*** (1.93)	16.40*** (2.93)	16.25*** (2.17)	12.70** (5.82)	19.59*** (3.04)	9.12*** (2.97)	4.12 (2.04)	9.99*** (1.15)	8.62*** (1.39)	-5.39 (3.48)
TREND	0.04*** (0.00)	0.04*** (0.01)	0.04*** (0.00)	0.06*** (0.02)	0.05*** (0.04)	0.08*** (0.00)	0.04*** (0.00)	0.03*** (0.00)	0.02*** (0.04)	0.01*** (0.00)

Notes for Table 3: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). Standard errors are shown in brackets below the coefficients. Coefficients and standard errors are shown to 2 decimal places. A variable is significant

³ Full results are shown in Appendix 6.

at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

While the bounds test in Appendix 8 shows that there is no long-run relationship between the variables when the Solow (1957) model is augmented with LM2, the ECT suggests that there is cointegration at the 10% significance level. The results provided by the ECT are corroborated by the findings of Nkrumah and Sackey (2012) and Prah and Quartey (2008) for Ghana. In this study, LM2 has negative and statistically insignificant effects on LGDP in both the long- and short-run. This finding is in line with the study by Lartey (2013), which finds that M2 money supply has a negative and insignificant effect on economic growth in the long-run. However, these findings are contrary to that of Adenutsi (2011), who finds that there is no relationship between M2 money supply and economic growth.

No known study on Ghana considers the effect of developments on the stock exchange on economic growth. The bounds test in Appendix 12 provides inconclusive results on the Solow (1957) model augmented with LGDS. The ECT, however, indicates that there is cointegration in the model and is significant at 5%. Model 2 in Table 3 above shows that a 1% increase in LGDS is associated with a 0.04% decrease in LGDP, ceteris paribus, and this result is statistically significant at 10%. This result is contrary to that of Hassan et al. (2011), who find that gross domestic savings positively and significantly affect economic growth in Sub-Saharan Africa. This is consistent with the argument that well-developed financial sectors in developing countries could significantly contribute to an increase in savings and investments, ultimately leading to economic growth.

Model 2 in Table 4.1 shows that in the short-run, LGDS has a negative and statistically insignificant effect on LGDP. The ECT of -0.93 suggests that 93% of the deviations from the long-run are adjusted back to long-run equilibrium in the short-run. Hassan et al. (2011) similarly find that gross domestic savings have little effect on Sub-Saharan Africa's growth in the short-run. Furthermore, they find that any effects of gross domestic savings on growth "*dies out quickly*" (Hassan et al., 2011, p. 99), which supports the high ECT found in Table 4.1. All diagnostic tests show that there is no serial-autocorrelation or heteroscedasticity in the models. However, the CUSUMSQ graph touches the lower boundary. It therefore indicates that there may be an issue with the recursive residuals regarding the variance (Arshed, 2014), and thus

these results should be interpreted with caution⁴. The R-squared value suggests that the variables explain 96% of the variation in LGDP in the model.

Table 4.1. Short-Run Estimates of GDP per Capita⁵

	Model 1	Model 2	Model 3	Model 4	Model 5
	LDCPS & OIL ARDL (1,3,4,1,4)	LGDS only ARDL (4,2,4,4)	LCI & GFC08 ARDL (1,0,0,0,4)	LREMIT only ARDL (4,4,0,0)	LREMIT & FINLIB ARDL (4,4,3,0,3)
dLREMIT				0.02** (0.01)	0.03*** (0.00)
dLDCPS	-0.10*** (0.03)				
dLREMIT*LDCPS					
dLM2					
dLREMIT*LM2					
dLGDS		-0.01 (0.00)			
dLREMIT*LGDS					
dLCI			-0.00 (0.01)		
dLREMIT*LCI					
dLPOPG	-9.05** (3.57)	12.00*** (2.68)	1.08*** (0.28)	0.42 (0.41)	0.15 (2.88)
dLGFCF	-0.20** (0.07)	-0.00 (0.02)	-0.04** (0.02)	-0.02 (0.02)	-0.02 (0.02)
dLFINLIB					-0.03* (0.02)
dOIL	0.10*** (0.03)				
dGFC08			-0.01 (0.02)		
dTREND	0.02** (0.01)	0.03** (0.01)	0.01*** (0.00)	0.01*** (0.00)	0.02*** (0.00)
ecm(-1)	-0.63*** (0.17)	-0.93* (0.42)	-0.27*** (0.07)	-0.15** (0.07)	-0.35** (0.12)
R ²	0.80	0.96	1.00	0.65	1.00
R bar squared	0.57	0.77	1.00	0.47	1.00
DW Statistic	2.68	1.95	1.92	2.18	2.79

Notes for Table 4.1: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). Standard errors are shown in brackets below the coefficients. Coefficients and standard errors are shown to 2 decimal places. A variable is significant

⁴ Full results are shown in Appendix 12.

⁵ Full results are shown in Appendix 3.

at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

The bounds test for the Solow (1957) model augmented with LCI in Appendix 15 shows that there is no cointegration in the model. The ECT, however, indicates cointegration in the model at the 10% significance level. The results suggest that Ghana's financial system has a negative and statistically insignificant effect on economic growth in the long- and short-run. This result contradicts Adenutsi (2011), who finds that the composite index positively affects long- and short-run growth. However, these findings align with Asomani et al. (2019), who find a negative relationship between financial development and growth.

The bounds test and ECT in Appendix 18 show that there is cointegration in the Solow (1957) model when augmented with LCI and GFC08. Model 3 in Table 3 shows that a 1% improvement in Ghana's overall financial system is associated with a 0.004% deterioration in LGDP in the long-run, *ceteris paribus*. This result, however, is insignificant. The effects of the GFC are positive and significant, which is unexpected as global GDP, and economic performance contracted during this period (Agbélénko & Kibet, 2015). The ECM in Model 3 in Table 4.1 shows that in the short-run, both LCI and GFC08 have negative and insignificant impacts on economic growth, which suggests that the GFC did not materially impact Ghana's financial system and economic performance. The ECT of -0.27 indicates that the adjustment towards long-run equilibrium is slow. The diagnostic tests for these regressions show that there is no serial-autocorrelation or heteroscedasticity and that the model is structurally stable.⁶ The R-squared value of 1.00 suggests that the variables explain almost all the variation in GDP in the model.

The bounds test and ECT in Appendix 19 show that there is cointegration in the Solow (1957) model when augmented with LREMIT. This is in line with results from studies by Abor et al. (2018), Adams and Klobodu (2016), Adjei et al. (2020), Adenutsi (2011), Agbola (2013), Agyei (2021), Atiga and Nyeadi (2014), Baidoo and Duodu (2020), Chami et al. (2005), Fayissa and Nsiah (2010), and Lartey (2013). However, unlike all the studies mentioned above except for those by Adjei et al. (2020) on Ghana and Chami et al. (2005) on developing countries, Model 4 in Table 3 shows that in the long-run, a 1% increase in LREMIT is associated with a 0.01% decrease in LGDP, *ceteris paribus* and this result is statistically

⁶ Full results are shown in Appendix 18.

insignificant. This is contrary to what is expected, given that most literature tends to find a positive and significant effect of remittances on economic growth.

Model 4 in Table 4.1 shows that in the short-run, a 1% increase in LREMIT is associated with a 0.02% increase in LGDP in the short-run, *ceteris paribus*, and this result is statistically significant at 1%. This finding is corroborated by Adjei et al. (2020) and Baidoo and Duodu (2020), who find that remittances have a positive and statistically significant effect on economic growth in the short-run. Similarly, Adams and Klobodu (2016) find that remittances have a positive but insignificant effect on economic growth in the short-run. The diagnostic tests for these regressions show that there is no serial-autocorrelation or heteroscedasticity and that the model is structurally stable. However, the CUSUMSQ graph breaks the lower boundary. It, therefore, indicates that there may be an issue with the recursive residuals regarding the variance (Arshed, 2014), and thus these results should be interpreted with caution.⁷ The R-squared value suggests that the variables explain 64% of the variation in GDP.

The bounds test and ECT in Appendix 20 show that there is still cointegration when the above model is further augmented with FINLIB. No study in this field on Ghana has considered the effect of remittances on economic growth when financial liberalisation is considered. Model 5 in Table 3 shows that in the long-run, a 1% increase in LREMIT is associated with a 0.02% decrease in LGDP, *ceteris paribus*, and this result is statistically significant at 1%. Additionally, the effect of FINLIB is negative and significant at 10% in the long- and short-run. This result is unexpected given that the history of Ghana's economy suggests that the effects of financial liberalisation were positive on the economy (Bawumia, 2010; Adu, Marbuah & Mensah, 2013). Model 5 in Table 4.1 shows that a 1% increase in LREMIT is associated with a 0.03% increase in LGDP, which is significant at 1%, which is more in line with Ghana's economic history compared to the long-run result. The ECT of -0.35 suggests that the economy made a slow adjustment back to its long-run equilibrium when financial liberalisation is considered. The diagnostic tests for these regressions show that there is no serial-autocorrelation or heteroscedasticity and that the model is structurally stable.⁸ The R-squared value of 1.00 suggests that the variables explain almost all the variation in GDP in the model.

When LREMIT is considered with OIL⁹, the effect of OIL on LGDP is positive and significant in the long-run and negative and insignificant in the short-run. The impact of LREMIT on

⁷ Full results are shown in Appendix 19.

⁸ Full results are shown in Appendix 20.

⁹ Full results and confirmation of cointegration are shown in Appendix 21.

LGDP is positive in both cases but insignificant in the long-run and significant in the short-run. The short-run result is consistent with Ghana's economic history, which shows that during the time of the oil price boom, more than one million Ghanaians emigrated to Nigeria in search of better employment opportunities (Ababio et al., 2003; Aryeetey & Fosu, 2008; Baffoe, 1993; World Bank, 2018). When LREMIT is considered with GFC08¹⁰, the effect of LREMIT on LGDP is negative but insignificant in the long- and short-run. This supports Orzell's (2013) proposition that the GFC did not cause a significant change in remittances' effect on developing countries' economic growth.

Table 4.2. Short-Run Estimates of GDP per Capita¹¹

	Model 6	Model 7	Model 8	Model 9	Model 10
	LREMIT, LDCPS & Interaction Term ARDL (1,3,0,0,0,0)	LREMIT, LDCPS, Interaction Term & FINLIB ARDL (4,4,4,3,4,4,4)	LREMIT, LM2 & Interaction Term ARDL (4,4,3,4,3,4)	LREMIT, LGDS & Interaction Term ARDL (2,0,1,0,0,0)	LREMIT, LCI & Interaction Term ARDL (4,1,4,4,4,2)
dLREMIT	-0.02* (0.01)	-0.04*** (0.03)	0.19** (0.07)	0.03** (0.01)	0.17*** (0.04)
dLDCPS	-0.01 (0.02)	0.01 (0.02)			
dLREMIT*LDCPS	0.02*** (0.01)	0.02 (0.01)			
dLM2			-0.10*** (0.03)		
dLREMIT*LM2			-0.04* (0.02)		
dLGDS				-0.03** (0.01)	
dLREMIT*LGDS				-0.02** (0.01)	
dLCI					0.32*** (0.04)
dLREMIT*LCI					0.09*** (0.02)
dLPOPG	0.40 (0.38)	-13.35*** (2.96)	10.87 (6.72)	0.41 (0.26)	-23.59** (8.05)
dLGFCF	-0.02 (0.02)	-0.06*** (0.01)	-0.04 (0.02)	0.00 (0.02)	-0.03 (0.02)
dLFINLIB		-0.02 (0.02)			
dTREND	0.01*** (0.00)	0.04*** (0.01)	0.04 (0.03)	0.01*** (0.00)	0.01*** (0.00)
ecm(-1)	-0.33*** (0.09)	-1.00*** (0.26)	-1.53*** (0.34)	-0.50*** (0.08)	-0.90*** (0.17)
R ²	0.60	1.00	0.95	0.92	0.93

¹⁰ Full results and confirmation of cointegration are shown in Appendix 22.

¹¹ Full results are shown in Appendix 3.

R bar squared	0.44	0.98	0.79	0.87	0.77
DW Statistic	2.24	3.09	2.20	2.39	2.45

Notes for Table 4.2: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). Standard errors are shown in brackets below the coefficients. Coefficients and standard errors are shown to 2 decimal places. A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

The bounds test and ECT for the Solow (1957) model augmented with LREMIT and LDCPS in Appendix 23 shows that there is no cointegration in the model at both the 5% and 10% significance levels. Antwi and Koranteng (2017) have the same findings. However, Ho and Iyke (2018), Diabah et al. (2017), and Esso (2010a) find there is cointegration in their models that focus on Ghana.

When the Solow (1957) model is further augmented with an interaction term between LREMIT and LDCPS, the bounds test in Appendix 24 provides inconclusive results as to the existence of cointegration. The ECT in Table 4.2, however, confirms a long-run relationship. While Model 6 in Table 3 shows that in the long-run, the individual effects of LREMIT and LDPCS are negative and significant and insignificant, respectively, the interaction term of the two is positive and significant at 1%. A 1% increase in LREMIT given LDCPS is associated with a 0.28%¹² increase in LGDP in the long-run, ceteris paribus. This result is corroborated by the studies of Lartey (2013) and Inoue (2017), who both find the interaction between remittances and domestic credit to the private sector to be positive and statistically significant in the long-run.

In the short-run, Model 6 in Table 4.2 shows that LREMIT and LDCPS both have a negative and statistically insignificant effect on LGDP. However, a 1% increase in LREMIT given LDCPS is associated with a 0.12%¹³ increase in economic growth, ceteris paribus and this result is statistically significant at 1%. The diagnostic tests for these regressions show that there is no serial-autocorrelation or heteroscedasticity and that the model is structurally stable. However, the CUSUMSQ graph breaks the lower boundary. It therefore indicates that there may be an issue with the recursive residuals regarding the variance (Arshed, 2014), and thus

¹² The calculation of the joint effect of remittances and domestic credit to the private sector by banks is shown in Appendix 24 and follows the method as outlined by Asomani et al. (2019) and Sobiech (2015).

¹³ The calculation of the joint effect of remittances and domestic credit to the private sector by banks is shown in Appendix 24 and follows the method as outlined by Asomani et al. (2019) and Sobiech (2015).

these results should be interpreted with caution.¹⁴ The R-squared value suggests that the variables explain only 60% of the model's variation in GDP.

When the previous model is further augmented with FINLIB¹⁵, Model 7 in Table 3 shows that the effect of LREMIT on LGDP is positive and statistically significant at 1%, while the effect of LDCPS remains unchanged. Domestic credit to the private sector is also positive and insignificant in Adu et al. (2013) and Adusei's (2013) studies. This study finds that the positive joint effect of LREMIT and LDCPS on LGDP in the long-run is 0.66%¹⁶ and is significant at 1%. Prah and Quartey (2008), however, find that there is no relationship between credit to the private sector and economic growth in either direction when financial liberalisation is considered. FINLIB is also found to have a positive and statistically significant impact on LGDP at 10%. This result is corroborated by Adu et al. (2013), who find that financial liberalisation has a positive but insignificant long-run impact on economic growth. Similarly, Esso (2010a) finds that when financial liberalisation is considered, financial development granger-causes economic growth, which supports the supply-leading hypothesis by King and Levine (1993) and Levine and Zervos (1998) that financial liberalisation enables the mobilisation of domestic savings. The ECT for Model 7 in Table 4.2 is -1.00, which suggests that the entire adjustment of the economy to long-run equilibrium is instantaneous. The diagnostic tests for these regressions show that there is no serial-autocorrelation or heteroscedasticity and that the model is structurally stable. However, the CUSUMSQ graph breaks the lower boundary. It therefore indicates an issue with the recursive residuals regarding the variance (Arshed, 2014); thus, these results should be interpreted with caution.¹⁷ The R-squared value of 1.00 suggests that the variables explain almost all the variation in GDP in the model.

The bounds test in Appendix 31 suggests that there is no cointegration in the Solow (1957) model that is augmented with LREMIT and LM2. However, the ECT suggests that there is cointegration. The results suggest that in the long-run, there is a positive but insignificant relationship between LREMIT and LGDP, while the relationship between LM2 and LGDP is negative and statistically significant at 10%. Lartey corroborates the findings for M2 money supply (2013); however, he finds that remittances have a negative and statistically significant effect on economic growth in Sub-Saharan Africa. Contrary to this study's findings, Nkrumah

¹⁴ Full results are shown in Appendix 24.

¹⁵ The bounds test and error correction term in Appendix 26 shows that there is cointegration in the model.

¹⁶ The calculation of the joint effect of remittances and domestic credit to the private sector by banks is shown in Appendix 26 and follows the method as outlined by Asomani et al. (2019) and Sobiech (2015).

¹⁷ Full results are shown in Appendix 26.

and Sackey (2012) find that M2 money supply positively and significantly affects economic growth. However, their results are to be interpreted with caution as they only employ bivariate models which do not consider important aspects of the economy such as labour and gross fixed capital formation. Adenutsi (2011) finds that there is no relationship between M2 and economic growth in Ghana.

When the above model is further augmented with an interaction term between LREMIT and LM2, the existence of a long-run relationship is confirmed by both the bounds test and ECT in Appendix 32. The presence of cointegration is also found by Adenutsi (2011), Barajas et al. (2009), Inoue (2017), Lartey (2013) and Nkrumah and Sackey (2012). Model 8 in Table 3 shows that in the long-run, a 1% increase in LREMIT given LM2 is associated with a 0.42%¹⁸ increase in LGDP, *ceteris paribus* and significant at 1%. This result is similar to Lartey (2013), whose results suggest that remittances and M2 money supply for Sub-Saharan African countries are complementary in enhancing economic growth. Barajas et al. (2009) come to the same conclusion for developing countries, and Inoue (2017) also finds that the joint effect of remittances and M2 money supply has a positive effect on economic growth in developing countries in all the various scenarios examined, although most of these effects are insignificant.

When no interaction term is considered¹⁹, LREMIT has a positive and significant impact on LGDP, while LM2 negatively and significantly affects LGDP in the short-run. Model 8 in Table 4.2 shows that when the above-mentioned model is further augmented with an interaction term, the individual relationships of LREMIT and LM2 on LGDP do not change in terms of the sign and significance of the coefficients. In the short-run, a 1% increase in LREMIT given LM2 is associated with a 0.82%²⁰ decrease in economic growth, *ceteris paribus*, and this result is significant at 1%. The diagnostic tests for these regressions show that there is no serial-autocorrelation or heteroscedasticity and that the model is structurally stable. However, the CUSUMSQ graph breaks the lower boundary. It therefore indicates that there is an issue with the recursive residuals regarding the variance (Arshed, 2014), and thus these results should be interpreted with caution.²¹ The R-squared value suggests that the variables explain 95% of the variation in GDP in the model.

¹⁸ The calculation of the joint effect of remittances and M2 money supply is shown in Appendix 32 and follows the method as outlined by Asomani et al. (2019) and Sobiech (2015).

¹⁹ Full results available in Appendix 31.

²⁰ The calculation of the joint effect of remittances and M2 money supply is shown in Appendix 32 and follows the method as outlined by Asomani et al. (2019) and Sobiech (2015).

²¹ Full results are shown in Appendix 32.

No known studies on Ghana consider the effect of gross domestic savings and remittances on economic growth; therefore, there is no study to compare these results to. The bounds test and ECT in Appendix 40 show that there is cointegration in the Solow (1957) model that is augmented with LREMIT, LGDS and an interaction term between the two. Model 9 in Table 3 shows the joint effect of LREMIT and LGDS on LGDP, in the long-run, is -0.23%²² ceteris paribus, and this result is significant at 1%. Model 9 in Table 4.2 shows that the effect of LREMIT on LGDP is positive and significant in the short-run while the effect of LGDS on LGDP is negative and significant. A 1% increase in LREMIT given LGDS is associated with a 0.11%²³ decrease in LGDP, ceteris paribus, which is significant at 1%. The diagnostic tests for these regressions show that there is no serial-autocorrelation or heteroscedasticity and that the model is structurally stable.²⁴ The R-squared value suggests that the variables explain 92% of the variation in GDP in the model.

The bounds test in Appendix 45 shows that there is no cointegration in the Solow model that is augmented with LREMIT and LCI. However, the ECT shows that there is cointegration in the model. In the long-run, LREMIT has a positive and significant effect on LGDP at 1%, while LCI has a negative and insignificant effect on LGDP. Alagidede and Ibrahim (2020) also employ the composite index by Svirydzienka (2016) and find that financial sector developments reduce Ghana's long-run economic growth. This is further echoed by Adenutsi (2011), who, although using a self-made financial development composite indicator, finds that financial development is the leading inhibitor to long-run economic growth in Ghana.

When the above model is further augmented with the interaction term, the bounds test and ECT in Appendix 46 show that there is cointegration in the model. This is in line with findings from Asomani et al.'s (2019) study on Ghana and Sobiech's (2015) study on developing countries. Model 10 in Table 3 shows that the individual effects of LREMIT and LCI on LGDP when an interaction term is included in the model are positive and significant in the long-run at 1%.

Model 10 in Table 3 shows that a 1% increase in LREMIT given LCI is associated with a 0.33%²⁵ increase in LGDP in the long-run, ceteris paribus, which is significant at 1%. This result is corroborated by Asomani et al. (2019), who find the joint effect of remittances and the

²² The calculation of the joint effect of remittances and gross domestic savings is shown in Appendix 40 and follows the method as outlined by Asomani et al. (2019) and Sobiech (2015).

²³ The calculation of the joint effect of remittances and gross domestic savings is shown in Appendix 40 and follows the method as outlined by Asomani et al. (2019) and Sobiech (2015).

²⁴ Full results are shown in Appendix 40.

²⁵ The calculation of the joint effect of remittances and the composite index for financial development is shown in Appendix 46 and follows the method as outlined by Asomani et al. (2019) and Sobiech (2015).

financial development index by Svirydzienka (2016) on economic growth in Ghana to be positive and significant at 10%. Furthermore, the magnitude of the effect in their study was 0.3%, which is very close to this study's 0.33%.

In the short-run, when the interaction term is not included in the Solow (1957) model²⁶, LCI has a negative, however insignificant effect on LGDP, while LREMIT has a positive and significant effect on LGDP. The finding on LCI is corroborated by Alagidede and Ibrahim (2020), who find that financial development does not significantly affect economic growth, and by Adenutsi (2011), who finds that financial development has a negative effect on economic growth in the short-run. Adenutsi (2011) also finds, like this study, that remittances have a positive and significant effect on growth in the short-run in Ghana.

When the interaction term is included in the Solow (1957) model, as shown in Model 10 in Table 4.2, individually, LREMIT and the LCI both have positive and significant effects on LGDP in the short-run. Asomani et al. (2019) also find that the individual effects of remittances and financial development on economic growth are positive and significant in the short-run. This study finds that LREMIT and LCI have a positive joint effect of 0.18%²⁷ on LGDP in the short-run, *ceteris paribus*, which is significant at 1%. This finding is contrary to that of Asomani et al. (2019), who finds that in the short-run, the joint effect of remittances and financial development is negative and significant at 5%. The diagnostic tests for these regressions show that there is no serial-autocorrelation or heteroscedasticity and that the model is structurally stable.²⁸ The R-squared value suggests that the variables explain 93% of the variation in GDP in the model. When the model is further augmented with FINLIB and OIL, its effects on LGDP are insignificant both in the long- and short-run²⁹.

In most cases, except for Models 6, 7, and 9 in Table 3, LPOPG has a positive and significant effect on LGDP in the long-run at 1%, which is in line with economic theory (Adu, Marbuah & Mensah, 2013). However, in most cases, except for Models 9 and 10, LGFCF has negative and significant effects on LGDP in the short-run at 1%, which is contrary to what is expected based on economic theory (Solow, 1956; Barro, 1989).

²⁶ Full results are available in Appendix 46.

²⁷ The calculation of the joint effect of remittances and the composite index for financial development is shown in Appendix 46 and follows the method as outlined by Asomani et al. (2019) and Sobiech (2015).

²⁸ Full results are shown in Appendix 46.

²⁹ Full results are shown in Appendix 48 and 50, respectively.

In most cases, except for in Models 1, 7, and 10 in Tables 4.1 and 4.2, in the short-run, LPOPG has a positive effect on LGDP, which is expected based on economic theory (Solow, 1956; Barro, 1989). However, unlike economic theory, in all models except for Model 9, LGFCF negatively affects LGDP. Baidoo and Duodu (2020) also find that Ghana's LGFCF has a negative economic growth in the short-run.

5.4 Discussion

This sub-section provides a comprehensive qualitative and economic analysis of the econometric results provided for each financial development proxy and control variable in Section 5.3.

Overall, the results show that in Ghana, the effect of financial development on economic growth is very much dependent on the financial development proxy employed, and this is echoed by Adu et al. (2013), Alagidede and Ibrahim (2018), and Prah and Quartey (2008).

In general, Section 5.3 shows that alone, domestic credit to the private sector by banks does not have a significant long-run effect on economic growth. This may suggest that the banking sector is not efficient in performing at least two of the five functions that financial intermediaries are known to perform (Beck, Levine & Loayza, 2000c; Levine, 2005), namely, investing and allocating capital and pooling savings which, if functioning well, would likely have a positive impact on economic growth. M2 money supply is a proxy that causes division in the Ghanaian literature, and this study finds that M2 money supply has a negative effect on economic growth which is corroborated by Adu et al. (2013) but contrary to Nkrumah and Sackey (2012), who find that M2 money supply has a positive effect on economic growth in Ghana. The domestic credit and M2 money supply results suggest that the banking sector is generally not strong enough to influence economic growth.

The existence of a relationship between gross domestic savings, as a proxy for the stock market, and economic growth is uncertain as it is negative in most cases and positive in others. More specifically, gross domestic savings positively affect economic growth in Ghana both in the long- and short-run when financial liberalisation is considered. The lack of a positive relationship could be because the GSE is not active enough to have a particular relationship with economic growth. As mentioned in Chapter 4, although the GSE has been operating since

1990, data on the value of stocks traded was only available from 1993 – 2003. This is surprising given that Ghana's average value of gross domestic savings as a percentage of GDP is the same as what Hassan et al. (2011) find in their study of Sub-Saharan African countries. They, however, find that gross domestic savings have a positive and, in most cases, significant effect on economic growth.

Finally, the results indicate that the overall Ghanaian financial system alone does not have a material impact on economic growth in the long- and short-run. As noted earlier in the Chapter, Ghana's average composite financial development index is significantly lower than the average for Sub-Saharan Africa (Svirydzenka, 2016), which may suggest that Ghana's financial system is not yet developed enough to have an impact on economic growth. This finding is similar to Alagidede and Ibrahim's (2018) finding that financial development does not influence short-run economic growth. The above findings are contrary to Asomani et al. (2019), who find that financial development has a positive effect on economic growth in both long- and short-run, although it is insignificant in the short-run. Overall, the empirical evidence from this study shows that neither the 'demand-following' nor 'supply-leading' hypotheses hold in Ghana.

The results show that remittances have a negative and insignificant effect on economic growth in the long-run and a positive and significant effect on economic growth in the short-run. This is similar to the findings of Adjei et al. (2020) and Asomani et al. (2019), who find that remittances alone have a negative and positive effect on economic growth in the long- and short-run, respectively. This suggests that remittances are used for consumption as opposed to investment and therefore supports the 'dependency view', which argues that foreign capital inflows could crowd out the domestic market and domestic production and therefore have a detrimental impact on the economic growth of recipient countries (Yaseen, 2012; Adarkwa, 2015). This, however, is contrary to the picture painted by the BoG, who argued the importance and positive effect of remittances on economic growth. They stated that remittances influenced economic policies and strengthened the economic fundamentals during the implementation of the SAP. Most remittance inflows were used for agriculture, business creation, housebuilding, purchasing housing, consumer goods, health, and education (Karley, 2011). A large limitation of this study was the inability to include a variable capturing the quality of institutions in the results due to inefficient data. The literature notes that this is an important explanatory variable for Sub-Saharan African countries and Ghana in providing more clarity on the relationship between remittances and economic growth.

The joint effect of domestic credit to the private sector by banks and remittances on economic growth in Ghana is positive and significant both in the long- and short-run, and the joint effect of M2 money supply and remittances on economic growth in Ghana is positive in the long-run and negative in the short-run, and both results are significant. These results suggest that when remittances pass through the banking sector, the outcome is positive economic growth. This study, therefore, supports the conclusion by Adenutsi (2011) that financial development is important for mobilising remittance inflows into Ghana, which supports the theory put forward by Asomani et al. (2019) that remittances can spur growth through increased access to credit for the recipients who then use the funds to develop small-to-medium enterprises.

The joint effect of the stock market and remittances on economic growth is negative and significant both in the long- and short-run. This study posits that this is because there is insufficient activity and liquidity in the stock market; therefore, remittance senders do not see the stock market as a viable investment option or way to send money back to Ghana. This result is contrary to what Alagidede and Ibrahim (2020) suggest as they argue that while the Ghanaian financial system is still largely bank based, the overall financial system has developed to the point where firms can raise funds through the capital market, which then provides another way for people to save. The results, therefore, suggest that remittances will have the most beneficial impact on economic growth if they pass through the banking sector as opposed to the financial market.

The joint effect of composite index and remittances on economic growth is positive and significant both in the long and short-run, which is the same as the findings of Asomani et al. (2019). This may indicate that the financial system and its development are important factors in ensuring that remittance inflows reach the intended household and positively impact economic growth. It, therefore, stands to reason that improvements in the financial system will increase remittance inflows via the financial system, which will positively impact economic growth.

Population growth as a proxy for labour was often found to have a positive and significant effect on economic growth. This result was expected as it aligns with neoclassical economic theory (Solow, 1956). Gross fixed capital formation, however, tended to show a negative and statistically significant relationship with economic growth which is unexpected as it is contrary to economic theory. This negative relationship is particularly strong when remittances were

included in regressions as opposed to any other scenario, which again suggests that most remittance inflows are used for consumption as opposed to investment.

Empirically, the effects of financial liberalisation have mixed effects on economic growth and seem to be sensitive to the financial development proxy employed. This may suggest that the SAP and ERP reform programs were only successful in certain parts of the financial system, such as restructuring the banking sector in such a way that, in the presence of financial liberalisation, remittance inflows can be used to increase domestic credit to the private sector by banks which will have a positive impact on the economy. The 1973 oil price boom seems to have had a positive and significant effect on the Ghanaian economy, both in the short and long-run, irrespective of the financial development proxy employed. This result is contrary to what is expected given that, as discussed in Chapter 3, emigration to Nigeria during this period was high due to worsening economic and living conditions in Ghana. The effect of the GFC in almost all cases is positive and insignificant in the long-run and negative and significant in the short-run. Although insignificant, the long-run result is unexpected but may suggest that Ghana was not significantly impacted by the GFC, which is similar to Orzell's (2013) finding on developing countries. The short-run result is expected given that the global economy was in a downturn due to the Crisis (Agbélénko & Kibet, 2015). While the individual effects of these shocks are either mixed or positive, this study's finding is the same as Alagidede and Ibrahim (2018), which is that in the cases examined in Tables 3, 4.1, and 4.2, economic shocks tend to have a negative effect on the composite financial development proxy which represents the overall economy.

Chapter 6: Summary and Conclusions

This study examines the relationship between financial development, remittances and economic growth in Ghana from 1979 – 2020, using various specifications of the Solow (1957) model and employing the ARDL approach to cointegration. Within this, the finance growth nexus and the relationship between remittances and economic growth are also examined. Chapter 1 introduced the study by outlining the various arguments regarding the relationship between remittances, financial development, and economic growth, Ghana's economic history, the motivation for the study and the model and method employed. The literature review in Chapter 2 provided the theoretical arguments and different empirical findings of studies considering developing countries, Sub-Saharan African countries, and Ghana. It also compared various models, methods and financial development proxies that are commonly used in the literature. The takeaway from this Chapter is that there are conflicting theories, different methods, and financial development proxies, all of which contribute to conflicting empirical findings. Ghana's political and economic history, migration patterns and resultant remittance inflows were discussed and analysed in Chapter 3. It established that the government spending and banking reforms implemented by the IMF and World Bank resulted in improvements in Ghana's macroeconomic performance indicators, although those living in urban areas during these reform programs faced large-scale retrenchment and poor living conditions. Chapter 4 outlined the model, data, and method employed, the conditions needed for these methods to be viable in the study, and the various diagnostic and post-estimation tests employed. The penultimate Chapter provided the descriptive statistics of the variables and analysed and discussed a selection of the results.

6.1 Conclusions and policy implications

Academic interest in remittances as a source of foreign capital inflow into developing countries is growing. Additionally, the magnitude of remittances compared to other sources of capital in Ghana is large and growing, which suggests that it is becoming a more important source of capital that needs to be well understood. Such understanding provides further guidance to

policymakers towards ideating and implementing policies around remittances which amplify its benefits to the economy while minimising its potential downsides. Therefore, this study aimed to make four contributions to the literature. The first is that this study considered a period of 42 years which is longer than previous Ghanaian studies in this field. The second was improving on the variables used in the literature in two ways; the first was by employing a financial development proxy for the stock market, which has not yet been considered in a study in Ghana, while the second was by employing the latest comprehensive financial development composite index by Svirydzenka (2016), which has only been previously employed by Asomani et al. (2019) and Alagidede and Ibrahim (2020). The third contribution was to provide a more comprehensive analysis of the relationship between financial development, remittances, and economic growth than previous studies by also analysing the finance growth nexus and the relationship between remittances and economic growth. The final contribution was to employ an advanced time series method, the ARDL approach to cointegration, which has not been used in previous studies due to insufficient data.

This study finds that for all the financial development proxies employed in Ghana, financial development does not impact economic growth and therefore does not support the ‘supply-leading’ hypothesis by Schumpeter (1934) or the ‘demand-following’ by Robinson (1952). The relationship between domestic credit and economic growth is insignificant, the relationship between M2 money supply and economic growth is negative, the relationship between gross domestic savings and economic growth is uncertain, and the relationship between overall financial development and economic growth is insignificant. The empirical evidence from this study shows that neither hypothesis applies to Ghana. This study also finds that remittances have a negative effect on economic growth. Therefore, this study concludes that remittances are used for consumption as opposed to investment which supports the ‘dependency view’ which argues that foreign capital inflows could crowd out the domestic market and domestic production and therefore have a detrimental impact on the economic growth of recipient countries (Yaseen, 2012; Adarkwa, 2015). Finally, financial liberalisation, the 1973 oil price boom and the 2008 GFC, when considered in the presence of a financial development proxy and remittances, have a negative effect on economic growth in Ghana.

Although the effects of financial development and remittances on economic growth are individually either non-existent or negative, their joint effect on economic growth is generally positive and significant, specifically when the remittances pass through the banking sector and negative when remittances pass through the financial sector via the stock exchange. Therefore,

this study concludes that when remittances pass through the banking sector, they are used by the recipient to increase their access to credit, which is then used to develop small-to-medium enterprises that positively contribute to economic growth.

Based on the above conclusions, policies regarding remittances must be considered within the context of financial development and not as a standalone source of capital if the policies are to use remittances to boost economic performance. This study, therefore, presents three policy implications and suggestions.

The first implication is that there needs to be greater efficiency in the banking sector which will make sending and receiving remittances faster and cheaper (Esso, 2010a; Lartey, 2013; Adarkwa, 2015). The second suggestion, which is complementary to the first, is that there need to be policies that will attract Ghanaians abroad to send money back to Ghana, such as more attractive interest rates or tax incentives (Adenutsi, 2011; Basnet, Donou-Adonsou & Pradhan, 2020). Furthermore, there must be an effort by government and monetary authorities to ensure that more remittance inflows flow through formal financial structures (Adenutsi, 2011; Baidoo & Duodu, 2020). However, policymakers must carefully minimise the likelihood of corruption in such a system (Adams & Klobodu, 2016; Baidoo & Duodu, 2020). This will allow for better recording of the value of remittance inflows into Ghana and will amplify the positive joint effect of remittances and financial development on economic growth. Finally, financial inclusion, pro-poor policies (Ahenkan et al., 2018; Acheampong et al., 2021) and the role of remittance service providers and other non-bank financial institutions should also be considered in policymaking, especially in areas where there is limited access to banks which can provide international services to ensure that the poor are not excluded from benefitting from remittances as they are often unable to easily access banking services (Nkrumah & Sackey, 2012).

6.2 Limitations and suggestions for future research

There are four limitations of this study. The first is that an institutional quality explanatory variable was not included in the analysis. The literature review in Chapter 2 highlighted the importance of such a variable for studies on African countries to clarify the relationship between remittances and economic growth and highlighted that this was present in very few

studies in this field on Ghana. However, due to data limitations, this was not included in the study. Thus, its effects could not be examined. The second is that data on informal remittance inflows is not available. Therefore, the true magnitude of the effect of remittances on economic growth has been underestimated in this study. This is, however, a common limitation of studies in this field (Sobiech, 2015; Asomani, Ofori & Peprah, 2019). The third limitation is that, while the ARDL approach to cointegration is the superior method, this study did not use other cointegration methods, such as the Johansen (1988) technique to conduct robustness tests on the results. The final limitation is that due to data limitations, the study could not use a more direct proxy, such as the value of stocks traded for the stock market, rather than gross domestic savings.

Based on the above limitations, this study suggests the following for future research. First, future studies on this topic should include the effect of the quality of institutions once sufficient data is available to the point where the chosen model and method will produce reliable results. Second, a revisit of the effect of stock markets on economic growth in Ghana is warranted if a direct proxy, more observations, or a better data source becomes available. Finally, when the ARDL approach to cointegration is used to measure the relationship between financial development, remittances, and economic growth, other cointegration methods should be employed as robustness checks to add credibility to the study's results.

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Appendices

Appendix 1. Solow (1957) model derivation and specification

The Solow Growth model for economic growth is derived from the per capita Cobb-Douglas production function which is as follows:

$$Y_t = AK_t^\alpha L_t^{1-\alpha} \quad (1)$$

Where:

Y_t : Gross domestic product

A : Stock of technology

K_t : Capital stock

L_t : Labour stock

α : Output elasticity of capital

$1 - \alpha$: Output elasticity of labour

The per capita equivalent is then derived through a Hicks-Neutral change and assuming constant returns (Choong, Jayaraman & Kumar, 2011) which results in the following:

$$y_t = Ak^\alpha \quad (2)$$

Where:

y_t : Gross domestic product per capita

A : Stock of technology

k_t : Capital stock per capita

α : Output elasticity of capital, $0 < \alpha < 1$

The Solow Growth model assumes that the stock of technology evolves in the following manner:

$$A_T = A_0 e^{gT} \quad (3)$$

Where:

A_0 : The initial stock of technology

g : The steady state of growth

T : Time

The stock of technology can then be described as the following according to Choong et al. (2011), Abdul-Mumuni and Quaidoo (2016), and Giri and Sehwat (2015):

$$A_T = f(T, \beta_0 REMIT^{\beta_1}, FD^{\beta_2}, GFCF^{\beta_3}) \quad (4)$$

Where:

A_T : Stock of technology

T : Time

$REMIT$: Remittance inflows

FD : Financial sector development proxy

$GFCF$: Gross fixed capital formation

$\beta_1 - \beta_3$: Output elasticities of coefficients

In this study, FD is represented by four different proxies, namely domestic credit to the private sector by banks, M2 money supply, gross domestic savings, and a composite financial development index. Each proxy will be estimated in a separate model. The model will be measured and analysed at a per capita level in natural logs to ensure reliable econometric outputs. Following Diabah et al. (2017) and Abdul-Mumuni and Quaidoo (2016), the final model specification is therefore:

$$LGDP = \beta_0 + \beta_1 LREMIT + \beta_2 LFD + \beta_3 LFD * LREMIT + \beta_4 LGFCF + \beta_5 LPOPG + TREND \quad (5)$$

Where:

$LGDP$: Log of GDP per capita in constant US\$ 2005 prices

$LREMIT$: Log of remittances received as a percentage of GDP

LFD : Log of financial development proxied by:

$LDCPS$: Log of domestic credit provided to the private sector by banks as a percentage of GDP

LM2: Log of M2 money supply as a percentage of GDP

LGDS: Log of gross domestic savings as a percentage of GDP

LCI: Log of composite financial sector development index by Svirydzenka (2016)

*LFD * LREMIT*: Interaction term of LREMIT received and LFD

LGFCF: Log of gross fixed capital formation as a percentage of GDP

LPOPG: Log of population growth

TREND: Time trend

Appendix 2. Unit Root Test results using ADF (results include an intercept and a trend)

Variables	Test statistic	Critical value	Result
Logged variables			
LGDP	-1.8678	-3.5386	Non-stationary or contains a unit root
LREMIT	-2.5149	-3.5286	Non-stationary or contains a unit root
LDCPS	-0.58025	-3.5386	Non-stationary or contains a unit root
LM2	-2.2795	-3.5386	Non-stationary or contains a unit root
LGDS	-4.5853	-3.6331	Stationary and no unit root
LCI	-4.7325	-3.5386	Stationary and no unit root
LPOPG	-1.1394	-3.5426	Non-stationary or contains a unit root
LGFCF	-1.2709	-3.5386	Non-stationary or contains a unit root
LFDI	-1.5679	-3.5426	Non-stationary or contains a unit root
LTOT	-2.3152	-3.5286	Non-stationary or contains a unit root
LREMIT*LDCPS	-3.4874	-3.5386	Non-stationary or contains a unit root
LREMIT*LM2	-4.4315	-3.5386	Stationary or contains no unit root
LREMIT*LGDS	-4.7693	-3.6331	Stationary or contains no unit root
LREMIT*CI	-1.7817	-3.5386	Non-stationary or contains a unit root
First difference of logged variables			
DLGDP	-3.3424	-3.5426	I(1) at 10% significance
DLREMIT	-8.0292	-3.5426	I(1) at 5% significance
DLDCPS	-6.8735	-3.5426	I(1) at 5% significance
DLM2	-6.4375	-3.5426	I(1) at 5% significance
DLGDS	-4.3341	-3.6454	Stationary
DLCI	-7.1396	-3.5426	Stationary
DLPOPG	-3.2432	-3.5468	I(1) at 10% significance
DLGFCF	-7.2175	-3.5426	I(1) at 5% significance
DLFDI	-5.5722	-3.5468	I(1) at 5% significance

DLTOT	-5.4884	-3.5426	I(1) at 5% significance
LREMIT*LDCPS	-5.9935	-3.5426	I(1) at 5% significance
LREMIT*LM2	-4.9340	-3.5426	Stationary
LREMIT*LGDS	-3.5514	-3.6454	Stationary
LREMIT*LCI	-4.8367	-3.5426	I(1) at 5% significance

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is classified as stationary or having no unit roots if the absolute value of the test statistic is greater than the absolute value of the critical value. A first differenced variable is classified as stationary or integrated of order one (I(1)) if the absolute value of the test statistic is greater than the absolute value of the critical value. The dummy variables are level variables, and first differences of these variables are not taken. OIL is a dummy variable that represents the 1973 oil boom and takes on values for the years 1975 – 1985. FINLIB is a dummy variable that represents the time in which the government received loans from the IMF and World Bank and had to implement structural changes to the economy and financial sector and financial liberalisation as a result. This variable takes on values for the years 1988 – 2000. GFC08 is a dummy variable which represents the 2008 Global Financial Crisis and takes on values for the years 2009 – 2016.

Appendix 3. Full Results of Short-Run Estimates of GDP per Capita

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
	LDCPS & OIL ARDL (1,3,4,1,4)	LGDS only ARDL (4,2,4,4)	LCI & GFC08 ARDL (1,0,0,0,4)	LREMI T only ARDL (4,4,0,0)	LREIT & FINLIB ARDL (4,4,3,0, 3)	LREMIT, LDCPS & Interactio n Term ARDL (1,3,0,0,0, 0)	LREMIT , LDCPS, Interactio n Term & FINLIB ARDL (4,4,4,3,4 ,4,4)	LREMIT , LM2 & Interactio n Term ARDL (4,4,3,4,3 ,4)	LREMIT, LGDS & Interaction Term ARDL (2,0,1,0,0,0)	LREMIT , LCI & Interactio n Term ARDL (4,1,4,4,4 ,2)
dLREMIT				0.02** (0.01)	0.03*** (0.00)	-0.02* (0.01)	-0.04*** (0.03)	0.19** (0.07)	0.03** (0.01)	0.17*** (0.04)
dLREMIT1				0.02* (0.10)	0.02** (0.01)	0.02*** (0.01)	0.23*** (0.03)	0.01 (0.06)		
dLREMIT2				0.02*** (0.06)	0.03*** (0.01)	0.01*** (0.00)	0.12*** (0.02)	0.04 (0.05)		
dLREMIT3				0.01* (0.01)			0.02*** (0.01)	-0.04* (0.02)		
dLDCPS	-0.10*** (0.03)					-0.01 (0.02)	0.01 (0.02)			
dLDCPS1	-0.08*** (0.02)					0.02*** (0.01)	-0.00 (0.03)			
dLDCPS2	-0.06*** (0.02)						-0.06** (0.02)			
dLDCPS3							0.03** (0.01)			
dLREMIT*LDCPS						0.02*** (0.01)	0.02 (0.01)			
dLREMIT*LDCPS1							-0.07*** (0.02)			
dLREMIT*LDCPS2							-0.03*** (0.01)			
dLM2								-0.10*** (0.03)		
dLM21								0.20*** (0.06)		
dLM22								0.05 (0.04)		
dLREMIT*LM2								-0.04* (0.02)		
dLREMIT*LM21								-0.00 (0.02)		
dLREMIT*LM22								-0.01 (0.02)		
dLREMIT*LM23								0.02** (0.00)		
dLGDS		-0.01 (0.00)							-0.03** (0.01)	
dLGDS1		0.01* (0.01)								
dLREMIT*LGDS									-0.02** (0.01)	
dLCI			-0.00 (0.01)							0.32*** (0.04)
dLCI1										-0.07***

dLCI2										(0.07)
										-0.03*
dLCI3										(0.01)
										0.02*
dLREMIT*LCI										(0.01)
										0.09***
dLREMIT*LCI1										(0.02)
										-0.02***
dLREMIT*LCI2										(0.00)
										-0.01***
dLREMIT*LCI3										(0.00)
										-0.01***
dLPOPG	-9.05**	12.00***	1.08***	0.42	0.15	0.40	-	10.87	0.41	-23.59**
							13.35***			
	(3.57)	(2.68)	(0.28)	(0.41)	(2.88)	(0.38)	(2.96)	(6.72)	(0.26)	(8.05)
dLPOPG1	20.44**	-10.39**			4.21		38.91***	-18.73*		14.22
	(5.93)	(3.28)			(4.70)		(8.26)	(9.54)		(10.75)
dLPOPG2	-24.92***	-4.22			-5.14*		-	10.87**		21.60**
							45.58***			
	(5.86)	(2.44)			(2.86)		(9.22)	(4.63)		(8.36)
dLPOPG3	6.07*	1.57					18.77***			-
										18.00***
	(3.17)	(0.83)					(4.62)			(4.72)
dLGFCF	-0.20**	-0.00	-0.04**	-0.02	-0.02	-0.02	-0.06***	-0.04	0.00	-0.03
	(0.07)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
dLGFCF1		0.13**					0.12**	0.04		-0.14***
		(0.01)					(0.05)	(0.03)		(0.04)
dLGFCF2		0.08**					0.11**	-0.00		
		(0.03)					(0.04)	(0.02)		
dLGFCF3		0.03**					0.07**	-0.02		
		(0.01)					(0.02)	(0.01)		
dLFINLIB					-0.03*		-0.02			
					(0.02)		(0.02)			
dLFINLIB1					0.06**		-0.19**			
					(0.02)		(0.06)			
dLFINLIB2					-0.04*		-0.20***			
					(0.02)		(0.02)			
dLFINLIB3							0.05**			
							(0.02)			
dOIL	0.10***									
	(0.03)									
dOIL1	-0.01									
	(0.04)									
dOIL2	0.04*									
	(0.02)									
dOIL3	-0.08***									
	(0.02)									
dGFC08			-0.01							
			(0.02)							
dGFC081			-0.18***							
			(0.03)							
dGFC082			-0.12***							
			(0.02)							
dGFC083			-0.05***							
			(0.02)							
dTREND	0.02**	0.03**	0.01***	0.01***	0.02***	0.01***	0.04***	0.04	0.01***	0.01***
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.03)	(0.00)	(0.00)
ecm(-1)	-0.63***	-0.93*	-0.27***	-0.15**	-0.35**	-0.33***	-1.00***	-1.53***	-0.50***	-0.90***
	(0.17)	(0.42)	(0.07)	(0.07)	(0.12)	(0.09)	(0.26)	(0.34)	(0.08)	(0.17)

R ²	0.80	0.96	1.00	0.65	1.00	0.60	1.00	0.95	0.92	0.93
R bar squared	0.57	0.77	1.00	0.47	1.00	0.44	0.98	0.79	0.87	0.77
DW Statistic	2.68	1.95	1.92	2.18	2.79	2.24	3.09	2.20	2.39	2.45

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). Standard errors are shown in brackets below coefficients. Coefficients and standard errors are shown to 2 decimal places. A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Appendix 4. Solow Model Augmented with LDCPS

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	2.4836	4.5479	5.7255	3.7905	4.8358	H ₀ cannot be rejected at 5% and 10% significance.
W	9.9346	18.1918	22.9018	15.1620	19.3430	H ₀ cannot be rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	22.2850	12.7372	0.090*
TREND	0.047395	0.012933	0.001***
LDCPS	0.0072461	0.16595	0.965
LPOPG	6.3736	5.1598	0.226
LGFCF	-0.19429	0.18588	0.304

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLDCPS	0.9118E-3	0.020492	0.965
dLPOPG	0.80204	0.36833	0.037
dLGFCF	-0.024449	0.021542	0.265
dTREND	0.0059641	0.0031497	0.068*
ecm(-1)	-0.12584	0.089559	0.170
R ²	0.21291		
R bar squared	0.085958		
DW statistic	1.2965		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

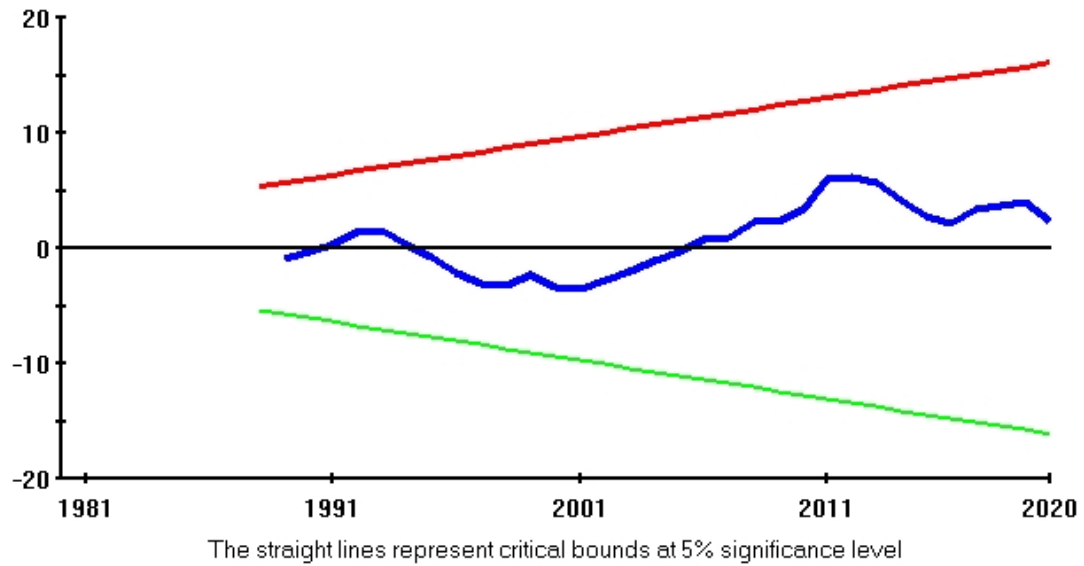
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	1.0441	0.307	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.81931	0.373	No serial-autocorrelation present
Heteroscedasticity: LM version	1.9397	0.164	No heteroscedasticity present
Heteroscedasticity: F version	1.9365	0.173	No heteroscedasticity present

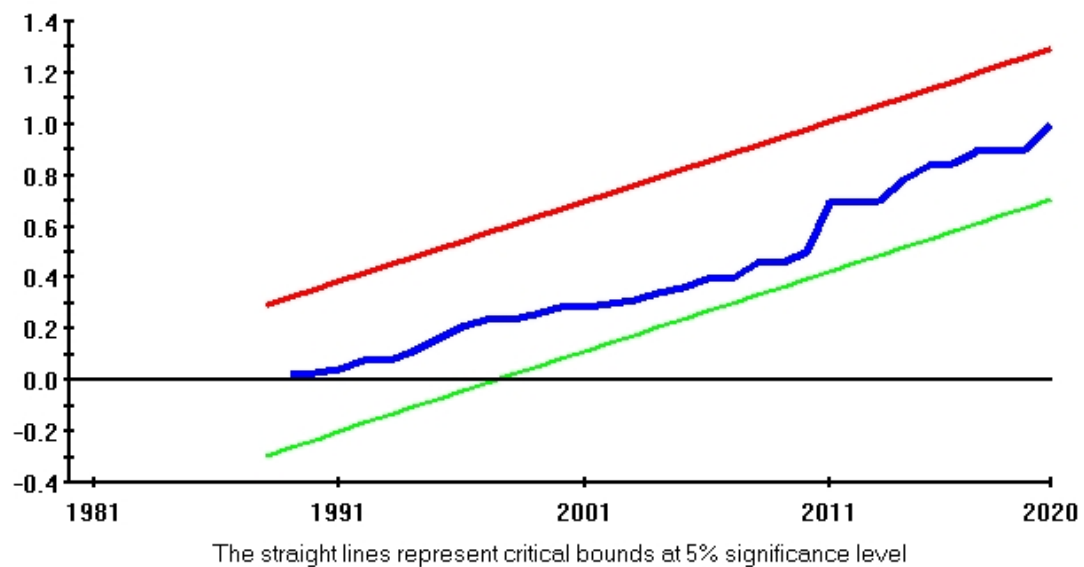
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

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Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 5. Solow Model Augmented with LDCPS and Financial Liberalisation

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	3.1039	4.0405	5.3296	3.3660	4.4809	H ₀ cannot be rejected at 5% and 10% significance.
W	15.5196	20.2025	26.6482	16.8298	22.4044	H ₀ cannot be rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (2,3,4,0,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	4.5950	3.5370	0.210
TREND	0.023922	0.0070990	0.003**
LDCPS	0.098912	0.13201	0.463
LPOPG	-0.59689	1.4024	0.675
LGFCF	-0.18435	0.085299	0.044**
FINLIB	-0.078682	0.085172	0.368

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (2,3,4,0,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
dLDCPS	-0.021518	0.021300	0.324
dLDCPS1	-0.013067	0.023978	0.592
dLDCPS2	-0.069876	0.021748	0.004***
dLPOPG	-10.8112	3.3201	0.004***
dLPOPG1	22.6391	6.2289	0.002***

dLPOPG2	-22.4883	5.5782	0.001***
dLPOPG3	9.8528	2.3274	0.000***
dLGFCF	-0.049803	0.019010	0.016**
dFINLIB	-0.0022109	0.016107	0.892
dFINLIB1	0.082635	0.020914	0.001***
dFINLIB2	0.017005	0.024793	0.500
dFINLIB3	0.093901	0.026916	0.002***
dTREND	0.0064628	0.0039931	0.120
ecm(-1)	-0.27016	0.10264	0.016**
R ²	0.77295		
R bar squared	0.54591		
DW statistic	2.0914		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

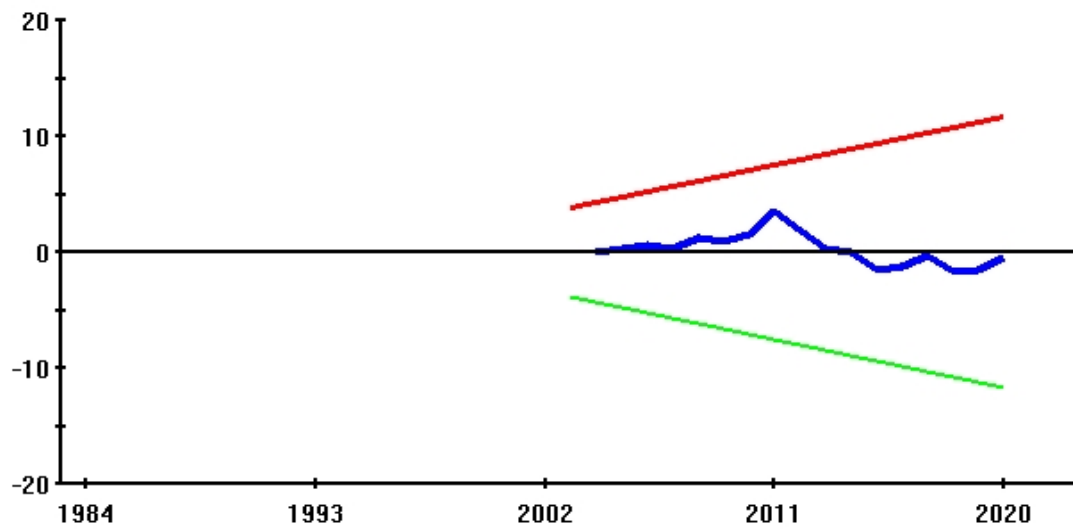
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.27967	0.597	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.12948	0.723	No serial-autocorrelation present
Heteroscedasticity: LM version	0.37866	0.538	No heteroscedasticity present
Heteroscedasticity: F version	0.36235	0.551	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

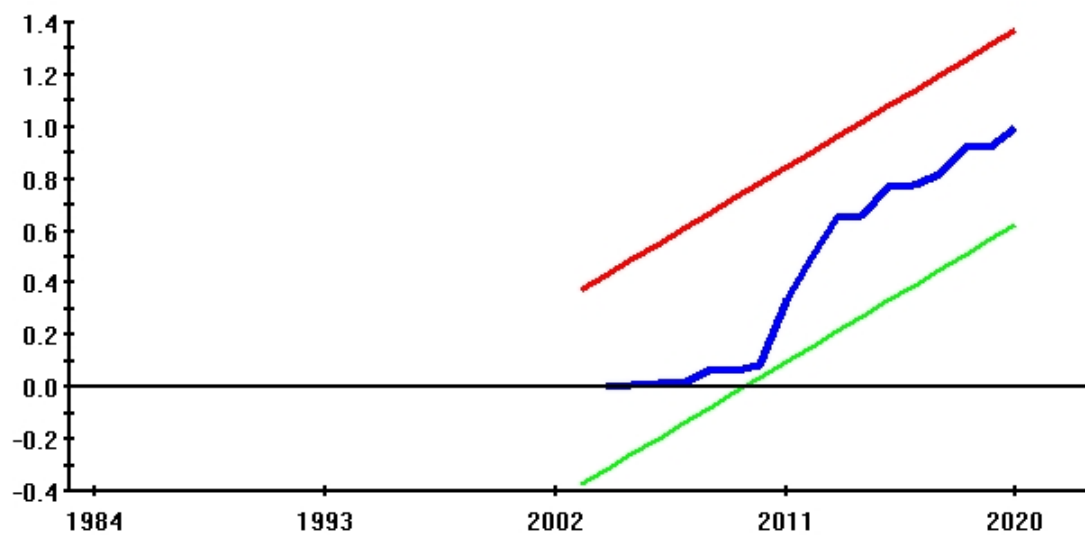
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 6. Solow Model Augmented with LDCPS and 1973 Oil Price Boom

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	7.8929	4.0405	5.3296	3.3660	4.4809	H ₀ is rejected at 5% and 10% significance.
W	39.4465	20.2025	26.6482	16.8298	22.4044	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,3,4,1,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	16.8310	1.9339	0.000***
TREND	0.037243	0.0023737	0.000***
LDCPS	0.023929	0.047532	0.621
LPOPG	4.0963	0.77242	0.000***
LGFCF	-0.59868	0.15862	0.002***
OIL	0.45471	0.077742	0.000***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,3,4,1,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLDCPS	-0.10137	0.027640	0.001***
dLDCPS1	-0.081145	0.021598	0.001***
dLDCPS2	-0.059876	0.020540	0.008***
dLPOPG	-9.0517	3.5738	0.019**
dLPOPG1	20.4430	5.9343	0.002***
dLPOPG2	-24.9219	5.8625	0.000***
dLPOPG3	6.0746	3.1715	0.069*

dLGFCF	-0.20249	0.071461	0.010**
dOIL	0.095115	0.031484	0.007***
dOIL1	-0.0089803	0.039094	0.820
dOIL2	0.041129	0.022125	0.076*
dOIL3	-0.082303	0.023592	0.002***
dTREND	0.023633	0.0068391	0.011**
ecm(-1)	-0.63456	0.16887	0.004***
R ²	0.79848		
R bar squared	0.57326		
DW statistic	2.6849		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

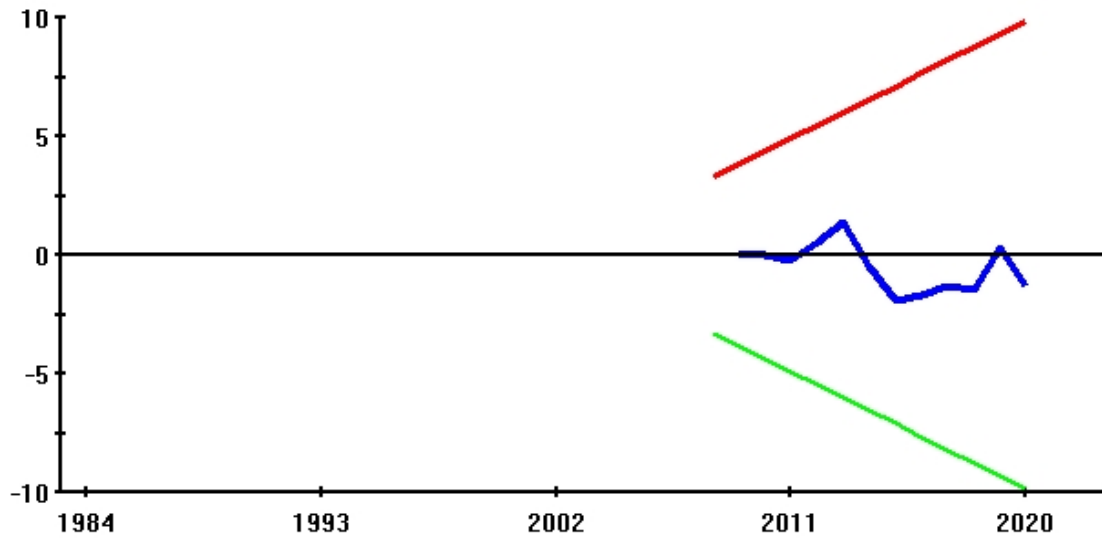
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.48920	0.484	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.36517	0.551	No serial-autocorrelation present
Heteroscedasticity: LM version	1.0004	0.317	No heteroscedasticity present
Heteroscedasticity: F version	0.97333	0.330	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

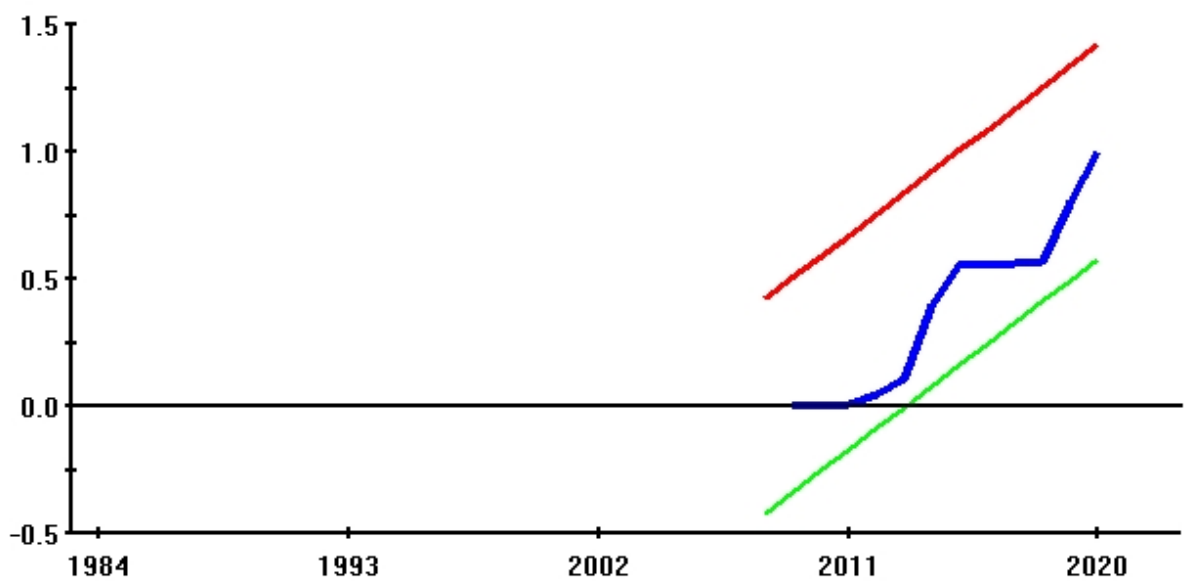
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 7. Solow Model Augmented with LDCPS and the 2008 Global Financial Crisis

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	5.8500	4.0405	5.3296	3.3660	4.4809	H ₀ is rejected at 5% and 10% significance.
W	29.2499	20.2025	26.6482	16.8298	22.4044	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,1,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
CONS	16.0917	3.1597	0.000***
TREND	0.037880	0.0028583	0.000***
LDCPS	-0.023667	0.051010	0.647
LPOPG	3.7171	1.2518	0.006***
LGFCF	-0.84989	0.25710	0.003***
GFC08	0.58829	0.21655	0.012**

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,1,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLDCPS	-0.0029959	0.014152	0.834
dLPOPG	1.0498	0.31752	0.003***
dLGFCF	-0.035225	0.015840	0.035**
dGFC08	-0.010244	0.015463	0.513
dGFC081	-0.18366	0.028238	0.000***
dGFC082	-0.11745	0.024633	0.000***
dGFC083	-0.054359	0.016592	0.003***

dTREND	0.010100	0.0024362	0.000***
ecm(-1)	-0.27426	0.070389	0.001***
R ²	0.74274		
R bar squared	0.62955		
DW statistic	1.8886		

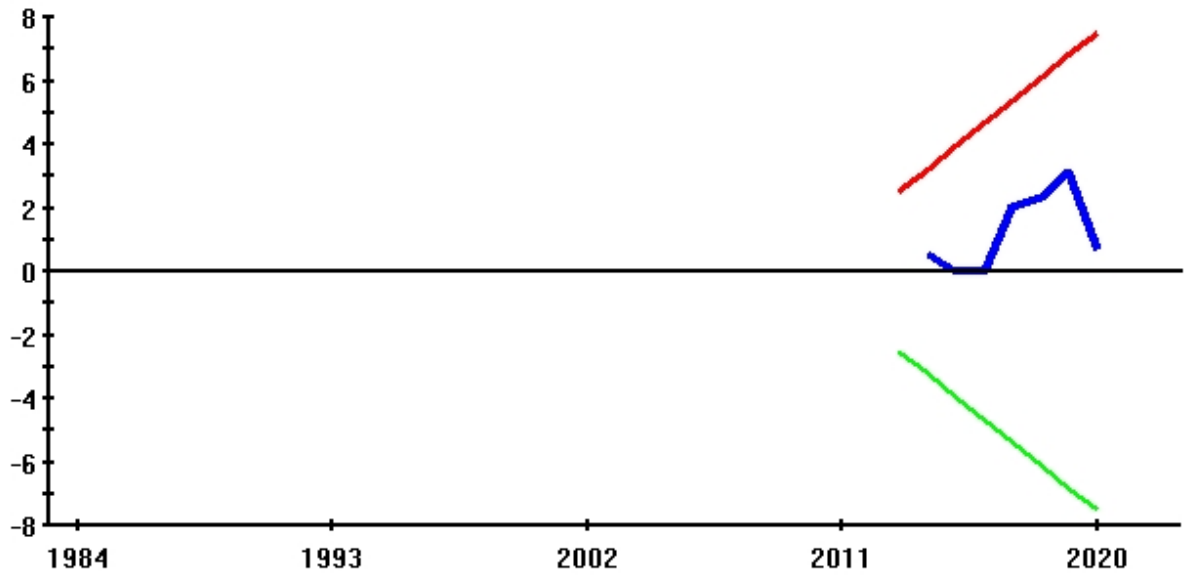
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.03548	0.851	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.023040	0.881	No serial-autocorrelation present
Heteroscedasticity: LM version	2.5458	0.111	No heteroscedasticity present
Heteroscedasticity: F version	2.5862	0.117	No heteroscedasticity present

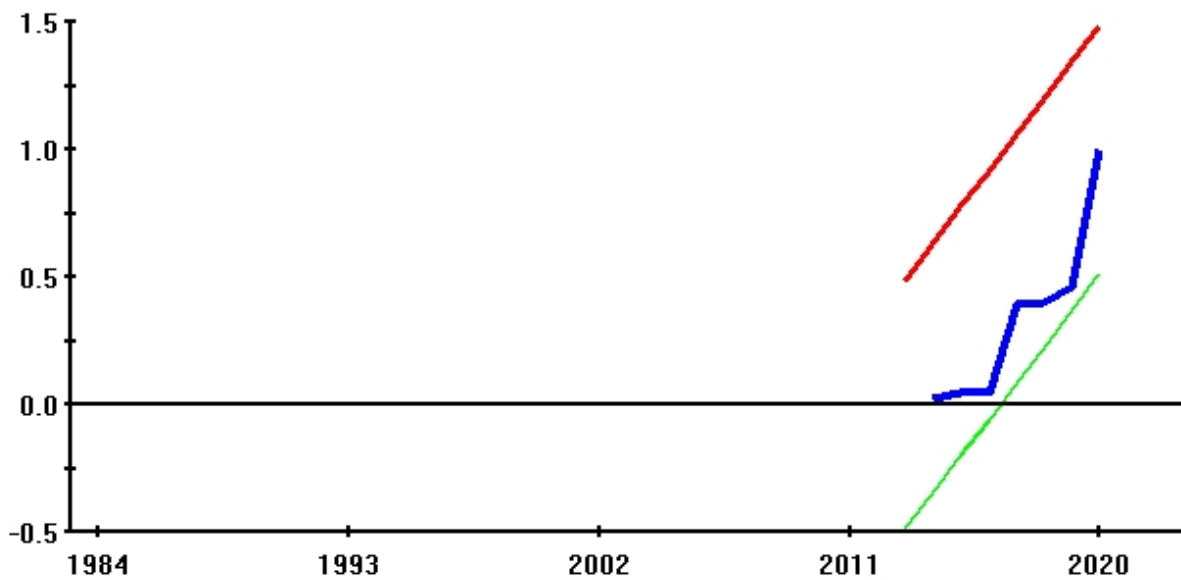
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 8. Solow Model Augmented with LM2

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	2.6308	4.5479	5.7255	3.7905	4.8358	H ₀ cannot be rejected at 5% and 10% significance.
W	10.5232	18.1918	22.9018	15.1620	19.3430	

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	15.4558	6.4937	0.024***
TREND	0.041883	0.0076818	0.000***
LM2	-0.17069	0.14271	0.241
LPOPG	3.4429	2.6889	0.210
LGFCF	-0.10784	0.10134	0.295

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLM2	-0.032439	0.035941	0.374
dLPOPG	0.65432	0.37365	0.090*
dLGFCF	-0.020495	0.020152	0.317
dTREND	0.0079599	0.0031927	0.018**
ecm(-1)	-0.19005	0.098842	0.064*
R ²	0.23301		
R bar squared	0.10931		
DW statistic	2.0796		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

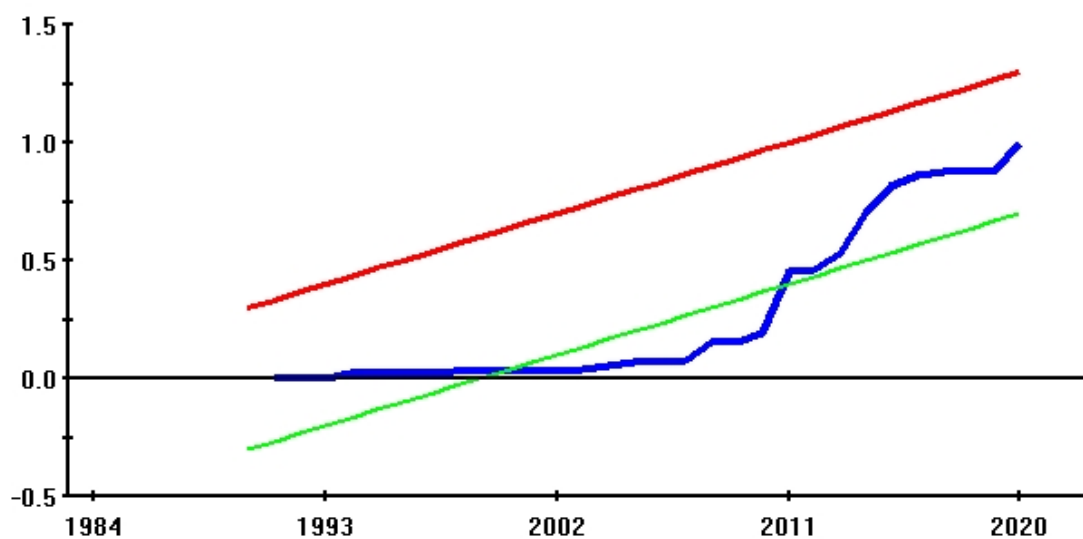
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.11169	0.738	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.10612	0.746	No serial-autocorrelation present
Heteroscedasticity: LM version	3.7474	0.053	No heteroscedasticity present
Heteroscedasticity: F version	3.9443	0.055	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

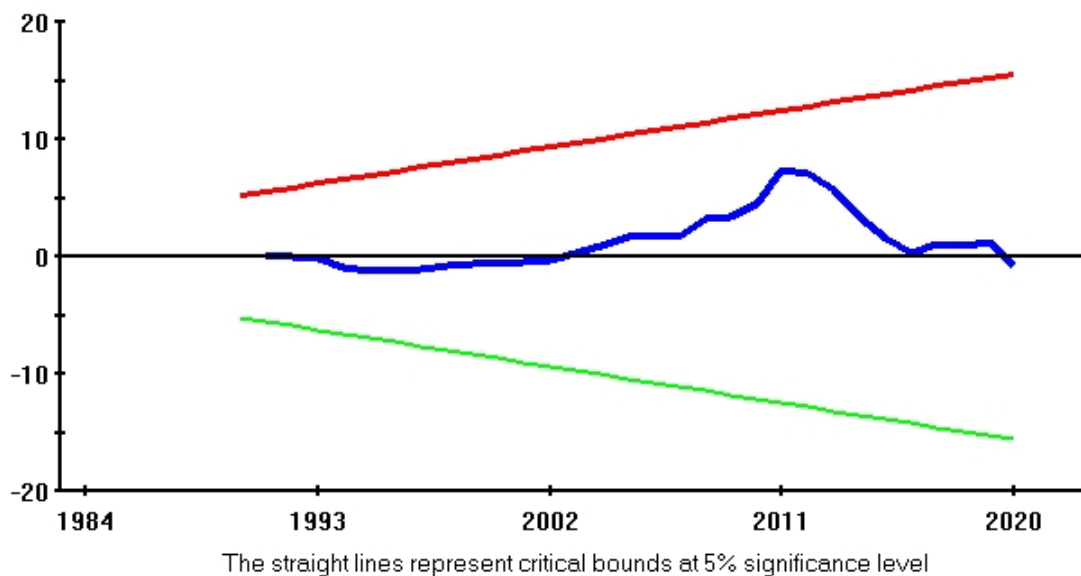
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Recursive Residuals



Appendix 9. Solow Model Augmented with LM2 and Financial Liberalisation

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	2.0492	4.0405	5.3296	3.3660	4.4809	H ₀ cannot be rejected at 5% and 10% significance.
W	10.2461	20.2025	26.6482	16.8298	22.4044	H ₀ cannot be rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0,0) approach to cointegration			
Variable	Coefficient	Standard error	P-value
CONS	15.2936	6.5102	0.026**
TREND	0.041675	0.0077047	0.000***
LM2	-0.16645	0.14565	0.262
LPOPG	3.3786	2.6946	0.220
LGFCF	-0.10345	0.10433	0.329
FINLIB	-0.0097786	0.058893	0.869

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,0,0) approach to cointegration			
Variable	Coefficient	Standard error	P-value
dLM2	-0.032134	0.036566	0.386
dLPOPG	0.65226	0.37986	0.096*
dLGFCF	-0.019972	0.020723	0.343
dFINLIB	-0.0018879	0.011507	0.871
dTREND	0.0080457	0.0032859	0.020**
ecm(-1)	-0.19306	0.10209	0.068*
R ²	0.23370		
R bar squared	.080441		
DW statistic	2.0762		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

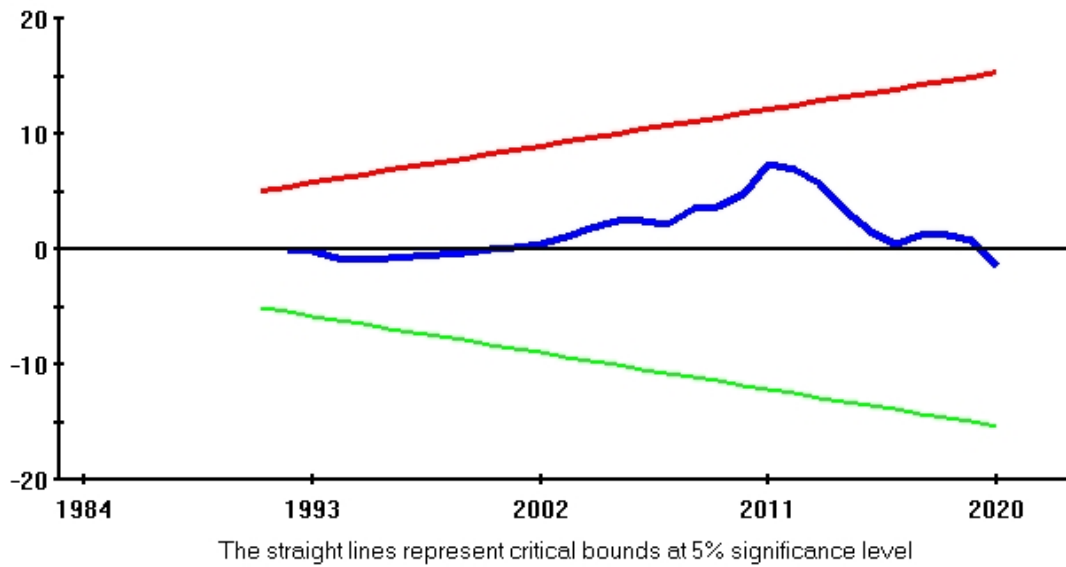
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.90212	0.342	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.70520	0.408	No serial-autocorrelation present
Heteroscedasticity: LM version	0.12374	0.725	No heteroscedasticity present
Heteroscedasticity: F version	0.11761	0.734	No heteroscedasticity present

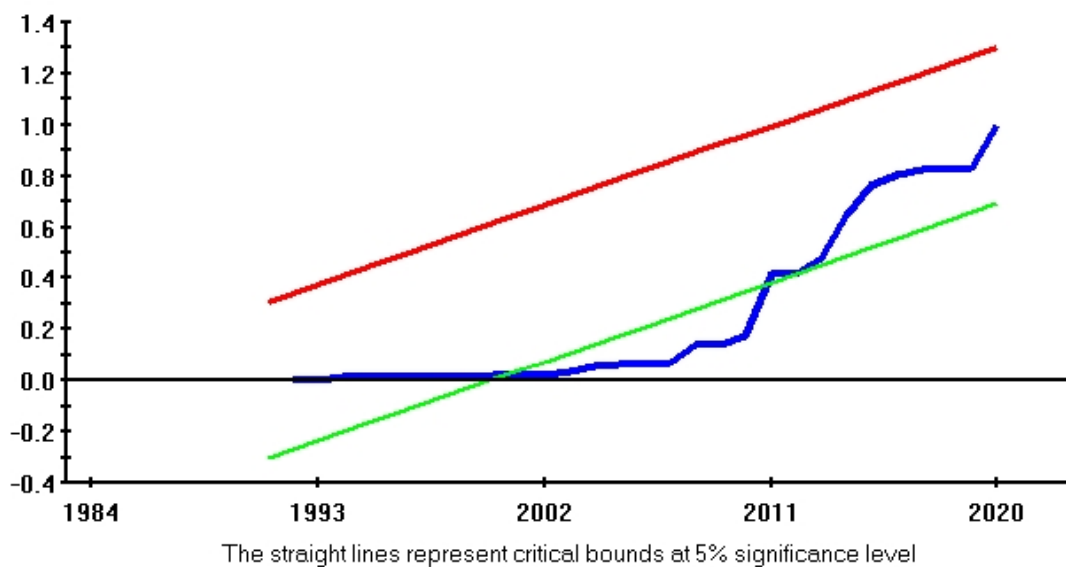
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 10. Solow Model Augmented with LM2 and 1973 Oil Boom

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	2.5430	4.0405	5.3296	3.3660	4.4809	H ₀ cannot be rejected at 5% and 10% significance.
W	12.7150	20.2025	26.6482	16.8298	22.4044	H ₀ cannot be rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	14.9320	6.5293	0.029
TREND	0.041907	0.0079359	0.000
LM2	-0.14792	0.15302	0.341
LPOPG	3.2608	2.7148	0.239
LGFCF	-0.093995	0.10432	0.375
OIL	0.10109	0.11462	0.385

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLM2	-0.027216	0.036254	0.459
dLPOPG	0.59994	0.37692	0.122
dLGFCF	-0.017294	0.020366	0.403
dOIL	0.018599	0.017985	0.309
dTREND	0.0077104	0.0031982	0.022**
ecm(-1)	-0.18399	0.098905	0.073*
R ²	0.25941		

R bar squared 0.11130
 DW statistic 1.9205

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

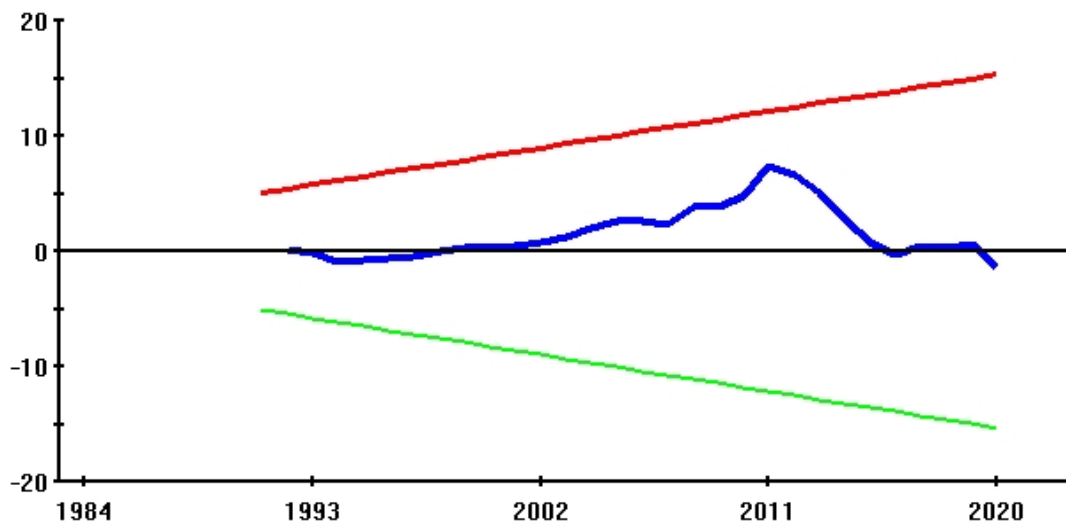
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	1.8289	0.176	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	1.2480	0.275	No serial-autocorrelation present
Heteroscedasticity: LM version	1.5105	0.219	No heteroscedasticity present
Heteroscedasticity: F version	1.4897	0.230	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

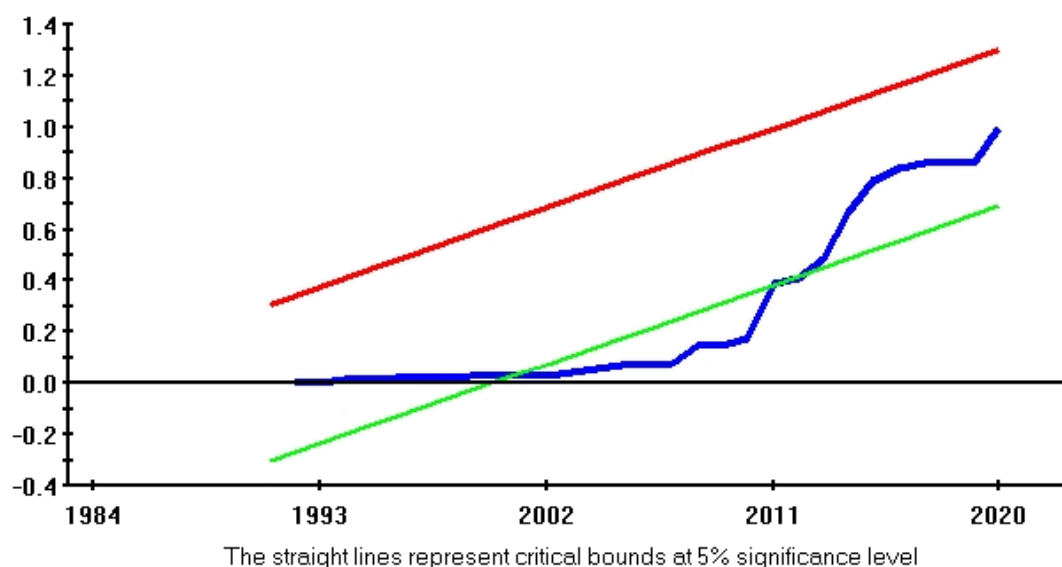
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 11. Solow Model Augmented with LM2 and 2008 Global Financial Crisis

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	8.3372	4.0405	5.3296	3.3660	4.4809	H ₀ is rejected at 5% and 10% significance.
W	41.6862	20.2025	26.6482	16.8298	22.4044	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,1,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	11.6360	1.6934	0.000***
TREND	0.034681	0.0017128	0.000***
LM2	-0.16779	0.048391	0.002***
LPOPG	1.9557	0.71954	0.012**
LGFCF	-0.15893	0.037622	0.000***
GFC08	0.50655	0.11819	0.000***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,1,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLM2	-0.062960	0.021584	0.007***
dLPOPG	0.73383	0.26999	0.011**
dLGFCF	-0.031019	0.013189	0.026**
dGFC08	-0.0090712	0.013198	0.498
dGFC081	-0.19110	0.024352	0.000***
dGFC082	-0.11895	0.021269	0.000***
dGFC083	-0.046286	0.014610	0.004***
dTREND	0.013013	0.0022213	0.000***
ecm(-1)	-0.062960	0.021584	0.007***
R ²	0.80772		
R bar squared	0.72312		
DW statistic	2.2366		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

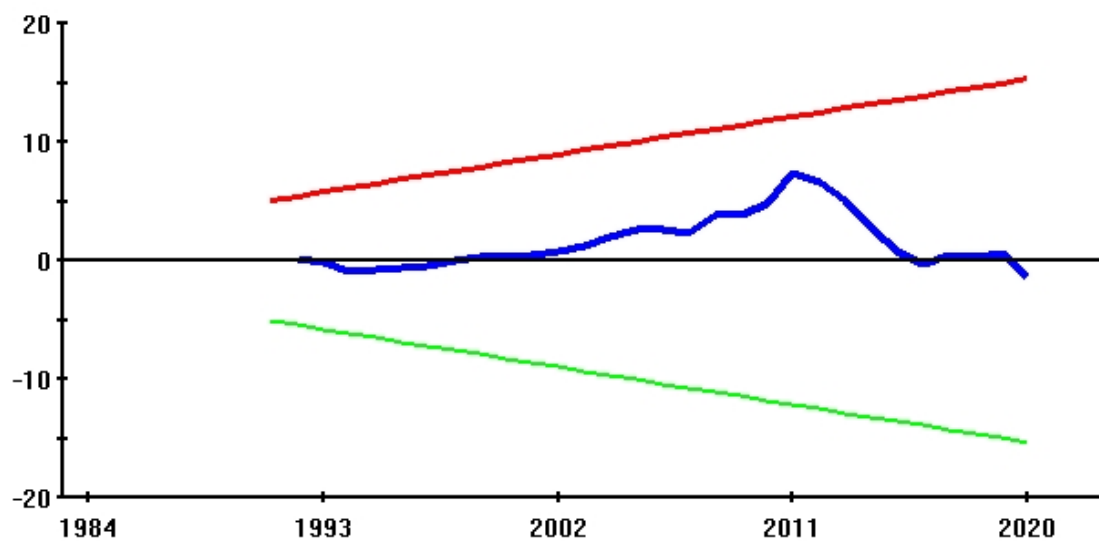
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	1.2070	0.272	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.91853	0.346	No serial-autocorrelation present
Heteroscedasticity: LM version	3.3892	0.066	No heteroscedasticity present
Heteroscedasticity: F version	3.5252	0.069	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

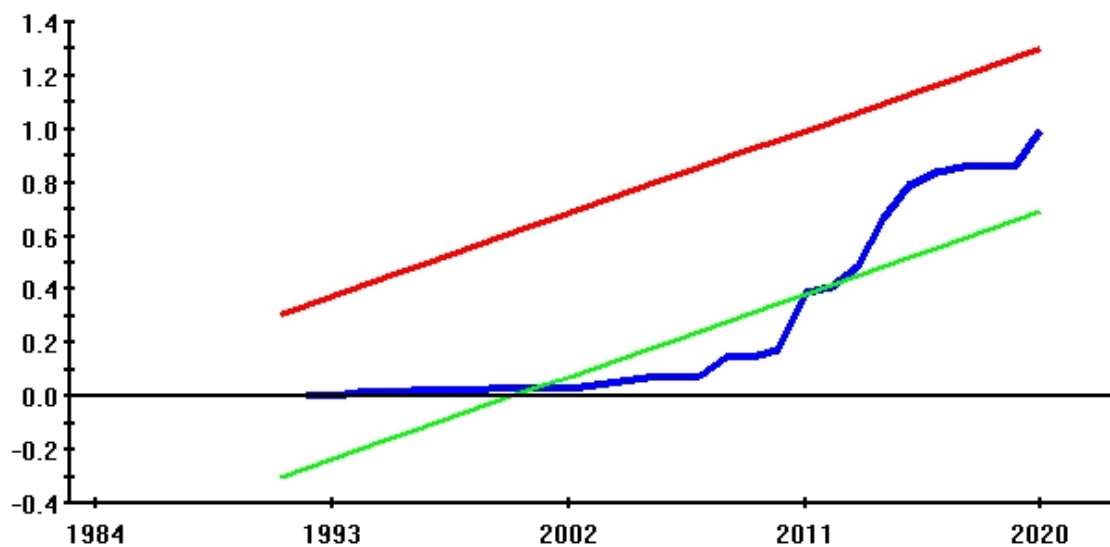
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 12. Solow Model Augmented with LGDS

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	4.9112	4.9770	6.2120	4.0423	5.1556	H ₀ cannot be rejected at 5% significance and is inconclusive at 10% significance
W	19.6446	19.9080	24.8480	16.1691	20.6224	H ₀ is inconclusive at 5% and 10% significance

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,2,4,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	16.3993	2.9335	0.005***
TREND	0.035512	0.0060289	0.004***
LGDS	-0.036692	0.014303	0.062*
LPOPG	3.9966	1.2087	0.030**
LGFCF	-0.14890	0.084344	0.152

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,2,4,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLGDS	-0.0052396	0.0041917	0.251
dLGDS1	0.012998	0.0063725	0.081*
dLPOPG	11.9978	2.6757	0.003***
dLPOPG1	-10.3868	3.2821	0.016**
dLPOPG2	-4.2169	2.4402	0.128
dLPOPG3	1.5671	0.83436	0.102
dLGFCF	-0.0045257	0.016044	0.786
dLGFCF1	0.12748	0.050845	0.041**
dLGFCF2	0.088250	0.031102	0.025**
dLGFCF3	0.031277	0.013996	0.061**
dTREND	0.033003	0.010753	0.018**
ecm(-1)	-0.92936	0.41582	0.061*
R ²	0.95845		
R bar squared	0.77149		
DW statistic	1.9488		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Diagnostic tests

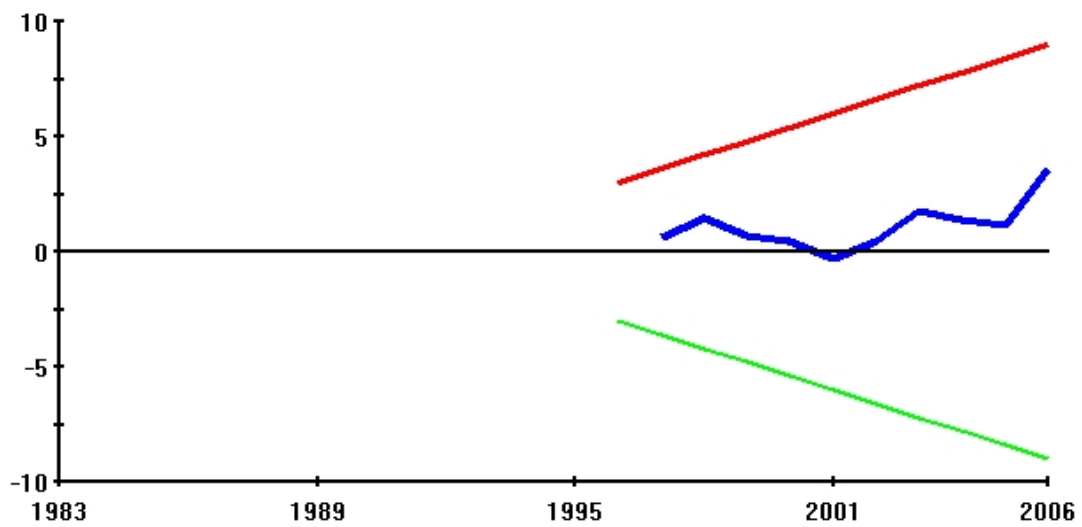
Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	1.3881	0.239	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	3.3767	0.163	No serial-autocorrelation present

Heteroscedasticity: LM version	0.20032	0.654	No heteroscedasticity present
Heteroscedasticity: F version	0.18451	0.672	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

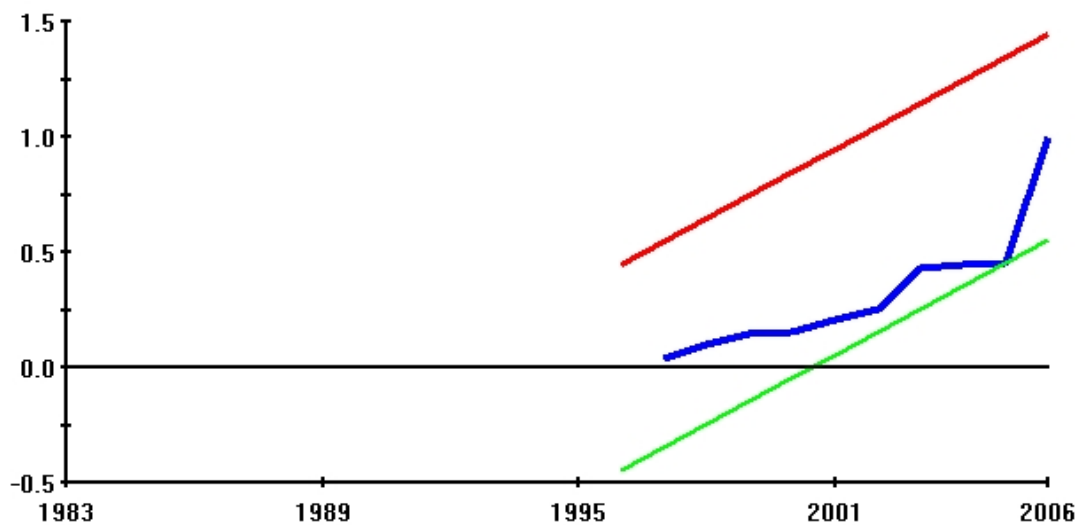
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 13. Solow Model Augmented with LGDS and Financial Liberalisation

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	26.7429	4.3859	5.9044	3.6112	4.8414	H ₀ is rejected at 5% and 10% significance.
W	133.7146	21.9294	29.5222	18.0558	24.2071	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,3,2,0,3) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	9.6610	0.44930	0.000***
TREND	0.022765	0.9582E-3	0.000***
LGDS	0.010899	0.0082782	0.221
LPOPG	1.2440	0.18518	0.000***
LGFCF	-0.0052232	0.0099830	0.613
FINLIB	-0.023583	0.0065966	0.006***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,3,2,0,3) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLGDS	0.0017361	0.0042745	0.692
dLGDS1	-0.012435	0.0058179	0.054*
dLGDS2	-0.0074499	0.0037491	0.070*
dLPOPG	2.6345	0.97710	0.019**
dLPOPG1	-1.4501	0.61625	0.037**
dLGFCF	-0.0062276	0.011866	0.609

dFINLIB	-0.1392E-3	0.0089705	0.988
dFINLIB1	0.030390	0.0099647	0.010**
dFINLIB2	0.013040	0.0093664	0.189
dTREND	0.027143	0.0023305	0.000***
ecm(-1)	-1.1923	0.12362	0.000***
R ²	0.96087		
R bar squared	0.90000		
DW statistic	2.7740		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

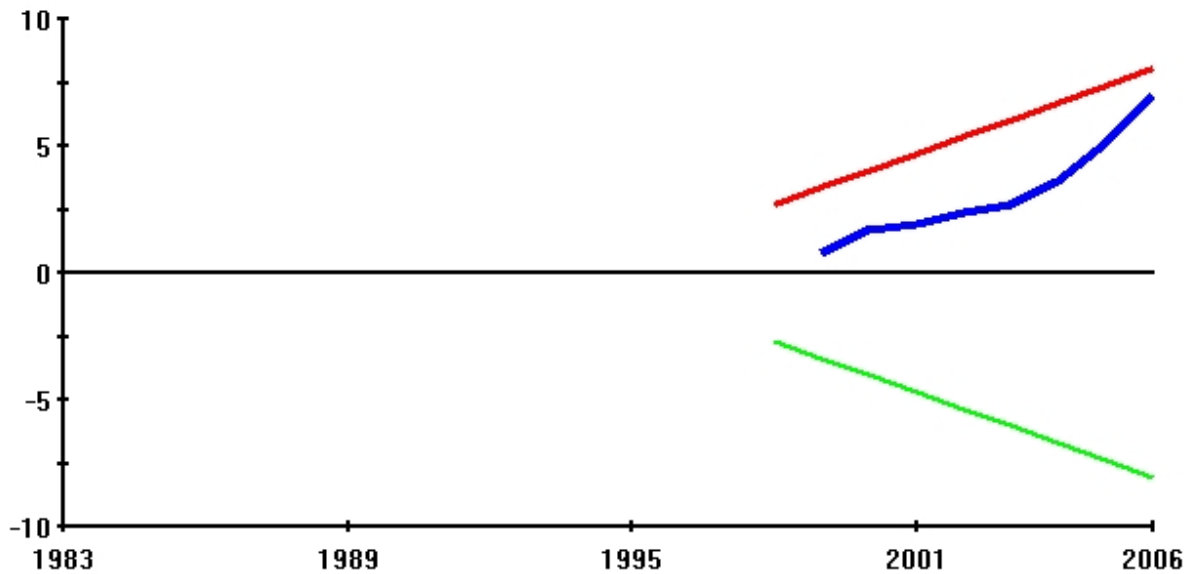
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	4.8595	0.027	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	2.0311	0.192	No serial-autocorrelation present
Heteroscedasticity: LM version	4.4903	0.034	Heteroscedasticity is present
Heteroscedasticity: F version	5.0635	0.035	Heteroscedasticity is present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

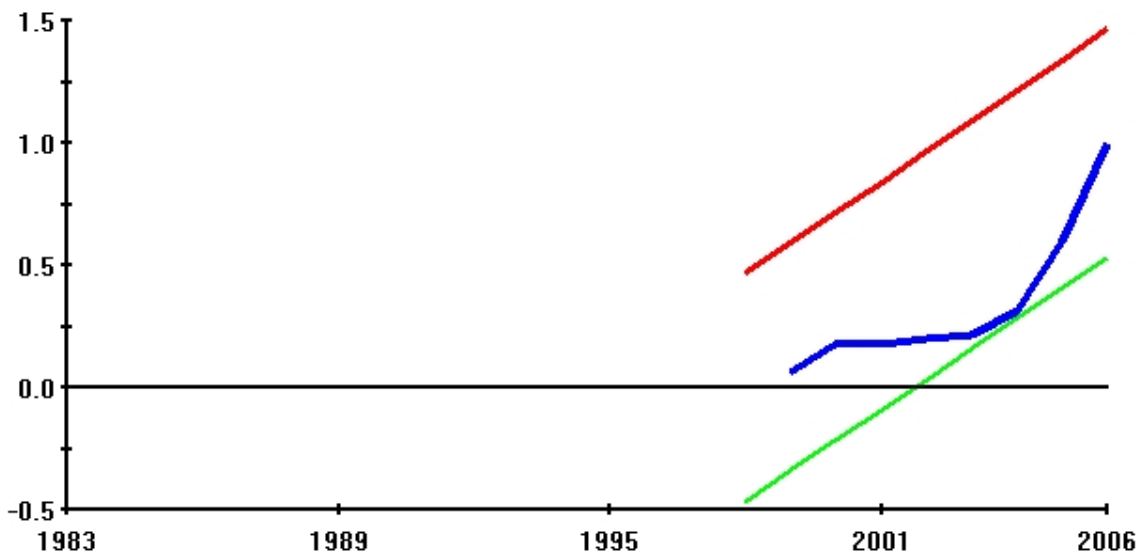
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 14. Solow Model Augmented with LGDS and 1973 Oil Boom

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	106.8234	4.3859	5.9044	3.6112	4.8414	H ₀ is rejected at 5% and 10% significance.
W	534.1169	21.9294	29.5222	18.0558	24.2071	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (3,3,3,3) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	14.2811	1.3474	0.002***
TREND	0.031180	0.0027193	0.001***
LGDS	-0.043711	0.015659	0.068*
LPOPG	3.0676	0.54453	0.011**
LGFCF	-0.0086336	0.041284	0.848
OIL	0.060782	0.028895	0.126

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (3,3,3,3) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLGDS	-0.0058543	0.0029020	0.083*
dLGDS1	0.011774	0.0053152	0.062*
dLGDS2	0.0024487	0.0028905	0.452
dLPOPG	11.4618	1.2845	0.000***
dLPOPG1	-13.2424	2.2688	0.001***
dLPOPG2	1.0861	1.1818	0.389

dLGFCF	0.0098154	0.0091182	0.317
dLGFCF1	0.0098154	0.0091182	0.114
dLGFCF2	0.030777	0.017044	0.043**
dOIL	-0.011580	0.025043	0.658
dOIL1	0.010116	0.0067974	0.180
dOIL2	-0.016666	0.0036824	0.003***
dTREND	0.024134	0.0017050	0.000***
ecm(-1)	-0.77400	0.10891	0.000***
R ²	0.99777		
R bar squared	0.98293		
DW statistic	2.6192		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

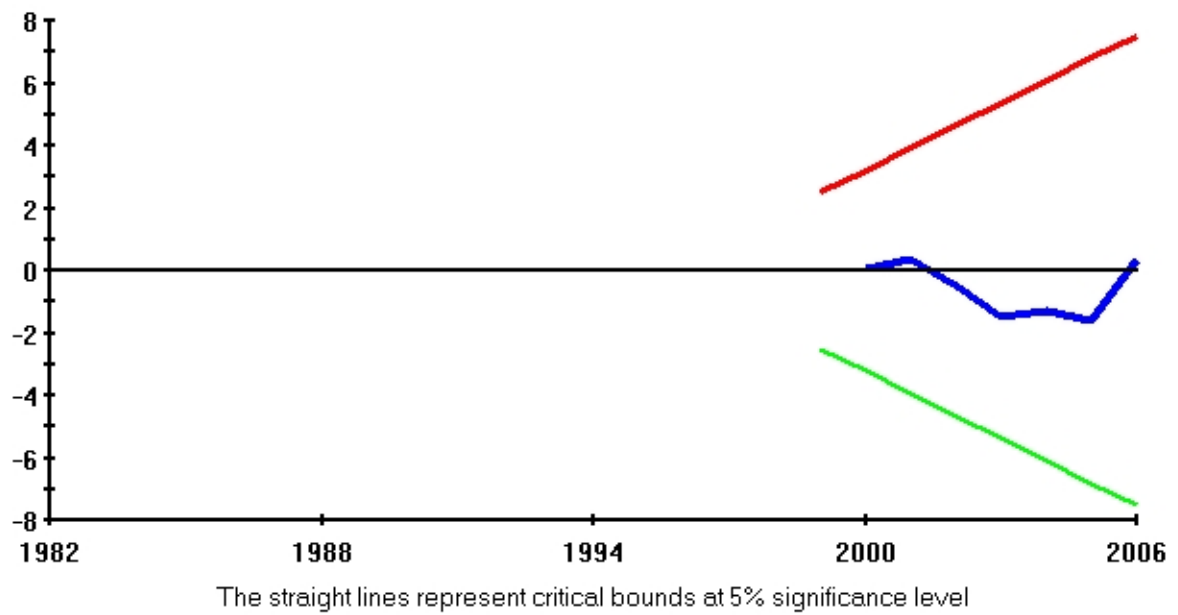
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	4.8572	0.028	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	0.50747	0.550	No serial-autocorrelation present
Heteroscedasticity: LM version	5.0993	0.024	Heteroscedasticity is present
Heteroscedasticity: F version	5.9354	0.023	Heteroscedasticity is present

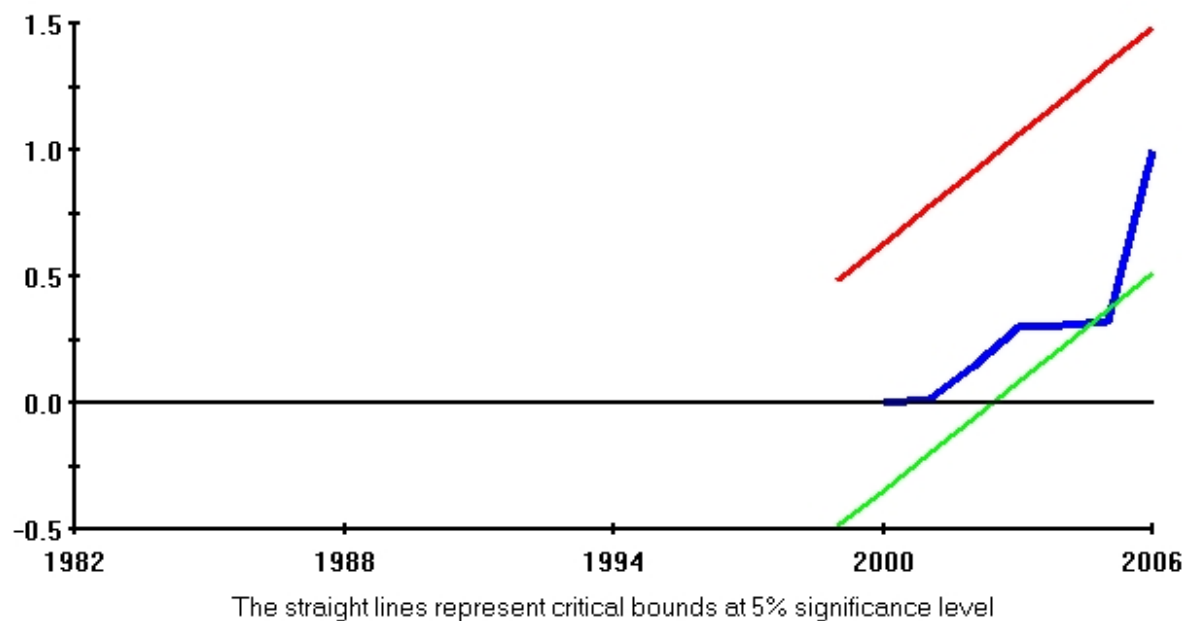
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 15. Solow Model Augmented with LCI

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	2.8792	4.5479	5.7255	3.7905	4.8358	H ₀ cannot be rejected at 5% and 10% significance.
W	11.5166	18.1918	22.9018	15.1620	19.3430	H ₀ cannot be rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	21.6039	8.6379	0.018**
TREND	0.048266	0.013339	0.001***
LCI	-0.025377	0.10999	0.819
LPOPG	6.1364	3.4339	0.084*
LGFCF	-0.17729	0.12376	0.162

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLCI	-0.0032228	0.013718	0.816
dLPOPG	0.77932	0.35051	0.034**
dLGFCF	-0.022515	0.021093	0.294
dTREND	0.0061297	0.0024449	0.018**
ecm(-1)	-0.12700	0.072274	0.089*
R ²	0.21426		
R bar squared	0.087524		

DW statistic 1.5734

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

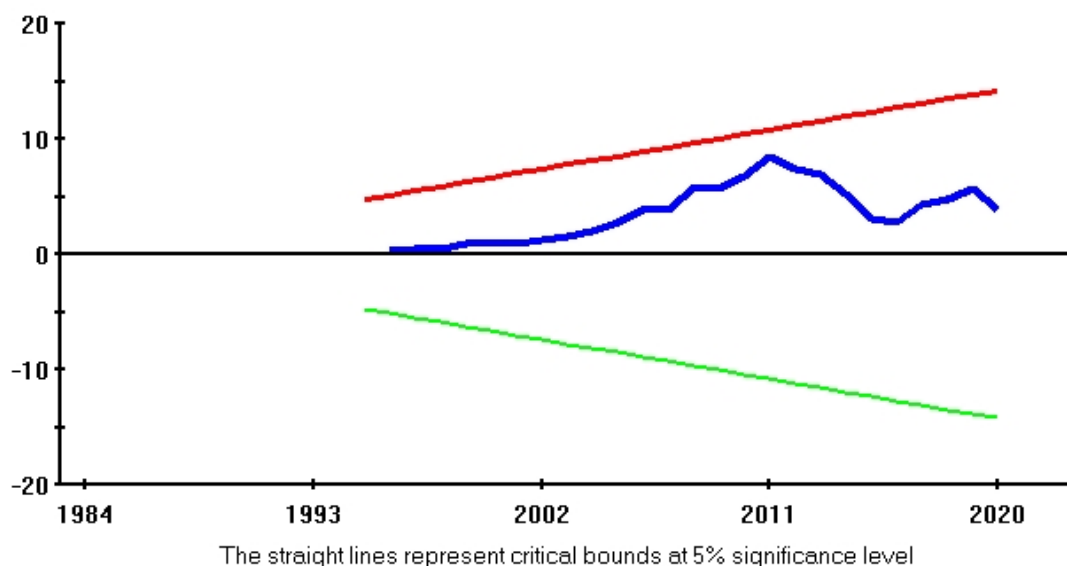
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	1.2838	0.257	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	1.0490	0.314	No serial-autocorrelation present
Heteroscedasticity: LM version	1.1490	0.284	No heteroscedasticity present
Heteroscedasticity: F version	1.1225	0.296	No heteroscedasticity present

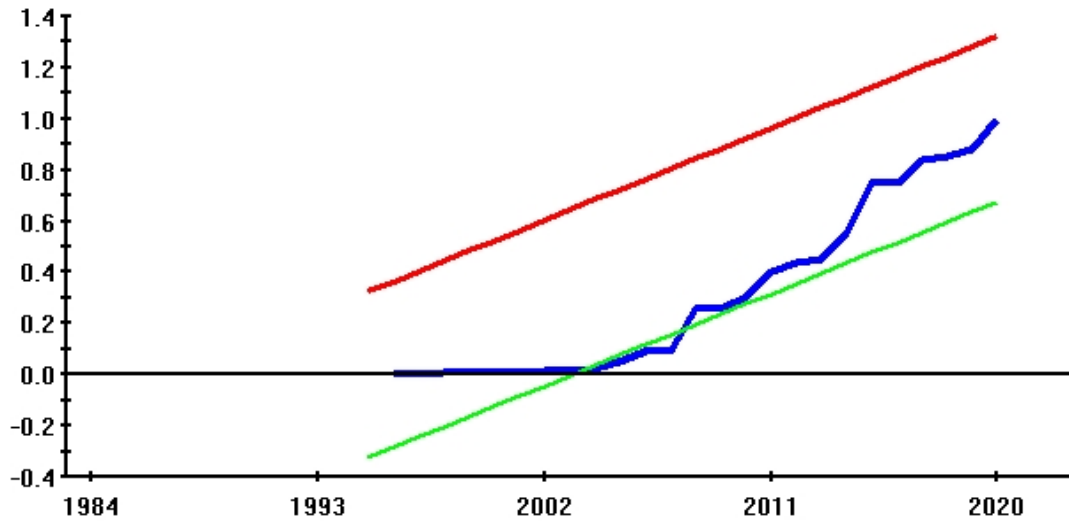
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 16. Solow Model Augmented with LCI and Financial Liberalisation

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H_0 : No cointegration)
F	2.2372	4.0405	5.3296	3.3660	4.4809	H_0 cannot be rejected at 5% and 10% significance.
W	11.1860	20.2025	26.6482	16.8298	22.4044	H_0 cannot be rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	21.1396	8.7416	0.022
TREND	0.047573	0.013433	0.001
LCI	-0.021584	0.11007	0.846
LPOPG	5.9381	3.4942	0.100

LGFCF	-0.16884	0.13145	0.209
FINLIB	-0.015389	0.087706	0.862

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLCI	-0.0028271	0.014129	0.843
dLPOPG	0.77776	0.35624	0.037
dLGFCF	-0.022114	0.021559	0.313
dFINLIB	-0.0020156	0.011790	0.865
dTREND	0.0062311	0.0025539	0.021
ecm(-1)	-0.13098	0.077035	0.099
R ²	0.99558		
R bar squared	0.99470		
DW statistic	1.7865		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

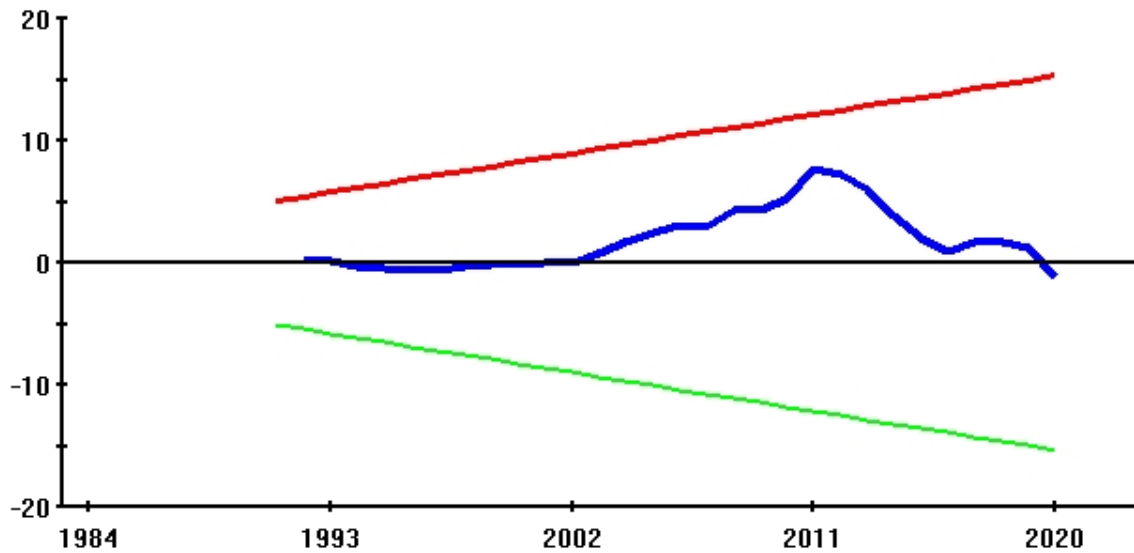
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.27933	0.597	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.19994	0.658	No serial-autocorrelation present
Heteroscedasticity: LM version	0.52906	0.467	No heteroscedasticity present
Heteroscedasticity: F version	0.50830	0.480	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

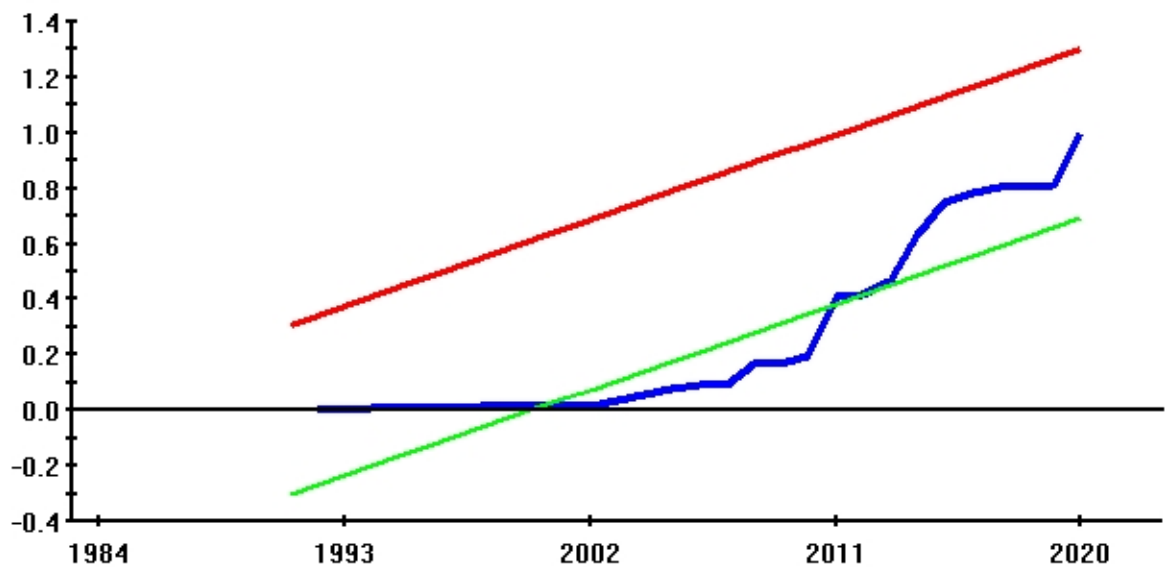
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 17. Solow Model Augmented with LCI and 1973 Oil Boom

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	2.4557	4.0405	5.3296	3.3660	4.4809	H ₀ cannot be rejected at 5% and 10% significance.
W	12.2787	20.2025	26.6482	16.8298	22.4044	

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	19.7121	7.7818	0.017**
TREND	0.046453	0.012131	0.001***
LCI	-0.0067360	0.10498	0.949
LPOPG	5.3527	3.0871	0.093*
LGFCF	-0.14783	0.12353	0.241
OIL	0.15367	0.15657	0.334

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLCI	-0.8900E-3	0.013823	0.949
dLPOPG	0.70719	0.35505	0.056
dLGFCF	-0.019531	0.021179	0.364
dOIL	0.020303	0.018184	0.273
dTREND	0.0061372	0.0024352	0.017
ecm(-1)	-0.13212	0.072134	0.077
R ²	0.99575		
R bar squared	0.99490		

DW statistic

2.1940

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

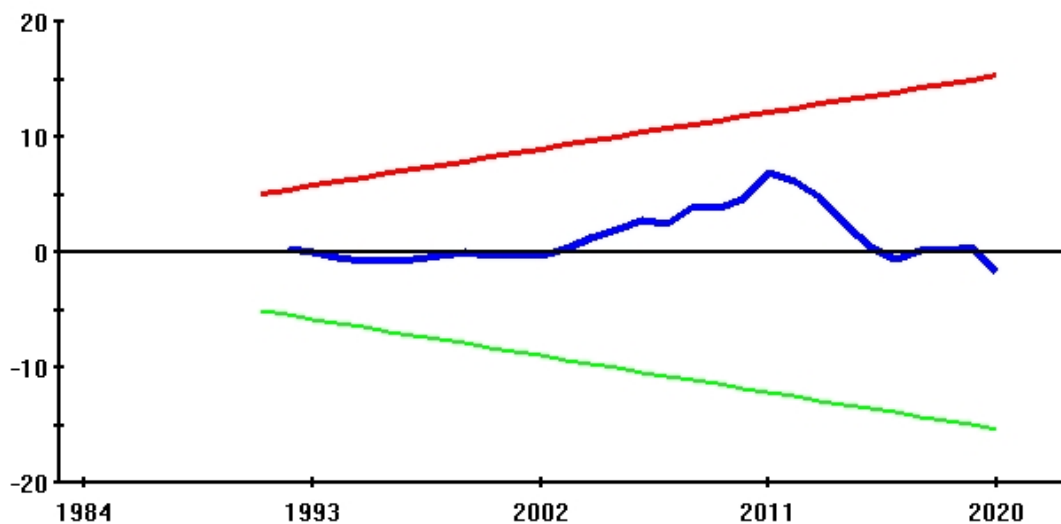
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	1.4761	0.224	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	1.0912	0.305	No serial-autocorrelation present
Heteroscedasticity: LM version	2.6935	0.101	No heteroscedasticity present
Heteroscedasticity: F version	2.7464	0.106	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

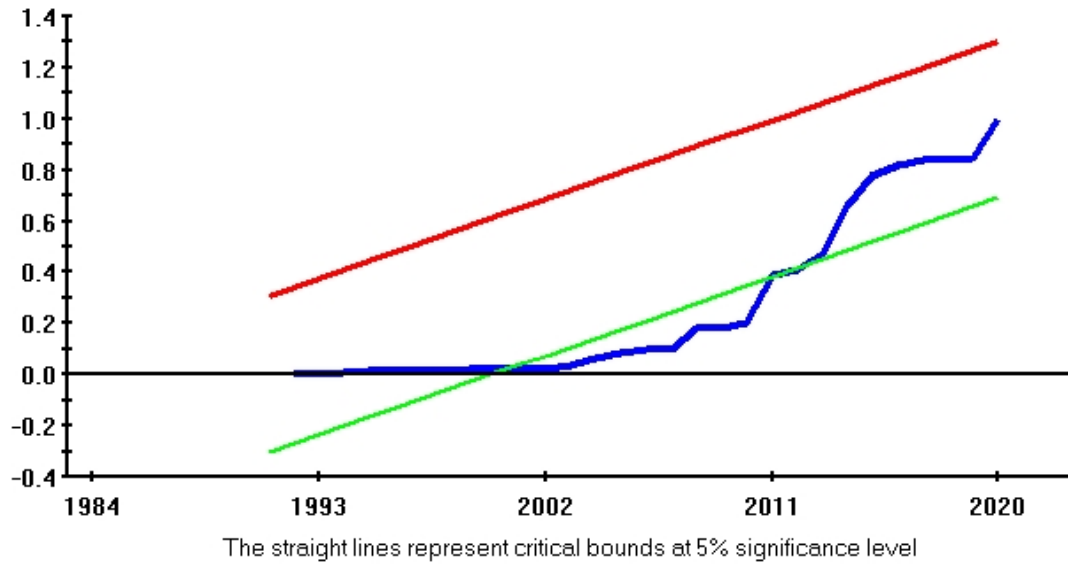
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 18. Solow Model Augmented with LCI and 2008 Global Financial Crisis

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H_0 : No cointegration)
F	7.1168	4.0405	5.3296	3.3660	4.4809	H_0 is rejected at 5% and 10% significance.
W	35.5841	20.2025	26.6482	16.8298	22.4044	H_0 is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Sviryzdenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	16.2475	2.1673	0.000***
TREND	0.037014	0.0032366	0.000***
LCI	-0.0037066	0.034663	0.916
LPOPG	4.0168	0.86306	0.000***
LGFCF	-0.25840	0.043145	0.000***
GFC08	0.65136	0.20859	0.004***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 5% level if the p-value < 0.05 and is significant and the 10% level if the p-value < 0.10

Error Correction Model

ECM for ARDL (1,0,0,0,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLCI	-0.9954E-3	0.0092957	0.916
dLPOPG	1.0787	0.28150	0.001***
dLGFCF	-0.035748	0.015775	0.032**
dGFC08	-0.011273	0.015928	0.485
dGFC081	-0.18243	0.028272	0.000***
dGFC082	-0.11675	0.024893	0.000***
dGFC083	-0.054278	0.016683	0.003***
dTREND	0.0099403	0.0022808	0.000***
ecm(-1)	-0.26856	0.065686	0.000***
R ²	0.99855		
R bar squared	0.99791		
DW statistic	1.9219		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 5% level if the p-value < 0.05 and is significant and the 10% level if the p-value < 0.10.

Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.34348	0.558	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.22489	0.640	No serial-autocorrelation present
Heteroscedasticity: LM version	1.7706	0.183	No heteroscedasticity present

Heteroscedasticity: F version	1.7591	0.193	No heteroscedasticity present
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Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

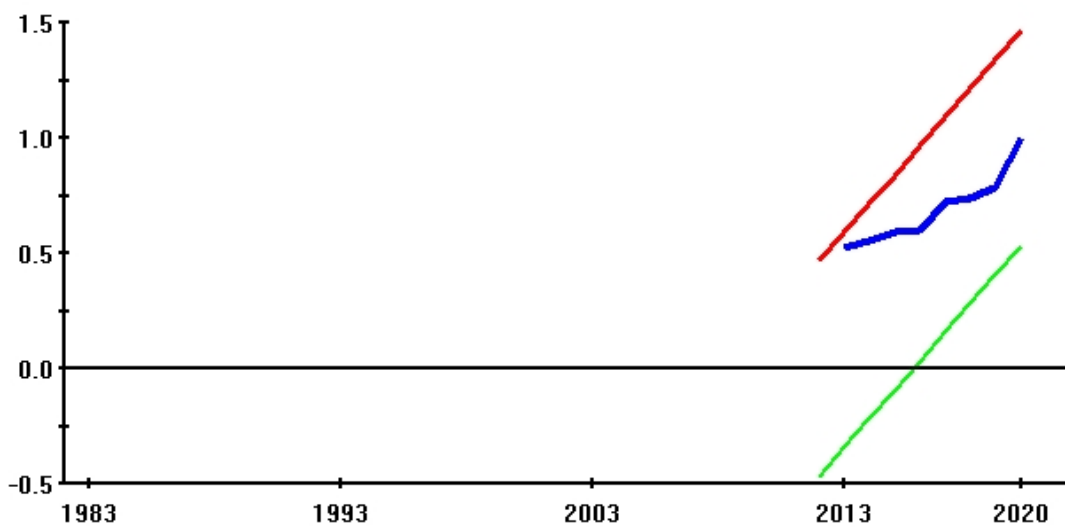
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 19. Solow Model Augmented with LREMIT

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	7.8929	4.5479	5.7255	3.7905	4.8358	H ₀ is rejected at 5% and 10% significance.
W	39.4465	18.1918	22.9018	15.1620	19.3430	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,4,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	12.6981	5.8246	0.039**
TREND	0.058162	0.018218	0.004***
LREMIT	-0.12174	0.11269	0.291
LPOPG	4.6111	1.6189	0.008***
LGFCF	-0.21022	0.063645	0.002***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,4,0,0) with control variables			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.017110	0.0064469	0.014**
dLREMIT1	0.016901	0.0093613	0.083*
dLREMIT2	0.016854	0.0059301	0.009***
dLREMIT3	0.010230	0.0054896	0.074*
dLPOPG	0.41765	0.40682	0.314
dLGFCF	-0.019919	0.020062	0.330
dTREND	0.0087240	0.0022407	0.001***
ecm(-1)	-0.14999	0.069934	0.042**
R ²	0.64676		

R bar squared 0.47014
 DW statistic 2.1829

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

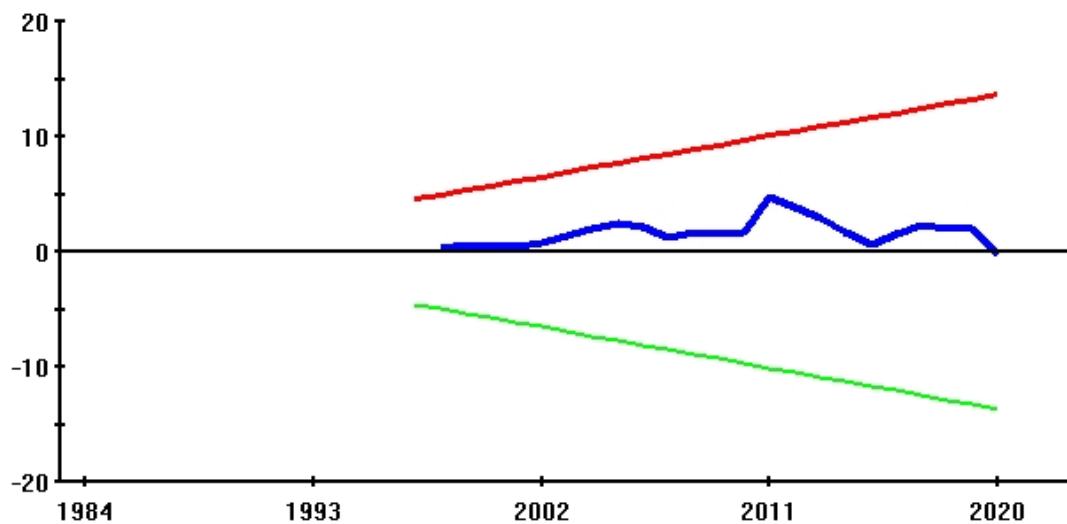
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	2.7744	0.096	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	1.8644	0.185	No serial-autocorrelation present
Heteroscedasticity: LM version	2.6054	0.107	No heteroscedasticity present
Heteroscedasticity: F version	2.6512	0.112	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

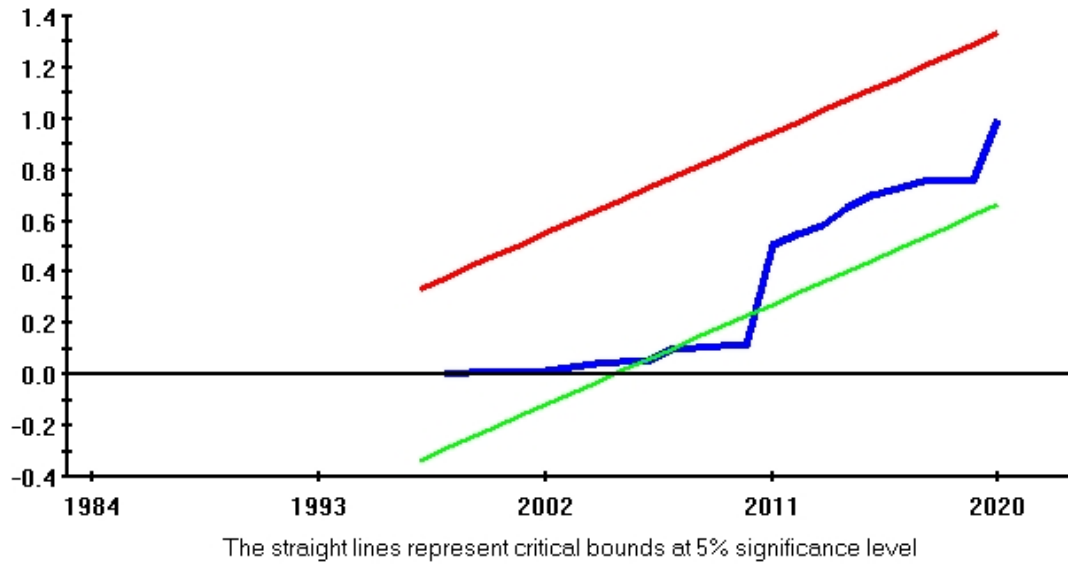
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 20. Solow Model Augmented with LREMIT and Financial Liberalisation

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	5.9225	4.0405	5.3296	3.3660	4.4809	H ₀ is rejected at 5% and 10% significance.
W	29.6126	20.2025	26.6482	16.8298	22.4044	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,4,3,0,3) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	19.5868	3.0402	0.000***
TREND	0.049732	0.0092749	0.000***
LREMIT	-0.014759	0.042137	0.730

LPOPG	5.2774	1.2162	0.000***
LGFCF	-0.070115	0.037937	0.082*
FINLIB	-0.19222	0.038670	0.000***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,4,3,0,3) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.026251	0.0058551	0.000***
dLREMIT1	0.019317	0.0077402	0.021**
dLREMIT2	0.026176	0.0056842	0.000***
dLREMIT3	0.022038	0.0051312	0.000***
dLPOPG	0.15004	2.8757	0.959
dLPOPG1	4.2143	4.7015	0.381
dLPOPG2	-5.1377	2.8581	0.087*
dLGFCF	-0.024438	0.017726	0.183
dFINLIB	-0.028764	0.015402	0.077*
dFINLIB1	0.064107	0.022998	0.011**
dFINLIB2	-0.036536	0.019140	0.071*
dTREND	0.017333	0.0036108	0.000***
ecm(-1)	-0.34854	0.12289	0.010**
R ²	0.99927		
R bar squared	0.99846		
DW statistic	2.7906		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Diagnostic tests

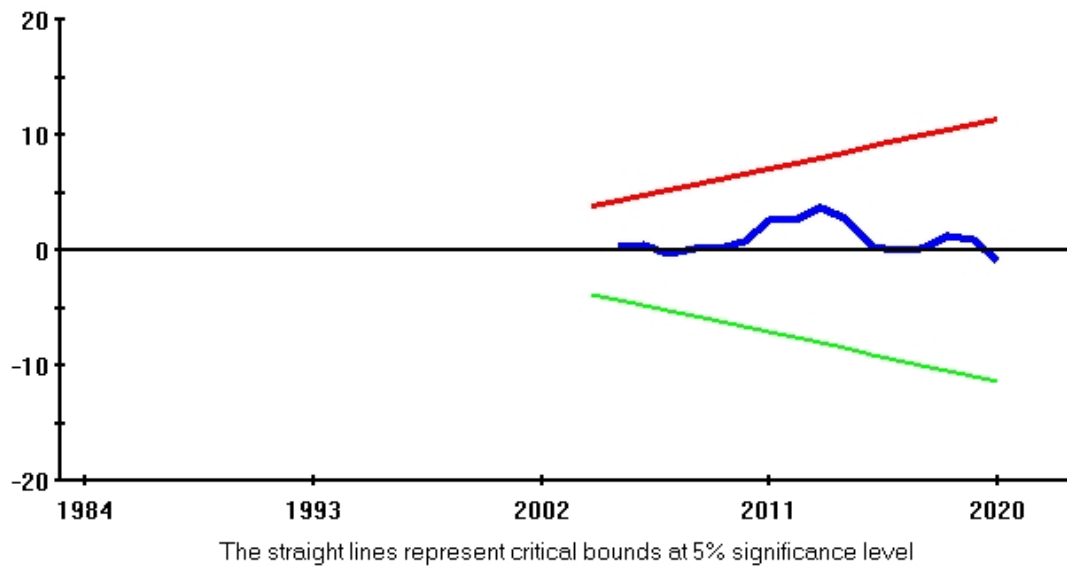
Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.37200	0.542	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.35547	0.555	No serial-autocorrelation present
Heteroscedasticity: LM version	0.11365	0.736	No heteroscedasticity present
Heteroscedasticity: F version	0.10799	0.744	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and

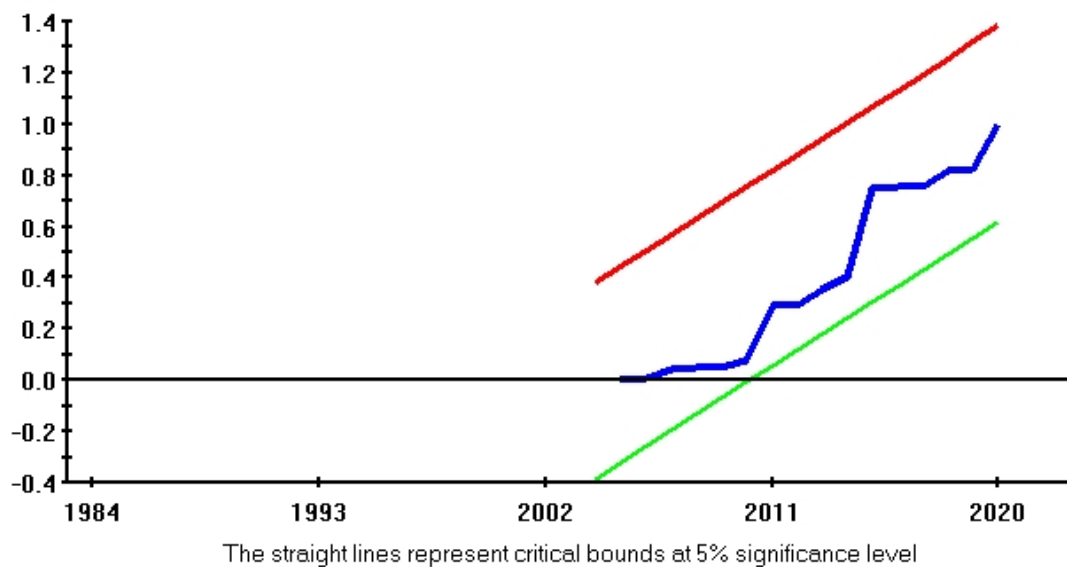
rejected at the 10% level if the p -value < 0.1 . If the p -value > 0.05 , the null hypothesis cannot be rejected at the 5% level and if the p -value > 0.1 , the null hypothesis cannot be rejected at the 10% level.

CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 21. Solow Model Augmented with LREMIT and 1973 Oil Price Boom

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	5.2158	4.0405	5.3296	3.3660	4.4809	H ₀ is rejected at 5% and 10% significance.
W	26.0792	20.2025	26.6482	16.8298	22.4044	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,4,3,0,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	18.0857	2.6866	0.000***
TREND	0.043369	0.0054813	0.000***
LREMIT	0.013005	0.027172	0.639
LPOPG	4.7220	1.0578	0.000***
LGFCF	-0.086898	0.035183	0.025**
OIL	0.24474	0.084254	0.010**

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,4,3,0,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.030921	0.0067474	0.000***
dLREMIT1	0.013537	0.0092281	0.159
dLREMIT2	0.015785	0.0057544	0.013**
dLREMIT3	0.018950	0.0058315	0.004***
dLPOPG	-2.9921	3.4127	0.392
dLPOPG1	9.5937	5.8417	0.117
dLPOPG2	-8.1966	3.7144	0.040**
dLGFCF	-0.037248	0.019894	0.077*
dOIL	-0.014765	0.036067	0.687

dOIL1	-0.095244	0.030936	0.006***
dOIL2	-0.026564	0.025080	0.303
dOIL3	-0.072870	0.027847	0.107
dTREND	0.018590	0.0033994	0.000***
ecm(-1)	-0.42864	0.10266	0.001***
R ²	0.99908		
R bar squared	0.99794		
DW statistic	2.8616		

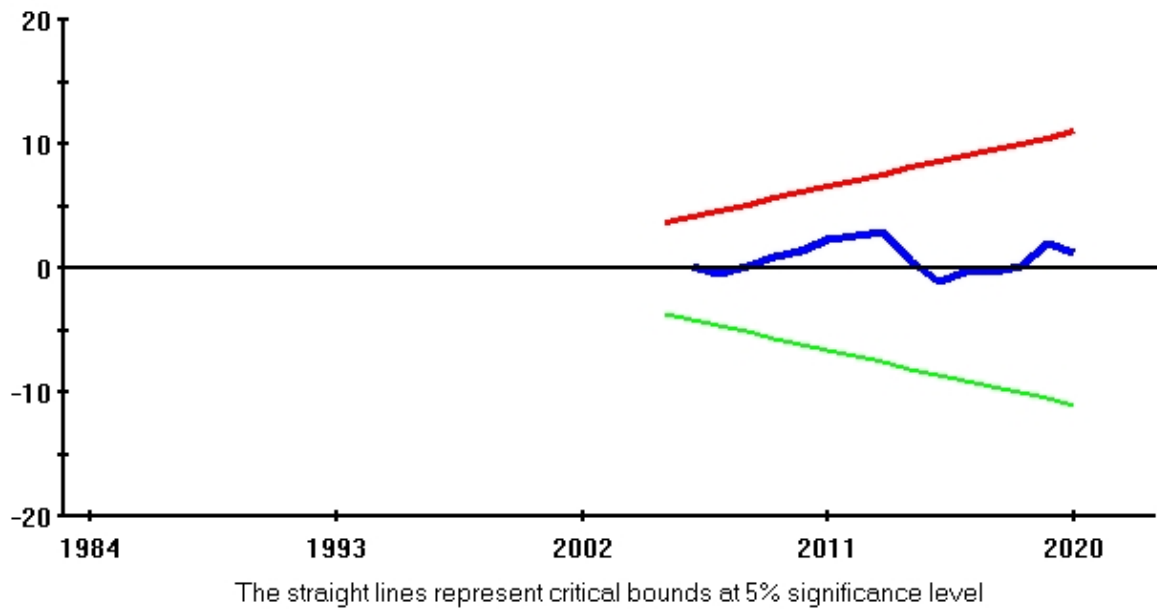
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Diagnostic tests

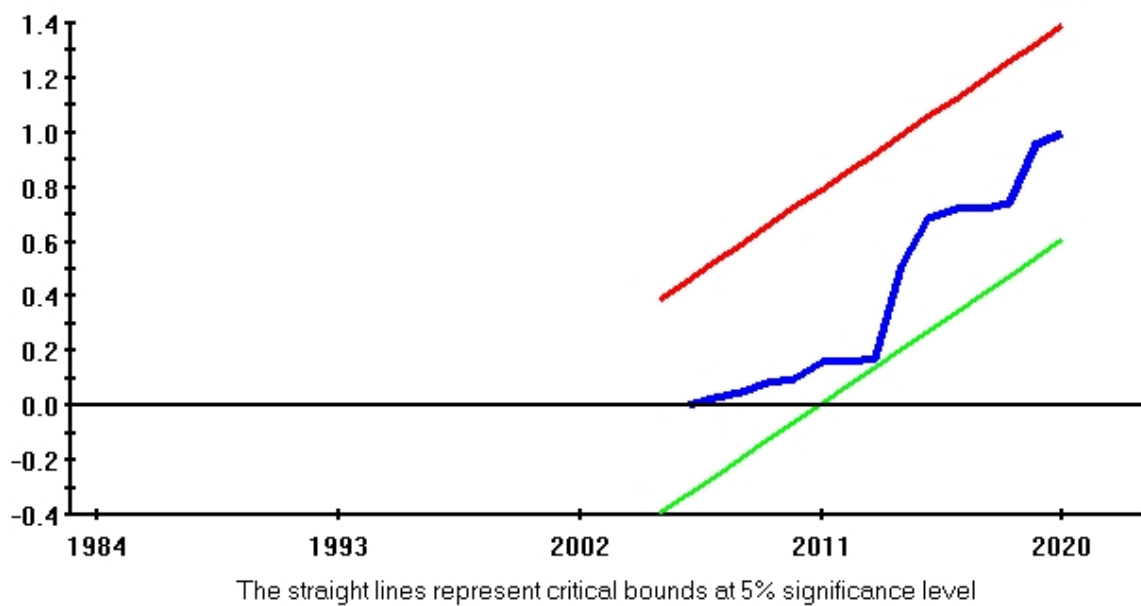
Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.0034215	0.953	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.0023412	0.962	No serial-autocorrelation present
Heteroscedasticity: LM version	4.0296	0.045	Heteroscedasticity is present
Heteroscedasticity: F version	4.2776	0.046	Heteroscedasticity is present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 22. Solow Model Augmented with LREMIT and 2008 Global Financial Crisis

Bounds test

Statistic	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	7.6044	4.0405	5.3296	3.3660	4.4809	H ₀ is rejected at 5% and 10% significance.
W	38.0221	20.2025	26.6482	16.8298	22.4044	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,1,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	15.8980	2.2386	0.000***
TREND	0.037591	0.0031985	0.000***
LREMIT	-0.0082530	0.016266	0.616
LPOPG	3.8860	0.88810	0.000***
LGFCF	-0.26298	0.040387	0.000***
GFC08	0.66026	0.20663	0.004***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,1,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	-0.0022139	0.0043203	0.613
dLPOPG	1.0424	-0.28920	0.001***
dLGFCF	-0.035631	0.015095	0.026**
dGFC08	-0.012390	0.015505	0.431
dGFC081	-0.18764	0.029380	0.000***
dGFC082	-0.11952	0.024917	0.000***
dGFC083	-0.055017	0.016549	0.003***

dTREND	0.010084	0.0022717	0.000***
ecm(-1)	-0.26825	0.065312	0.000***
R ²	0.74496		
R bar squared	0.63274		
DW statistic	1.9315		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

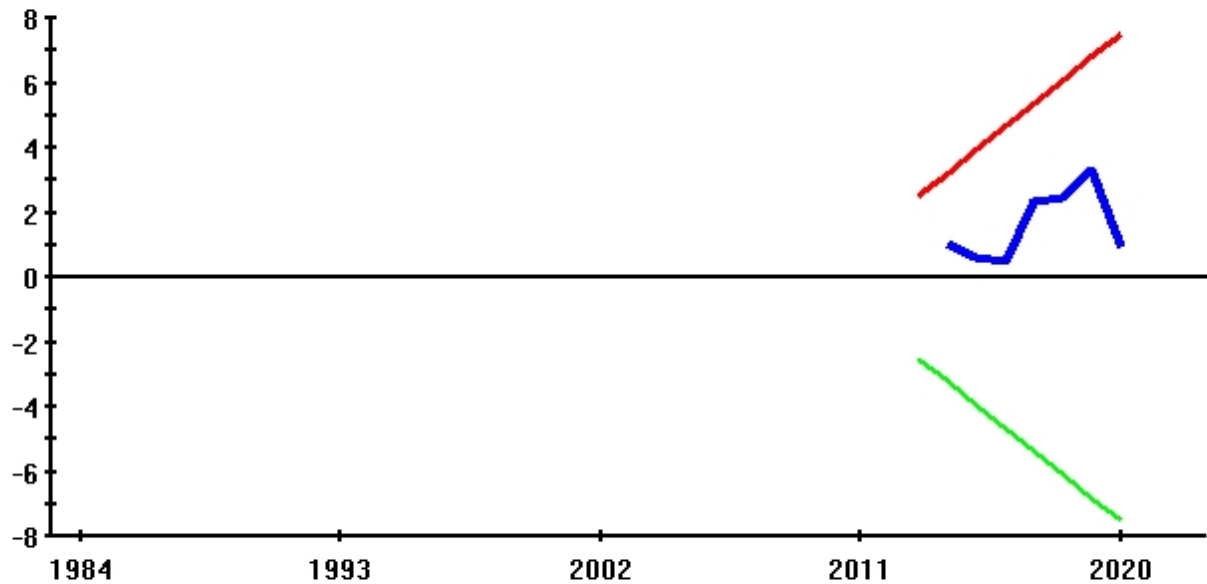
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.49581	0.481	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.32598	0.573	No serial-autocorrelation present
Heteroscedasticity: LM version	1.6501	0.199	No heteroscedasticity present
Heteroscedasticity: F version	1.6338	0.210	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

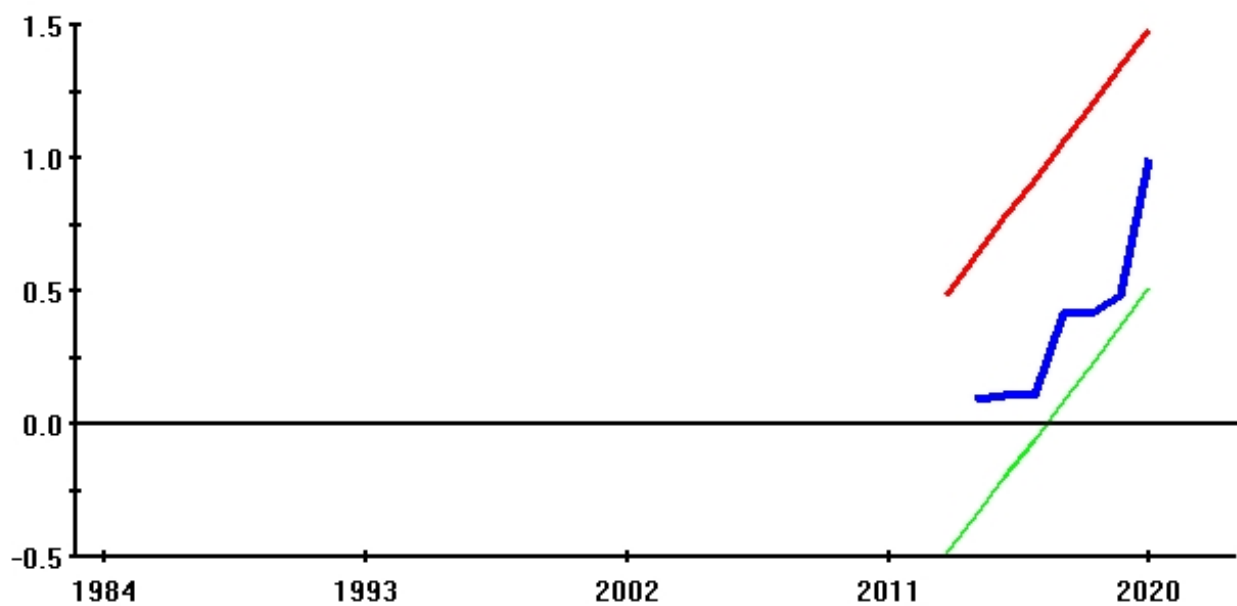
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 23. Solow Model Augmented with LREMIT and LDCPS

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	2.6095	4.0405	5.3296	3.3660	4.4809	H ₀ cannot be rejected at 5% and 10% significance.
W	13.0475	20.2025	26.6482	16.8298	22.4044	H ₀ cannot be rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,0,4,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	14.1916	8.6583	0.115
TREND	0.061422	0.025773	0.026**
LREMIT	-0.13784	0.15042	0.369
LDCPS	0.045693	0.16898	0.789
LPOPG	3.4411	3.5234	0.339
LGFCF	-0.15800	0.13775	0.263

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,0,4,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.017362	0.0066204	0.015**
dLREMIT1	0.016479	0.0096366	0.100
dLREMIT2	0.016575	0.0061096	0.012**
dLREMIT3	0.010540	0.0056823	0.076*
dLDCPS	0.0059720	0.019033	0.756
dLPOPG	0.44975	0.42712	0.303
dLGFCF	-0.020650	0.020582	0.326

dTREND	0.0080277	0.0031846	0.019**
ecm(-1)	-0.13070	0.094148	0.178
R ²	0.64826		
R bar squared	0.44945		
DW statistic	2.2371		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

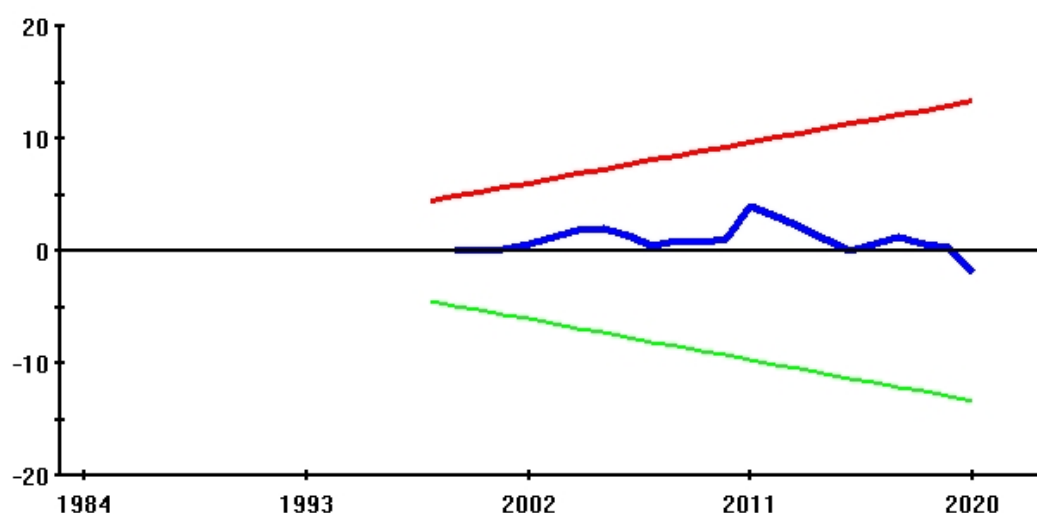
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	5.2749	0.022	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	4.0297	0.056	No serial-autocorrelation present
Heteroscedasticity: LM version	2.2473	0.134	No heteroscedasticity present
Heteroscedasticity: F version	2.2629	0.141	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

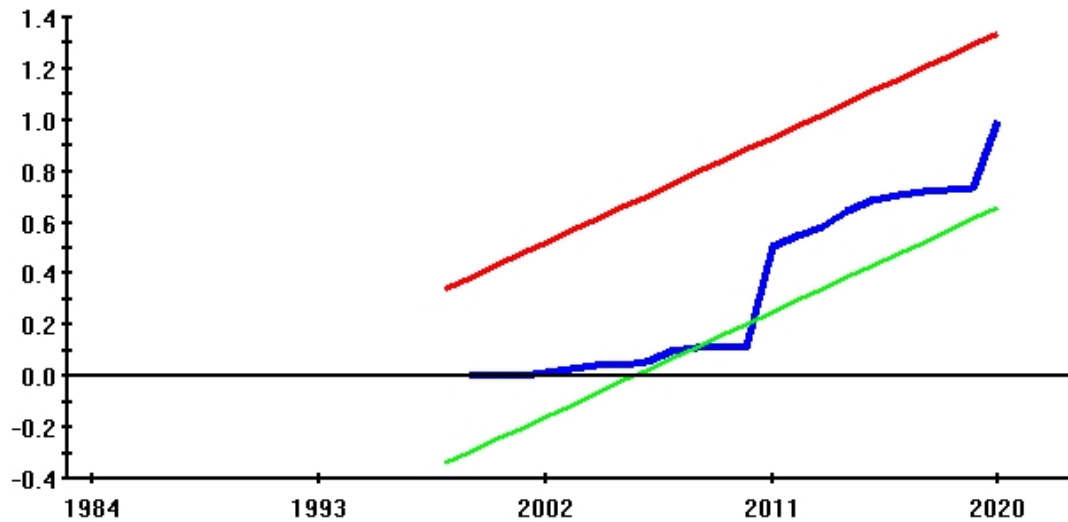
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 24. Solow Model Augmented with LREMIT, LDCPS and Interaction Term

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	3.5059	3.6510	4.9653	3.0488	4.2251	H ₀ is rejected at 5% significance and inconclusive at 10% significance.
W	21.0357	21.9063	29.7915	18.2927	25.3508	H ₀ is rejected at 5% significance and inconclusive at 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,3,0,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	9.1219	2.9692	0.005
TREND	0.040808	0.00428535	0.000
LREMIT	-0.13968	0.043559	0.004
LDCPS	-0.022377	0.050905	0.664
LREMIT*LDCPS	0.046724	0.013728	0.002
LPOPG	1.2028	1.1810	0.318
LGFCF	-0.073892	0.050665	0.157

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LDPCS: Long-Run Coefficients

$$LGDP = -0.022377(LDCPS) - 0.13968(LREMIT) + 0.046724(LREMIT * LDCPS)$$

$$\frac{dLGDP}{dLREMIT} = -0.13968 + 0.046724(8.9002)$$

$$= 0.2761729448$$

Therefore, the joint effect is 0.2762%

Test for significance:

$$H_0: LREMIT*LDCPS = 0$$

$$F(\alpha=0.05,10,26) = 2.2$$

Prob > F = 0.000 (significant at 1%)

Error Correction Model

ECM for ARDL (1,3,0,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	-0.021484	0.011733	0.078*
dLREMIT1	0.018626	0.0061968	0.006***
dLREMIT2	0.014895	0.0048833	0.005***
dLDCPS	-0.0074540	0.017866	0.680
dLREMIT*LDCPS	0.015564	0.0051571	0.005***
dLPOPG	0.40067	0.38141	0.303
dLGFCF	-0.024614	0.017493	0.171
dTREND	0.013593	0.0032666	0.000***
ecm(-1)	-0.33311	0.094056	0.001***

R ²	0.59777
R bar squared	0.44306
DW statistic	2.2367

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LDCPS: Short-Run Coefficients

$$LGDP = -0.0074540(LDCPS) - 0.021484(LREMIT) + 0.015564(LREMIT * LDCPS)$$

$$\frac{dLGDP}{dLREMIT} = -0.021484 + 0.015564(8.9002)$$

$$= 0.1170387128$$

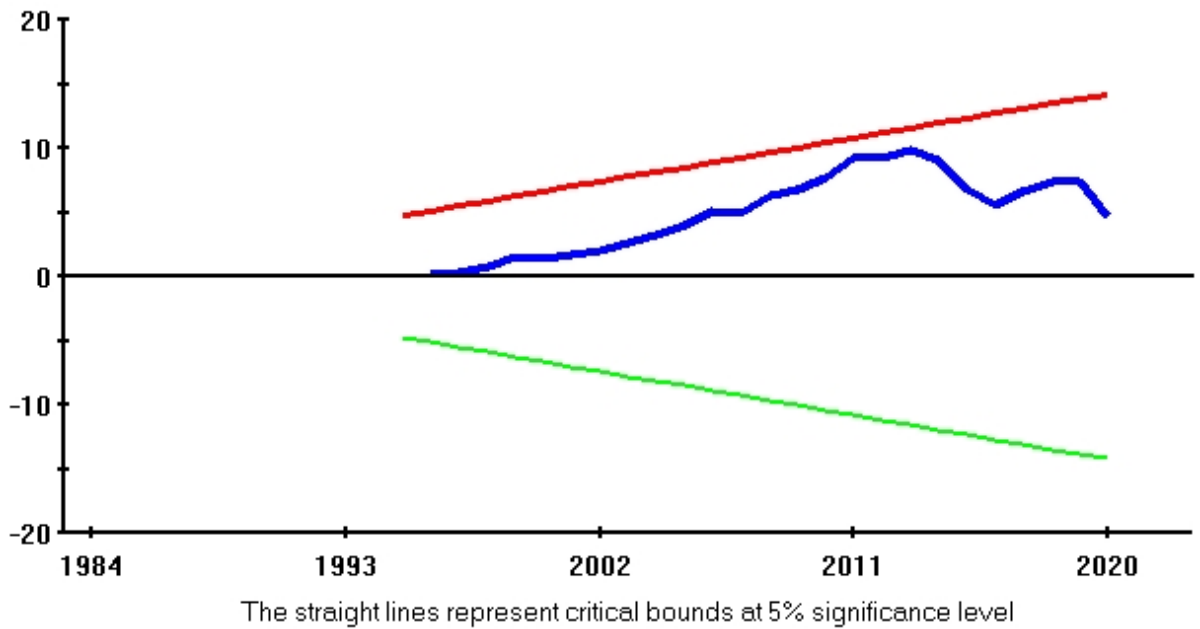
Therefore, the joint effect is 0.1170%

Diagnostic tests

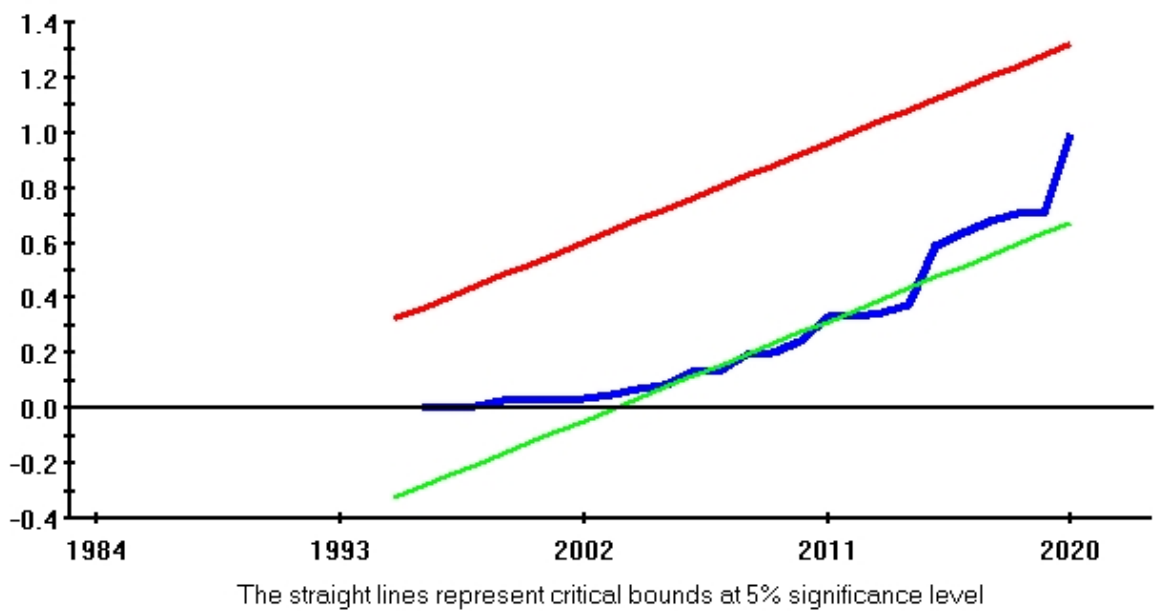
Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.21545	0.643	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.14643	0.705	No serial-autocorrelation present
Heteroscedasticity: LM version	0.30512	0.581	No heteroscedasticity present
Heteroscedasticity: F version	0.29140	0.593	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 25. Solow Model Augmented with LREMIT, LDCPS and Financial Liberalisation

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	7.2357	3.6510	4.9653	3.0488	4.2251	H ₀ is rejected at 5% and 10% significance.
W	43.4140	21.9063	29.7915	18.2927	25.3508	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,0,4,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	20.3183	6.2310	0.010**
TREND	0.062884	0.020561	0.014**
LREMIT	-0.11686	0.10735	0.305
LDCPS	0.065416	0.10089	0.533
LPOPG	6.1768	2.7631	0.052*
LGFCF	-0.60562	0.35812	0.125
FINLIB	0.20508	0.27736	0.479

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,2,4,4,4,3) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.021306	0.0064383	0.005***
dLREMIT1	0.050102	0.012652	0.001***
dLREMIT2	0.031990	0.0060853	0.000***
dLREMIT3	0.026897	0.0060895	0.001***
dLDCPS	0.030943	0.026456	0.262
dLDCPS1	0.064785	0.023985	0.017**
dLPOPG	-4.5122	3.9991	0.278

dLPOPG1	24.3876	8.6915	0.014**
dLPOPG2	-31.8280	8.9509	0.003***
dLPOPG3	14.3504	4.6896	0.008***
dLGFCF	-0.057079	0.021337	0.018**
dLGFCF1	0.14560	0.071028	0.060*
dLGFCF2	0.14018	0.057045	0.028**
dLGFCF3	0.072316	0.031150	0.036**
dFINLIB	0.0012231	0.026363	0.964
dFINLIB1	0.021030	0.030720	0.505
dFINLIB2	-0.11846	0.032054	0.002***
dTREND	0.019905	0.0048684	0.001***
ecm(-1)	-0.31654	0.16554	0.077*
R ²	0.94933		
R bar squared	0.79730		
DW statistic	3.0094		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

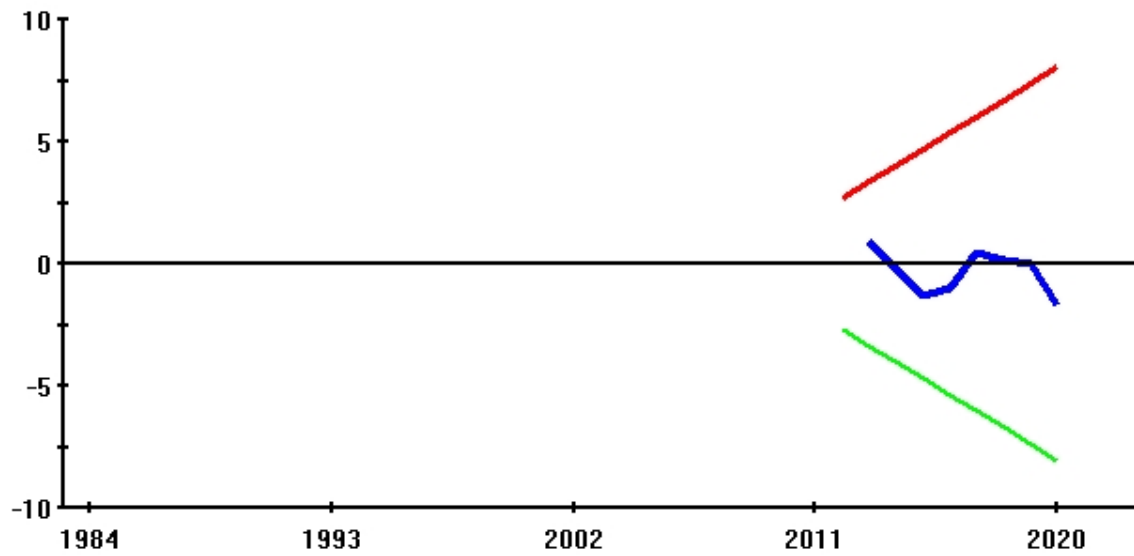
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	1.2911	0.256	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.77376	0.389	No serial-autocorrelation present
Heteroscedasticity: LM version	0.67577	0.411	No heteroscedasticity present
Heteroscedasticity: F version	0.65179	0.425	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

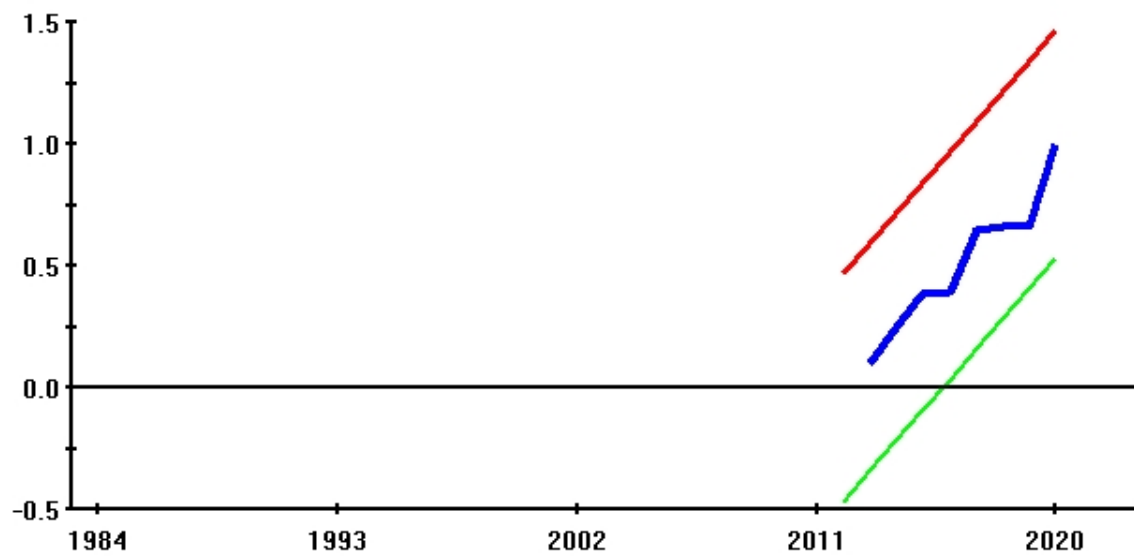
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 26. Solow Model Augmented with LREMIT, LDCPS, Interaction Term and Financial Liberalisation

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	50.4535	3.3730	4.7941	2.8535	4.0952	H ₀ is rejected at 5% and 10% significance.
W	353.1747	23.6113	33.5589	19.9745	28.6661	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,4,4,3,4,4,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	4.1171	2.0434	0.181
TREND	0.038117	0.0031547	0.007***
LREMIT	-0.32604	0.047990	0.021**
LDCPS	0.090716	0.064261	0.294
LREMIT*LDCPS	0.11130	0.017164	0.023**
LPOPG	-0.47133	0.85926	0.638
LGFCF	-0.16249	0.072798	0.155
FINLIB	0.25843	0.061214	0.052*

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LDCPS: Long-Run Coefficients

$$LGDP = 0.090716(LDCPS) - 0.32604(LREMIT) + 0.11130(LREMIT * LDCPS)$$

$$\begin{aligned} \frac{dLGDP}{dLREMIT} &= -0.32604 + 0.11130(8.9002) \\ &= 0.664552 \end{aligned}$$

Therefore, the joint effect is 0.6646%

Test for significance:

$H_0: LREMIT * LDCPS = 0$
 $F(\alpha=0.05, 34, 2) = 19.46$
 Prob > F = 0.000 (significant at 1%)

Error Correction Model

ECM for ARDL (4,4,4,3,4,4,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	-0.043272	0.031190	0.000***
dLREMIT1	0.23357	0.033873	0.000***
dLREMIT2	0.11510	0.015738	0.000***
dLREMIT3	0.017850	0.0056302	0.013**
dLDCPS	0.011630	0.016465	0.500
dLDCPS1	-0.3034E-3	0.034005	0.993
dLDCPS2	-0.060541	0.023059	0.030**
dLDCPS3	0.030277	0.010219	0.018**
dLREMIT*LDCPS	0.016867	0.011381	0.177
dLREMIT*LDCPS1	-0.073797	0.015810	0.002***
dLREMIT*LDCPS2	-0.034295	0.0082570	0.002***
dLPOPG	-13.3489	2.9642	0.002***
dLPOPG1	38.9050	8.2649	0.002***
dLPOPG2	-45.5767	9.2196	0.001***
dLPOPG3	18.7721	4.6207	0.004***
dLGFCF	-0.061012	0.013079	0.002***
dLGFCF1	0.11520	0.046937	0.040**
dLGFCF2	0.10999	0.038979	0.022**
dLGFCF3	0.067634	0.020408	0.011**
dFINLIB	-0.021299	0.024783	0.415
dFINLIB1	-0.19310	0.058557	0.011**
dFINLIB2	-0.20129	0.024182	0.000***
dFINLIB3	0.047868	0.018465	0.032**
dTREND	0.038273	0.0075851	0.001***
ecm(-1)	-1.0041	0.25970	0.005***
R ²	0.99882		
R bar squared	0.97881		
DW statistic	3.0931		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LDCPS: Short-Run Coefficients

$$LGDP = 0.011630(LDCPS) - 0.043272 (LREMIT) + 0.016867(LREMIT * LDCPS)$$

$$\frac{dLGDP}{dLREMIT} = -0.043272 + 0.016867(8.9002)$$

$$= 0.106848$$

Therefore, the joint effect is 0.1068%

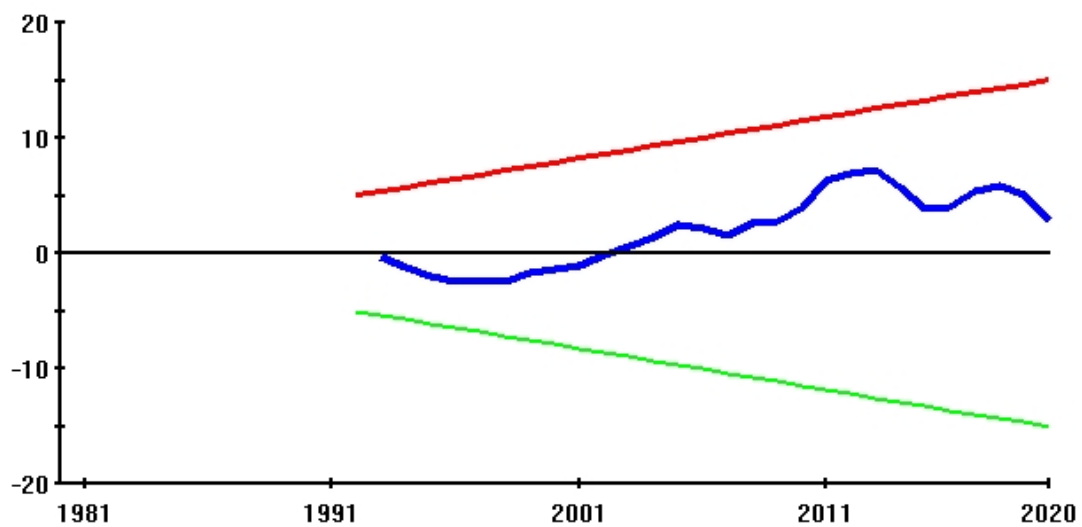
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.23045	0.631	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.16255	0.690	No serial-autocorrelation present
Heteroscedasticity: LM version	0.88604	0.347	No heteroscedasticity present
Heteroscedasticity: F version	0.85871	0.360	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

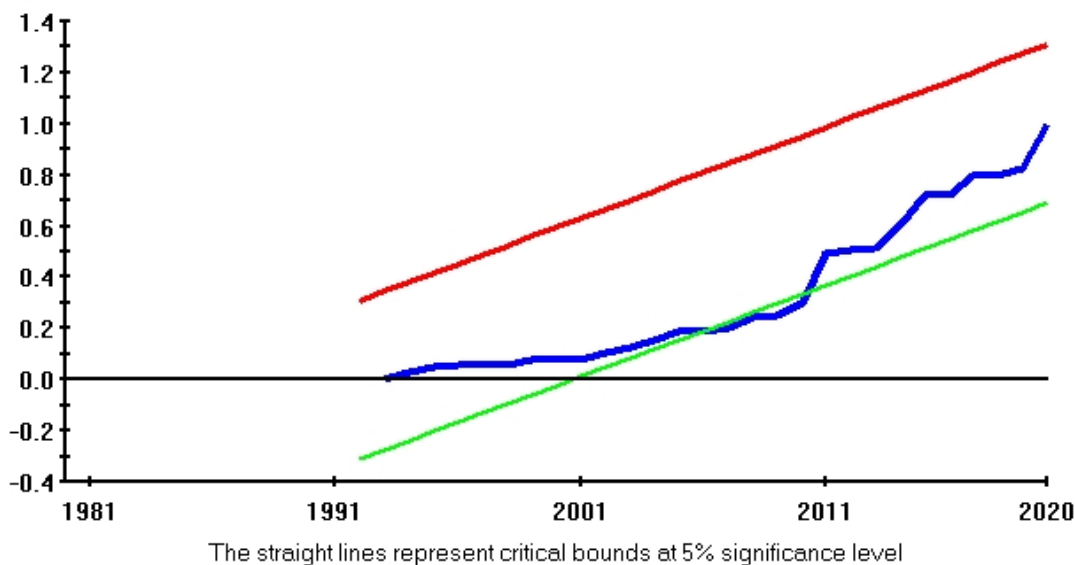
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 27. Solow Model Augmented with LREMIT, LDCPS and 1973 Oil Price Boom

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	5.0037	3.6510	4.9653	3.0488	4.2251	H ₀ is rejected at 5% and 10% significance.
W	30.0225	21.9063	29.7915	18.2927	25.3508	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,4,0,3,2,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	13.6950	1.6642	0.000
TREND	0.039167	0.003082	0.000
LREMIT	0.010538	0.013855	0.461
LDCPS	-0.079050	0.028755	0.071
LPOPG	2.9137	0.67021	0.001
LGFCF	-0.062381	0.051119	0.244
OIL	0.28731	0.044216	0.000

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,0,4,3,2,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.030569	0.0066434	0.000
dLDCPS	-0.062263	0.026013	0.028
dLPOPG	-7.7268	3.7102	0.053
dLGFCF	-0.053748	0.021677	0.024
dOIL	0.0038023	0.037960	0.921
dTREND	0.030850	0.0069963	0.000
ecm(-1)	-0.78764	0.21466	0.002
R ²	0.89370		
R bar squared	0.70563		
DW statistic	2.8270		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

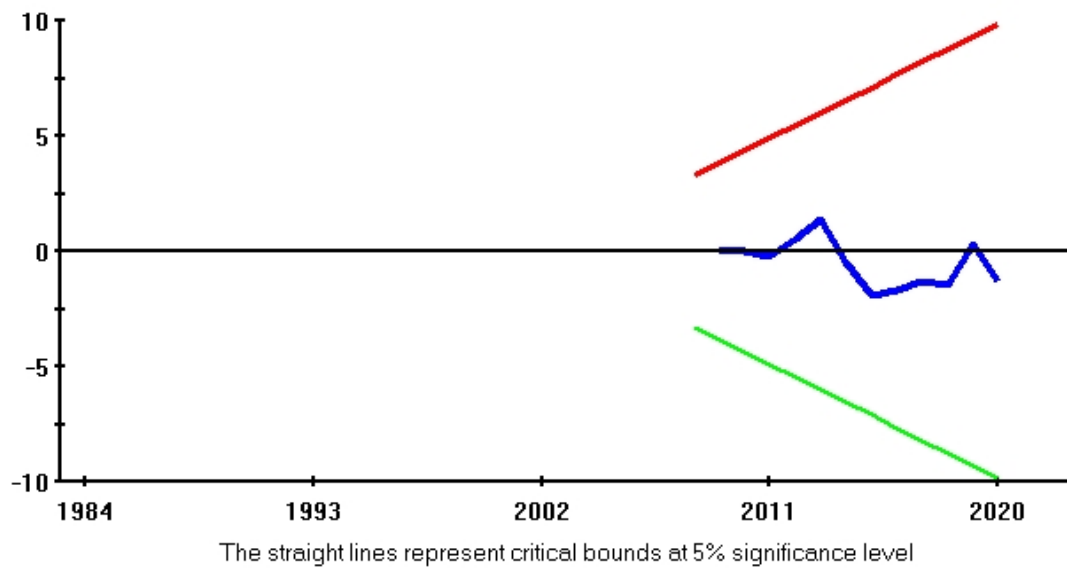
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	2.8736	0.090	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	2.1477	0.154	No serial-autocorrelation present
Heteroscedasticity: LM version	4.9165	0.027	Heteroscedasticity is present
Heteroscedasticity: F version	5.3372	0.027	Heteroscedasticity is present

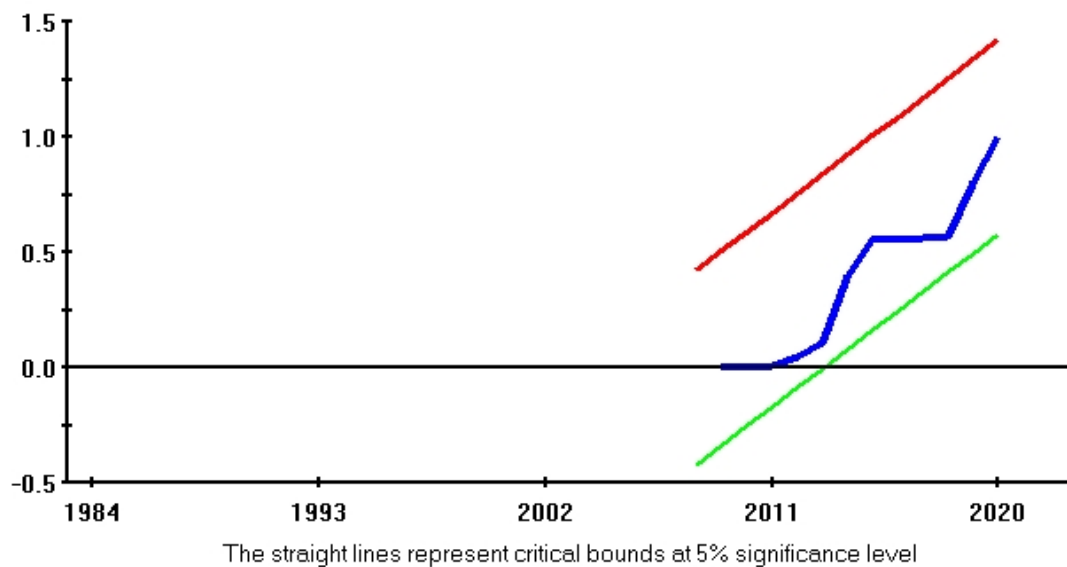
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 28. Solow Model Augmented with LREMIT, LDCPS, Interaction Term and 1973 Oil Price Boom

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	9.9040	3.3730	4.7941	2.8535	4.0952	H ₀ is rejected at 5% and 10% significance.
W	69.3278	23.6113	33.5589	19.9745	28.6661	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (3,4,4,4,4,4) approach to cointegration				
Dependent variable: LGDP				
Variable	Coefficient	Standard error	P-value	
CONS	24.6670	8.3175	0.097*	
TREND	0.049382	0.0083922	0.028**	
LREMIT	0.13279	0.15297	0.477	
LDCPS	-0.13342	0.10436	0.329	
LREMIT*LDCPS	-0.061614	0.066867	0.454	
LPOPG	7.1693	3.2275	0.156	
LGFCF	0.026051	0.10823	0.832	
OIL	1.3129	0.58535	0.154	

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (3,4,4,4,4,4) approach to cointegration				
Dependent variable: dLGDP				
Variable	Coefficient	Standard error	P-value	
dLREMIT	-0.10775	0.072297	0.174	
dLREMIT1	-0.35705	0.18022	0.083*	
dLREMIT2	0.17165	0.052410	0.011**	
dLDCPS	-0.10024	0.055311	0.108	
dLDCPS1	-0.21651	0.079964	0.027**	
dLDCPS2	-0.38462	0.12555	0.016**	

dLDCPS3	-0.15025	0.051981	0.020**
dLREMIT*LDCPS	0.028839	0.026926	0.315
dLREMIT*LDCPS1	0.12237	0.065957	0.101
dLREMIT*LDCPS2	-0.041003	0.013415	0.016**
dLREMIT*LDCPS3	0.028119	0.019250	0.182
dLPOPG	63.1105	31.5192	0.080*
dLPOPG1	-172.8891	78.2024	0.058*
dLPOPG2	199.0505	83.9137	0.045**
dLPOPG3	-116.0290	43.1606	0.028**
dLGFCF	0.069185	0.063067	0.305
dLGFCF1	-0.10197	0.10921	0.378
dLGFCF2	-0.39240	0.17655	0.057*
dLGFCF3	-0.25875	0.11489	0.054*
dOIL	1.0970	0.40544	0.027**
dOIL1	-0.89701	0.40150	0.056*
dOIL2	-1.0624	0.45547	0.048**
dOIL3	-0.055256	0.11327	0.639
dTREND	0.070157	0.010166	0.000***
ecm(-1)	-1.4207	0.25764	0.001***
R ²	0.99995		
R bar squared	0.99915		
DW statistic	3.6061		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

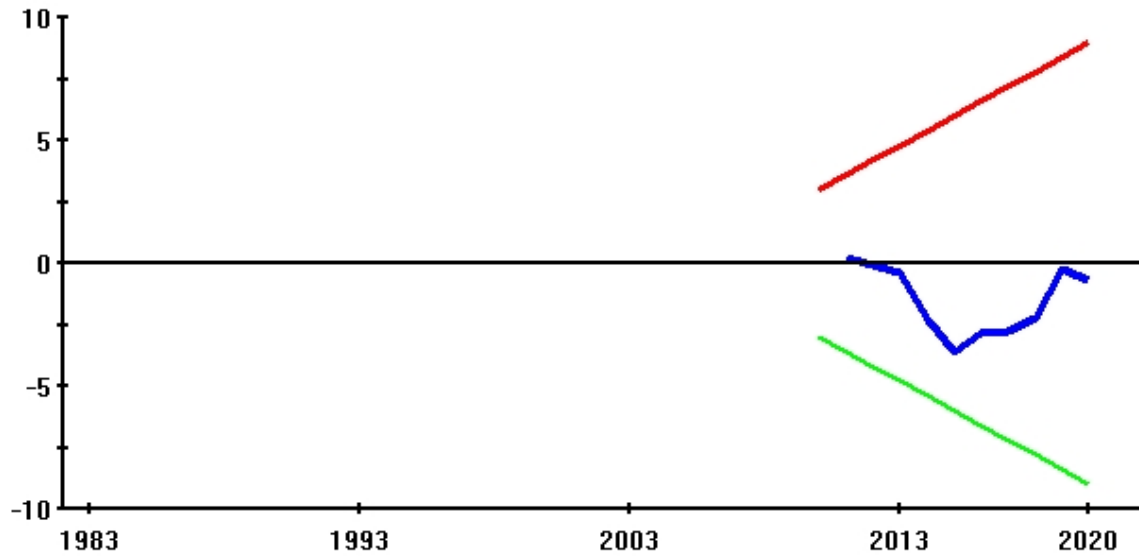
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	12.3894	0.000	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	4.8376	0.052	Serial-autocorrelation is present
Heteroscedasticity: LM version	0.38513	0.535	No heteroscedasticity present
Heteroscedasticity: F version	0.36814	0.548	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

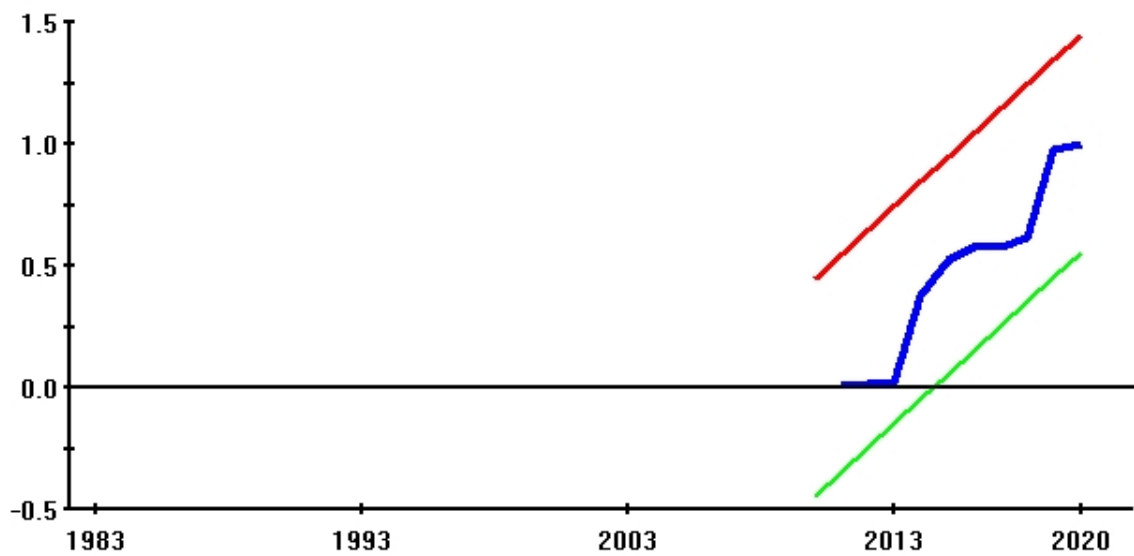
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 29. Solow Model Augmented with LREMIT, LDCPS and 2008 Global Financial Crisis

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	6.0972	3.6510	4.9653	3.0488	4.2251	H ₀ is rejected at 5% and 10% significance.
W	36.5835	21.9063	29.7915	18.2927	25.3508	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0,1,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	15.4106	3.0849	0.000***
TREND	0.037568	0.0031926	0.000***
LREMIT	-0.0081665	0.016240	0.620
LDCPS	-0.011579	0.051436	0.824
LPOPG	3.6812	1.2594	0.007***
LGFCF	-0.25014	0.069702	0.001***
GFC08	0.65382	0.20712	0.004***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,0,1,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	-0.0022374	0.0044062	0.616
dLDCPS	-0.0031724	0.014371	0.827
dLPOPG	1.0085	0.33240	0.005***
dLGFCF	-0.034564	0.016133	0.042**
dGFC08	-0.011836	0.016008	0.466
dTREND	0.010293	0.0025022	0.000***
ecm(-1)	-0.27397	0.071459	0.001***

R ²	0.74548
R bar squared	0.61821
DW statistic	1.9049

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

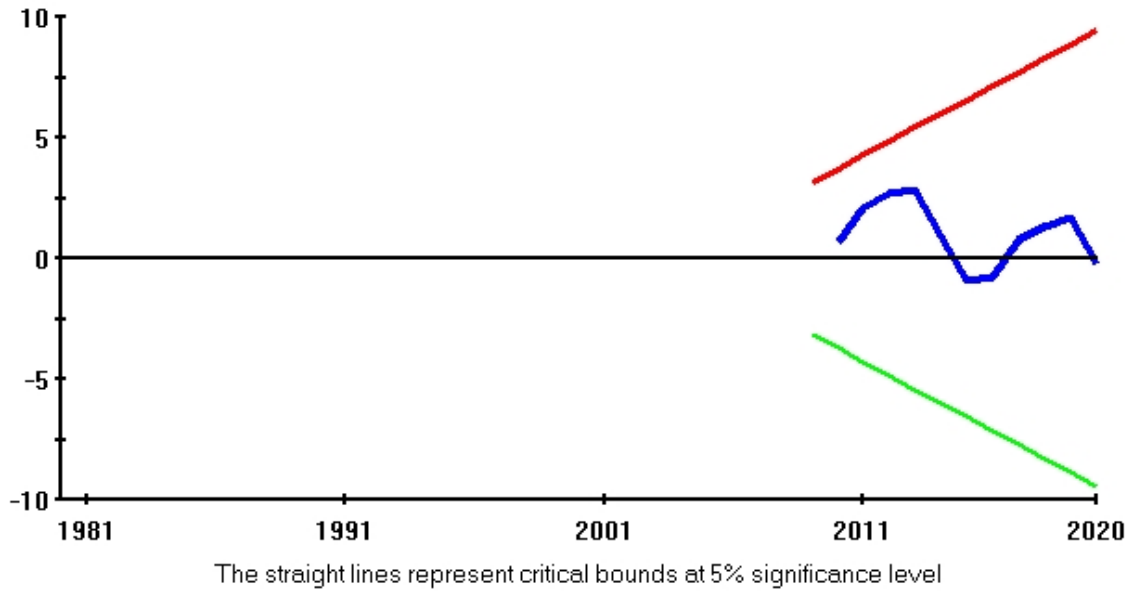
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.42440	0.515	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.26688	0.610	No serial-autocorrelation present
Heteroscedasticity: LM version	1.8060	0.179	No heteroscedasticity present
Heteroscedasticity: F version	1.7961	0.189	No heteroscedasticity present

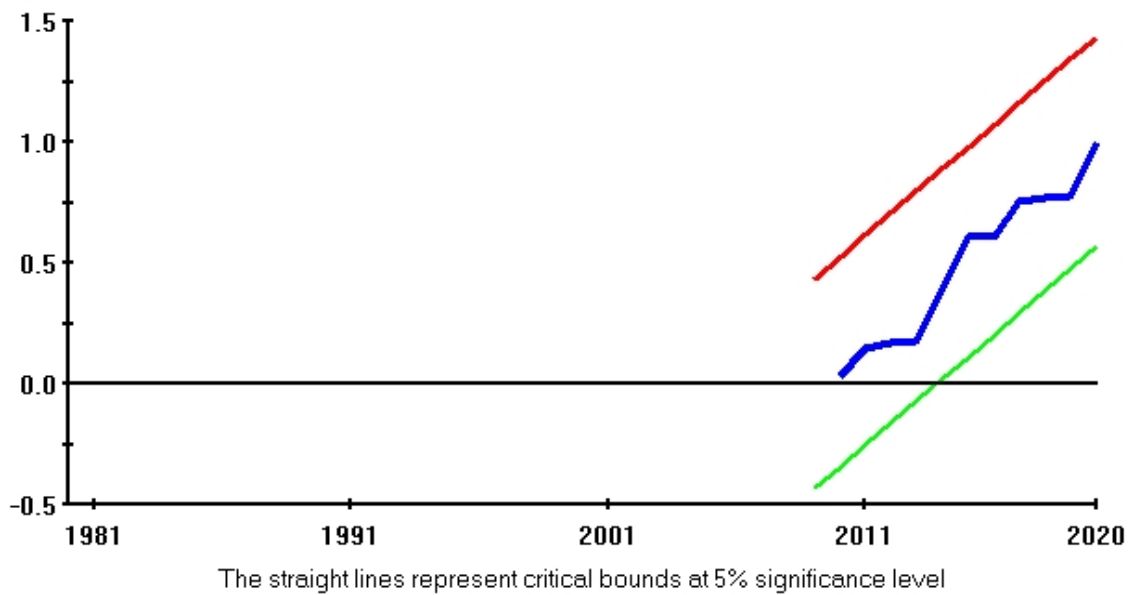
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 30. Solow Model Augmented with LREMIT, LDCPS, Interaction Term and 2008 Global Financial Crisis

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	4.2701	3.3730	4.7941	2.8535	4.0952	H ₀ is rejected at 5% and 10% significance.
W	29.8908	23.6113	33.5589	19.9745	28.6661	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,4,4,4,3,4,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	6.3973	0.91213	0.020**
TREND	0.024415	0.9903E-3	0.002***
LREMIT	-0.064973	0.0092731	0.020**
LDCPS	-0.064962	0.016485	0.059*
LREMIT*LDCPS	0.050735	0.0015376	0.001***
LPOPG	-0.023382	0.36752	0.955
LGFCF	-0.079042	0.021406	0.066*
GFC08	0.53638	0.090376	0.027**

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,4,4,4,3,4,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	-0.33562	0.17915	0.098*
dLREMIT1	0.45979	0.17472	0.030**
dLREMIT2	0.19823	0.082118	0.042**
dLREMIT3	0.052634	0.025273	0.071*
dLDCPS	-0.030884	0.049924	0.553
dLDCPS1	0.096514	0.11008	0.406

dLDCPS2	-0.092387	0.047872	0.090*
dLDCPS3	0.089483	0.059957	0.174
dLREMIT*LDCPS	0.11603	0.072231	0.147
dLDCPS*LREMIT1	-0.30672	0.10408	0.019**
dLDCPS*LREMIT2	-0.17158	0.059389	0.020**
dLDCPS*LREMIT3	-0.032866	0.012576	0.031**
dLPOPG	-97.5501	41.9105	0.048**
dLPOPG1	175.0436	74.0600	0.046**
dLPOPG2	-92.1154	36.9709	0.037**
dLGFCF	-0.15782	0.065462	0.042**
dLGFCF1	0.15141	0.11798	0.235
dLGFCF2	0.15472	0.080216	0.090*
dLGFCF3	0.17541	0.067879	0.032**
dGFC08	0.54169	0.18545	0.019**
dGFC081	-2.6057	0.79629	0.011**
dGFC082	-1.8035	0.56896	0.013**
dGFC083	-0.73610	0.24530	0.017**
dTREND	0.17433	0.072204	0.042**
ecm(-1)	-7.1401	2.8376	0.036**
R ²	0.99991		
R bar squared	0.99846		
DW statistic	3.5214		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

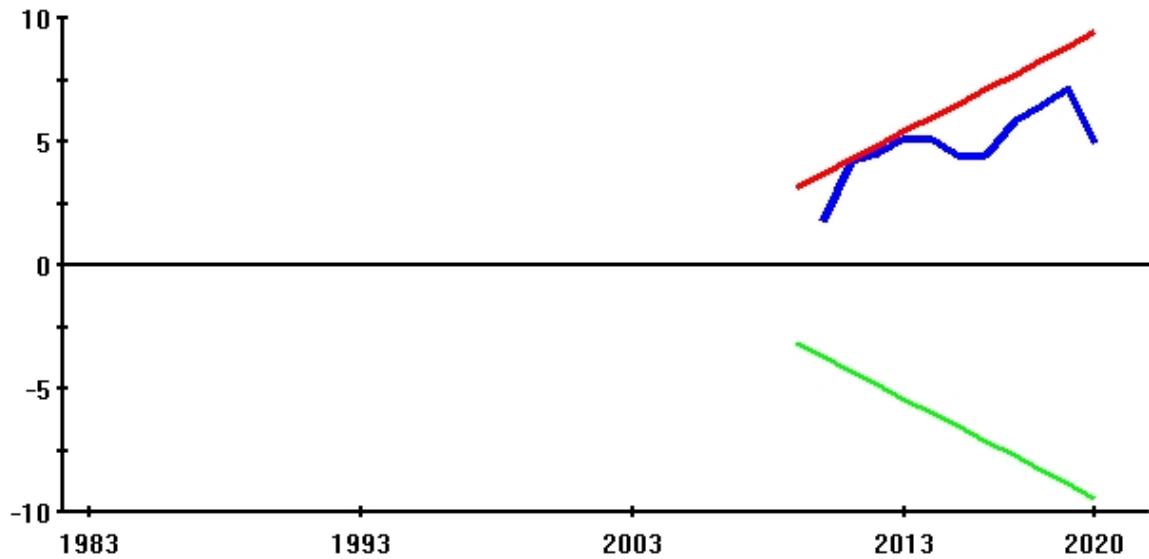
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	6.9821	0.008	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	4.9522	0.037	Serial-autocorrelation is present
Heteroscedasticity: LM version	0.28711	0.592	No heteroscedasticity present
Heteroscedasticity: F version	0.27371	0.604	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

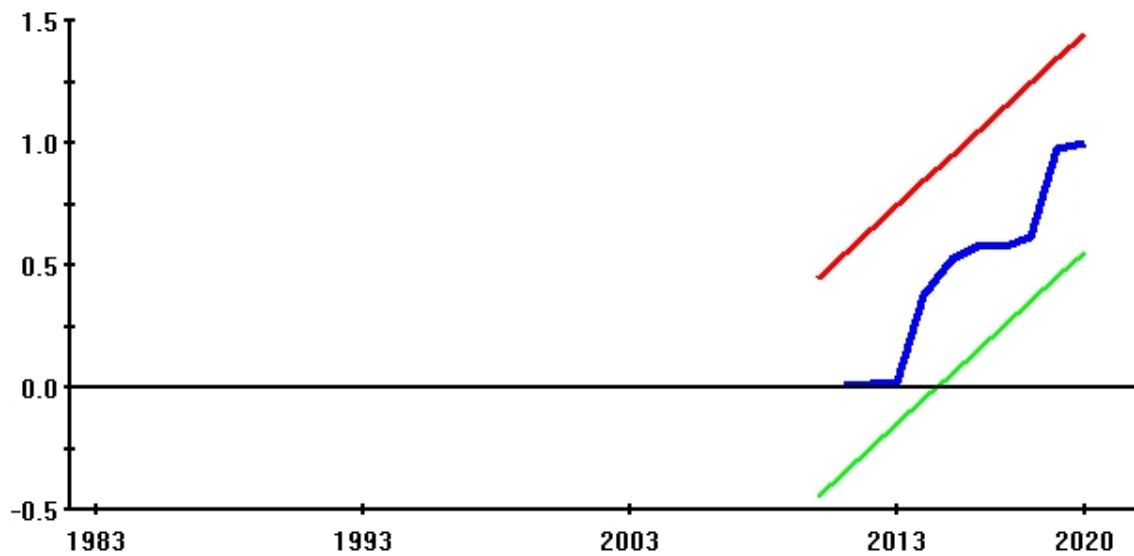
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 31. Solow Model Augmented with LREMIT and LM2

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	1.4283	4.0405	5.3296	3.3660	4.4809	H ₀ cannot be rejected at 5% and 10% significance.
W	7.1417	20.2025	26.6482	16.8298	22.4044	H ₀ cannot be rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,1,0,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	12.6753	3.0033	0.000***
TREND	0.034601	0.0041312	0.000***
LREMIT	0.022450	0.020411	0.281
LM2	-0.19842	0.069876	0.009***
LPOPG	2.2874	1.2343	0.075*
LGFCF	-0.10103	0.053723	0.071*

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,1,0,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.022391	0.0061434	0.001***
dLM2	-0.061821	0.032281	0.066*
dLPOPG	0.71268	0.38040	0.072*
dLGFCF	-0.031479	0.020866	0.143
dTREND	0.010781	0.0030145	0.001***
ecm(-1)	-0.31157	0.10783	0.008***
R ²	0.57906		
R bar squared	0.41717		
DW statistic	2.1899		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

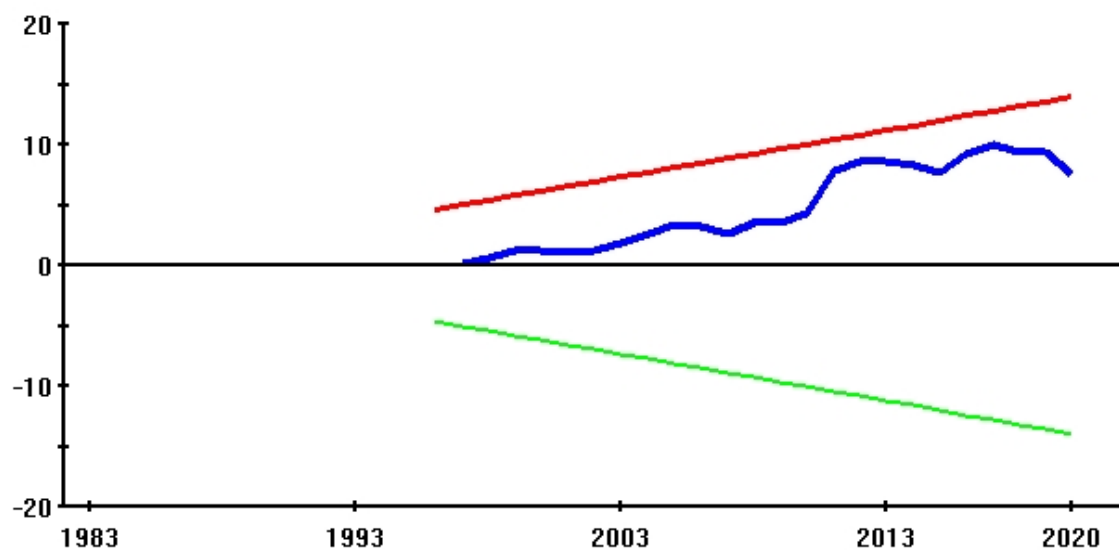
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	1.4939	0.222	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	1.0518	0.315	No serial-autocorrelation present
Heteroscedasticity: LM version	1.3469	0.246	No heteroscedasticity present
Heteroscedasticity: F version	1.3222	0.258	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

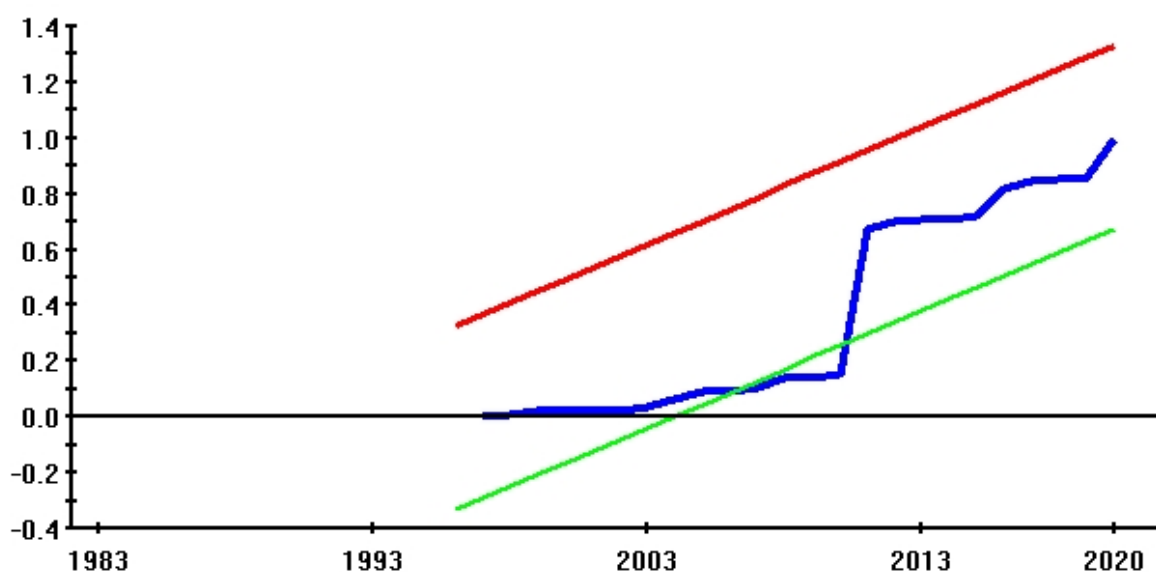
CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 32. Solow Model Augmented with LREMIT, LM2 and Interaction Term

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	9.9653	3.6510	4.9653	3.0488	4.2251	H ₀ is rejected at 5% significance and 10% significance.
W	59.7921	21.9063	29.7915	18.2927	25.3508	H ₀ is rejected at 5% significance and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,4,3,4,3,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	9.9916	1.1478	0.000***
TREND	0.030815	0.0019234	0.000***
LREMIT	-0.031042	0.066020	0.651

LM2	-0.22651	0.053659	0.003***
LREMIT*LM2	0.019676	0.020916	0.374
LPOPG	1.1921	0.43702	0.026**
LGFCF	-0.073551	0.025747	0.021**

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LM2: Long-Run Coefficients

$$LGDP = -0.22651(LM2) - 0.031042(LREMIT) + 0.019676(LREMIT * LM2)$$

$$\frac{dLGDP}{dLREMIT} = -0.031042 + 0.019676(22.9985)$$

$$= 0.421476$$

Therefore, the joint effect is 0.4215%

Test for significance:

$$H_0: LREMIT*LM2 = 0$$

$$F(\alpha=0.05, 28, 8) = 2.38302$$

Prob > F = 0.000 (significant at 1%)

Error Correction Model

ECM for ARDL (4,4,3,4,3,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.18644	0.073992	0.026**
dLREMIT1	0.0092409	0.064078	0.888
dLREMIT2	0.037738	0.047531	0.441
dLREMIT3	-0.044735	0.023573	0.080*
dLM2	-0.096397	0.030703	0.008***
dLM21	0.20048	0.059592	0.005***
dLM22	0.050198	0.037975	0.209
dLREMIT*LM2	-0.043558	0.021183	0.060*
dLM2*LREMIT1	-0.1498E-3	0.020599	0.994
dLM2*LREMIT2	-0.0058685	0.015236	0.706
dLM2*LREMIT3	0.020894	0.0080175	0.022**
dLPOPG	10.8716	6.7248	0.130
dLPOPG1	-18.7340	9.5410	0.071*
dLPOPG2	10.8743	4.6305	0.035**
dLGFCF	-0.036190	0.024710	0.167
dLGFCF1	0.041525	0.028339	0.167
dLGFCF2	-0.0026214	0.019671	0.896
dLGFCF3	-0.023485	0.014911	0.139
dTREND	0.041525	0.028339	0.167
ecm(-1)	-1.5304	0.33783	0.001***

R ²	0.95418
R bar squared	0.79380
DW statistic	2.2006

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LM2: Short-Run Coefficients

$$LGDP = -0.096397(LM2) + 0.18644(LREMIT) - 0.043558 (LREMIT * LM2)$$

$$\frac{dLGDP}{dLREMIT} = 0.18644 - 0.043558(22.9985)$$

$$= -0.815329$$

Therefore, the joint effect is -0.8153%

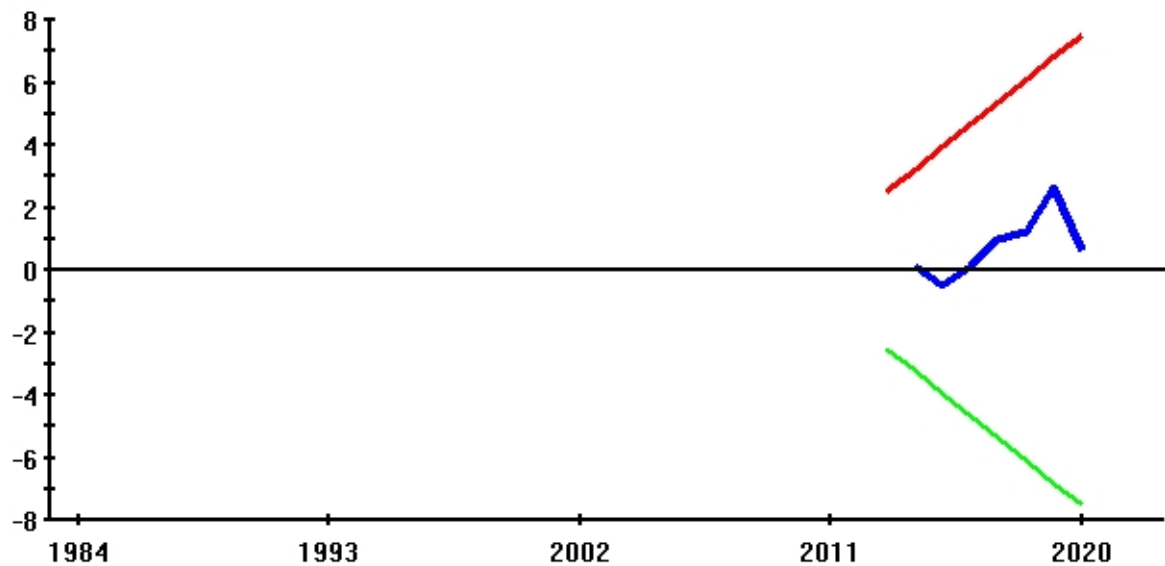
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	1.6855	0.194	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	1.1139	0.302	No serial-autocorrelation present
Heteroscedasticity: LM version	4.6976	0.030	Heteroscedasticity is present
Heteroscedasticity: F version	5.0781	0.030	Heteroscedasticity is present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

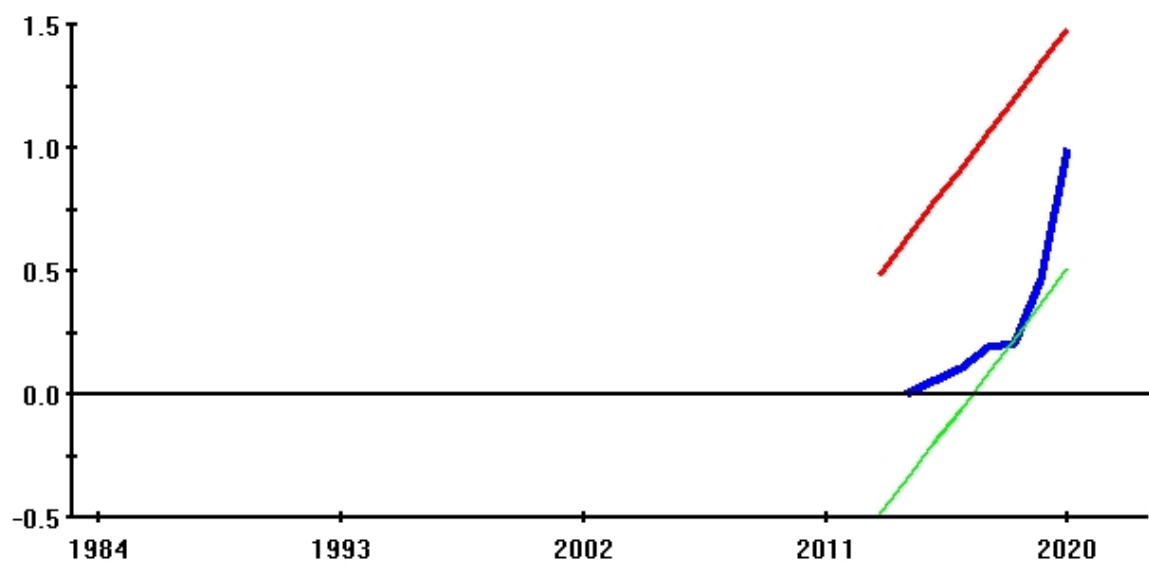
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 33. Solow Model Augmented with LREMIT, LM2 and Financial Liberalisation

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	14.6235	3.6510	4.9653	3.0488	4.2251	H ₀ is rejected at 5% and 10% significance.
W	87.7411	21.9063	29.7915	18.2927	25.3508	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (3,4,2,4,4,3) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	10.4349	1.1487	0.000***
TREND	0.035601	0.0020885	0.000***
LREMIT	-0.0033050	0.016297	0.843
LM2	-0.16599	0.030891	0.000***
LPOPG	1.5174	0.45160	0.007***
LGFCF	-0.15621	0.032085	0.001***
FINLIB	-0.023179	0.044641	0.615

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (3,4,2,4,4,3) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.026141	0.0055051	0.000***
dLREMIT1	0.041393	0.0077786	0.000***
dLREMIT2	0.033389	0.0048862	0.000***
dLREMIT3	0.028941	0.0049141	0.000***
dLM2	-0.050909	0.020813	0.027***
dLM21	0.097495	0.019821	0.000***
dLPOPG	-7.0074	3.3340	0.053*
dLPOPG1	24.3172	6.7326	0.003***

dLPOPG2	-26.0626	5.8416	0.000***
dLPOPG3	10.9593	2.5237	0.001***
dLGFCF	-0.062114	0.014893	0.001***
dLGFCF1	0.047389	0.027663	0.107
dLGFCF2	0.049591	0.024398	0.060*
dLGFCF3	0.028410	0.014895	0.076*
dFINLIB	-0.018015	0.017110	0.309
dFINLIB1	0.057689	0.024356	0.032**
dFINLIB2	-0.065402	0.016309	0.001***
dTREND	0.031104	0.0044716	0.000***
ecm(-1)	-0.87367	0.15949	0.000***
R ²	0.96188		
R bar squared	0.86276		
DW statistic	2.6181		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

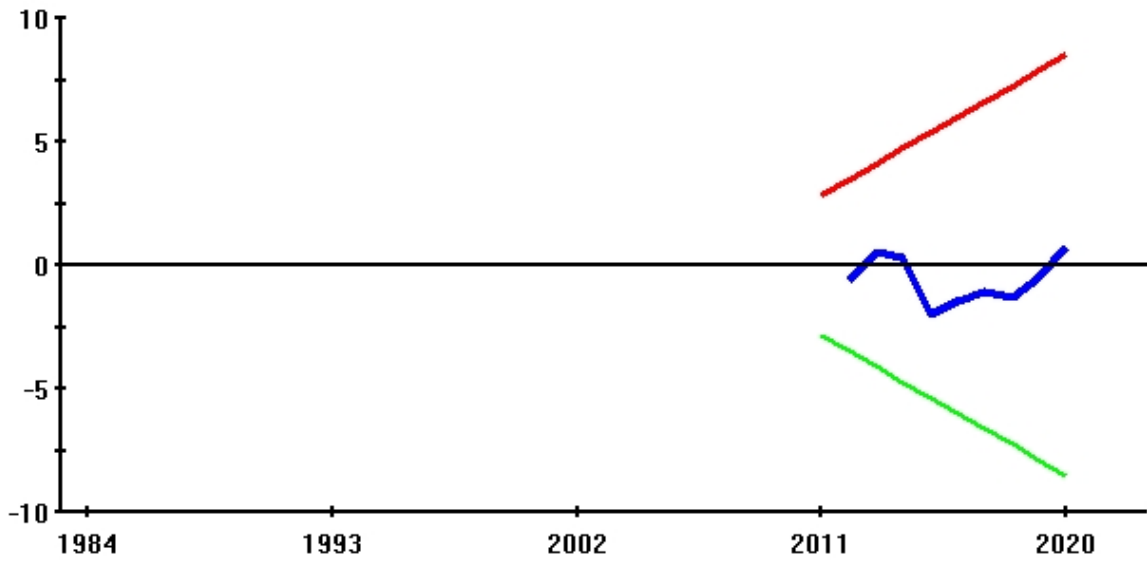
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	7.7247	0.005	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	2.3748	0.158	No serial-autocorrelation present
Heteroscedasticity: LM version	0.045443	0.831	No heteroscedasticity present
Heteroscedasticity: F version	0.043039	0.837	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

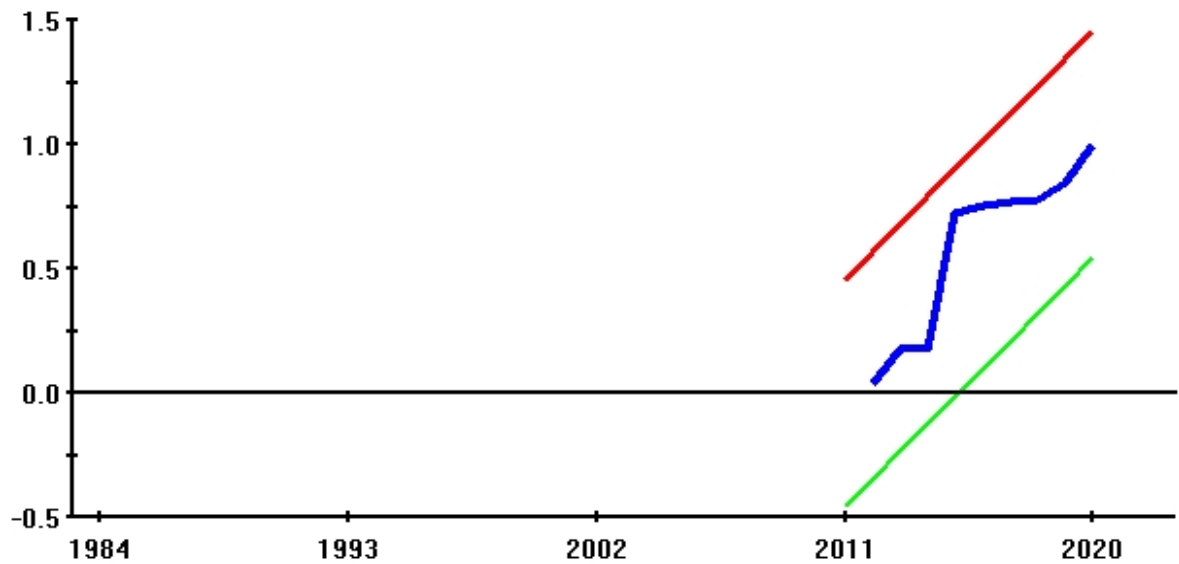
CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 34. Solow Model Augmented with LREMIT, LM2, Interaction Term and Financial Liberalisation

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	5.5012	3.3730	4.7941	2.8535	4.0952	H ₀ is rejected at 5% and 10% significance.
W	38.5081	23.6113	33.5589	19.9745	28.6661	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,4,4,4,4,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	6.3613	4.7145	0.406
TREND	0.024363	0.0041244	0.107
LREMIT	-0.40940	0.47394	0.546
LM2	-0.086693	0.21090	0.752
LREMIT*LM2	0.14361	0.14306	0.499
LPOPG	-0.11564	1.5864	0.954
LGFCF	0.0091465	0.055436	0.896
FINLIB	0.054057	0.10573	0.699

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,4,4,4,4,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	-0.20569	0.29514	0.508
dLREMIT1	0.066336	0.46476	0.891
dLREMIT2	-0.057223	0.28232	0.845
dLREMIT3	-0.16770	0.15727	0.322
dLM2	-0.11977	0.048463	0.043**
dLM21	0.041195	0.31300	0.899
dLM22	0.012920	0.18416	0.458
dLM23	0.069030	0.087831	0.442

dLREMIT*LM2	0.071018	0.086945	0.441
dLREMIT*LM21	-0.034105	0.14201	0.817
dLREMIT*LM22	0.010057	0.083860	0.908
dLREMIT*LM23	0.047996	0.046407	0.335
dLPOPG	-2.0707	14.9361	0.894
dLPOPG1	-26.2758	28.7883	0.392
dLPOPG2	38.6233	38.3298	0.347
dLPOPG3	-17.0607	19.5658	0.412
dLGFCF	-0.019120	0.028899	0.529
dLGFCF1	-0.091196	0.092996	0.359
dLGFCF2	-0.12905	0.10235	0.248
dLGFCF3	-0.079826	0.052757	0.174
dFINLIB	-0.024731	0.025641	0.367
dFINLIB1	-0.071081	0.16322	0.676
dFINLIB2	0.095372	0.15327	0.553
dFINLIB3	0.036499	0.064095	0.587
dTREND	0.040548	0.0076198	0.001***
ecm(-1)	-1.6644	0.41545	0.005***
R ²	0.99998		
R bar squared	0.99943		
DW statistic	2.9051		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

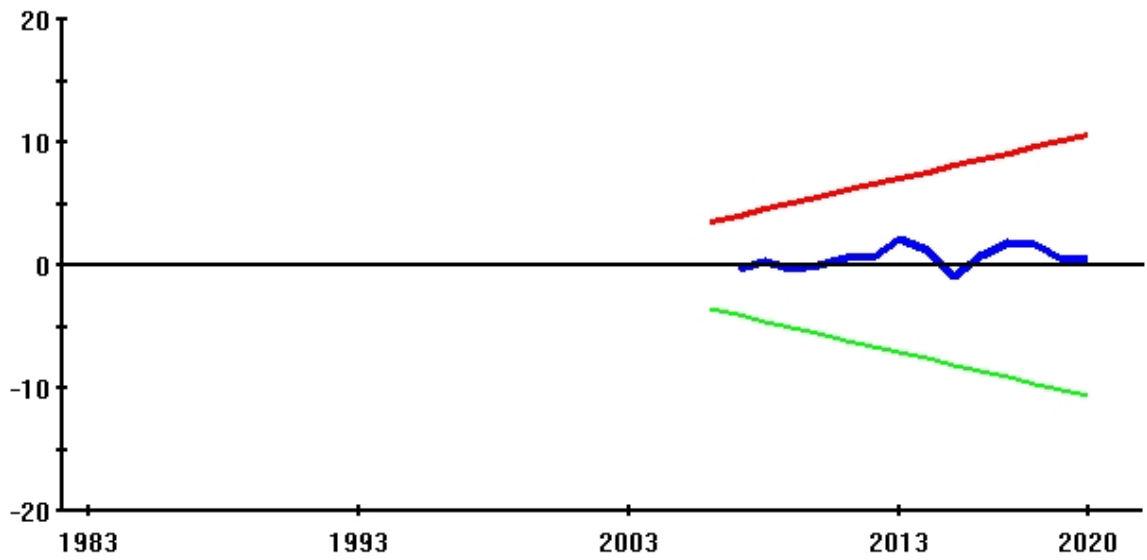
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	4.4948	0.034	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	1.8781	0.192	No serial-autocorrelation present
Heteroscedasticity: LM version	0.98558	0.321	No heteroscedasticity present
Heteroscedasticity: F version	0.95782	0.334	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

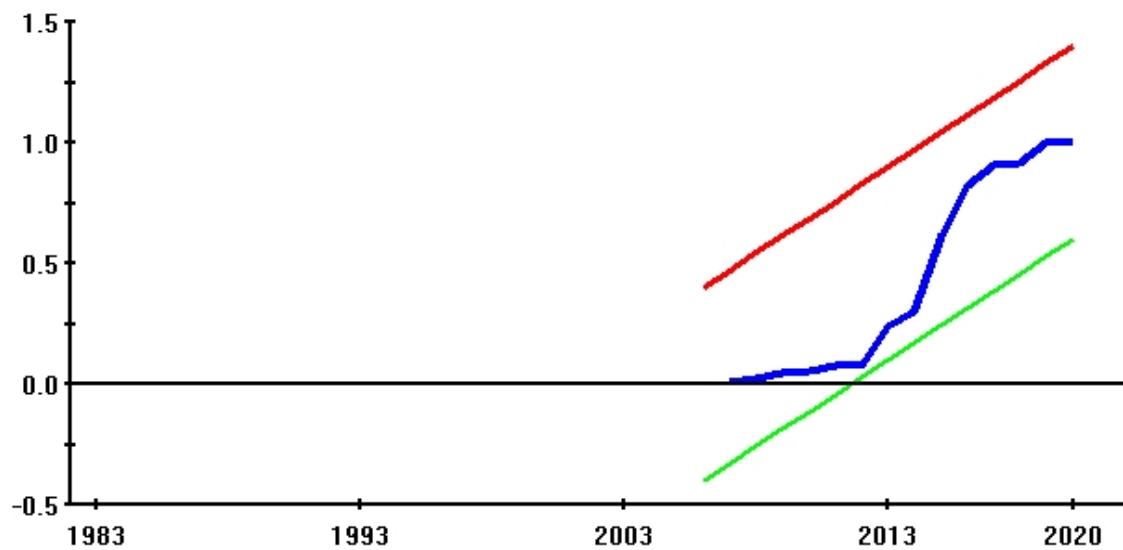
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 35. Solow Model Augmented with LREMIT, LM2 and 1973 Oil Price Boom

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	2.8541	3.6510	4.9653	3.0488	4.2251	H ₀ is rejected at 5% and 10% significance.
W	17.1246	21.9063	29.7915	18.2927	25.3508	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,4,0,0,0,2) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	13.6950	1.6642	0.000***
TREND	0.039167	0.003082	0.000***
LREMIT	0.010538	0.013855	0.461
LM2	-0.079050	0.028755	0.071*
LPOPG	2.9137	0.67021	0.001***
LGFCF	-0.062381	0.051119	0.244
OIL	0.28731	0.044216	0.000***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,4,0,0,0,2) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.031414	0.0067711	0.000***
dLREMIT1	0.024241	0.0082697	0.008***
dLREMIT2	0.014216	0.0052518	0.013**
dLREMIT3	0.0096120	0.0049747	0.066*
dLM2	-0.076954	0.029296	0.015**
dLPOPG	0.73007	0.37020	0.061*
dLGFCF	-0.033554	0.018569	0.084*
dOIL	-0.054412	0.030382	0.087*
dTREND	0.016279	0.0030311	0.000***
ecm(-1)	-0.42793	0.10869	0.001***
R ²	0.79054		
R bar squared	0.62298		

DW statistic

2.5306

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

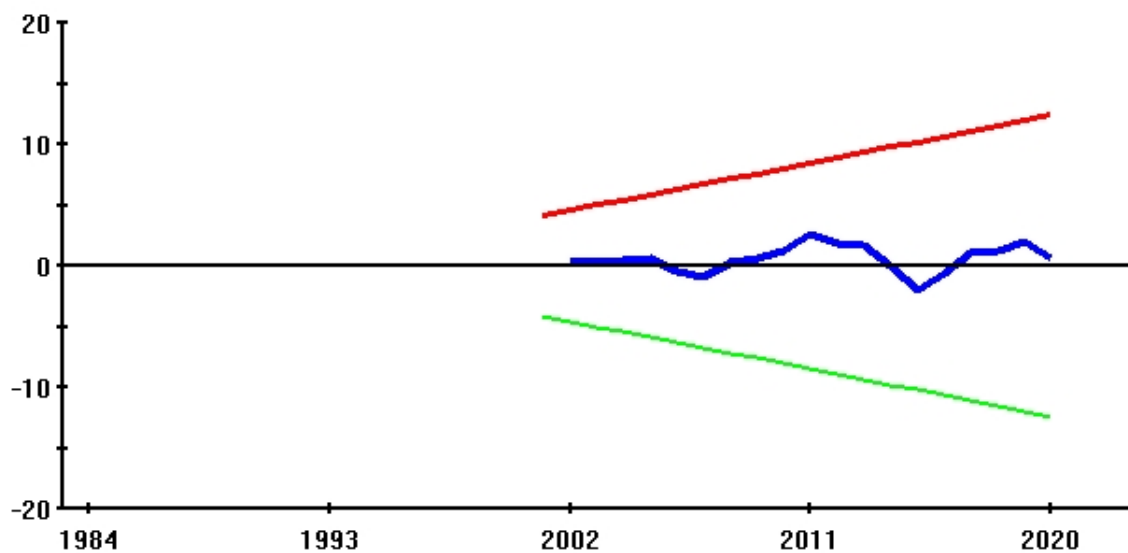
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	6.5508	0.010	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	4.0876	0.058	No serial-autocorrelation present
Heteroscedasticity: LM version	0.65146	0.420	No heteroscedasticity present
Heteroscedasticity: F version	0.62729	0.434	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

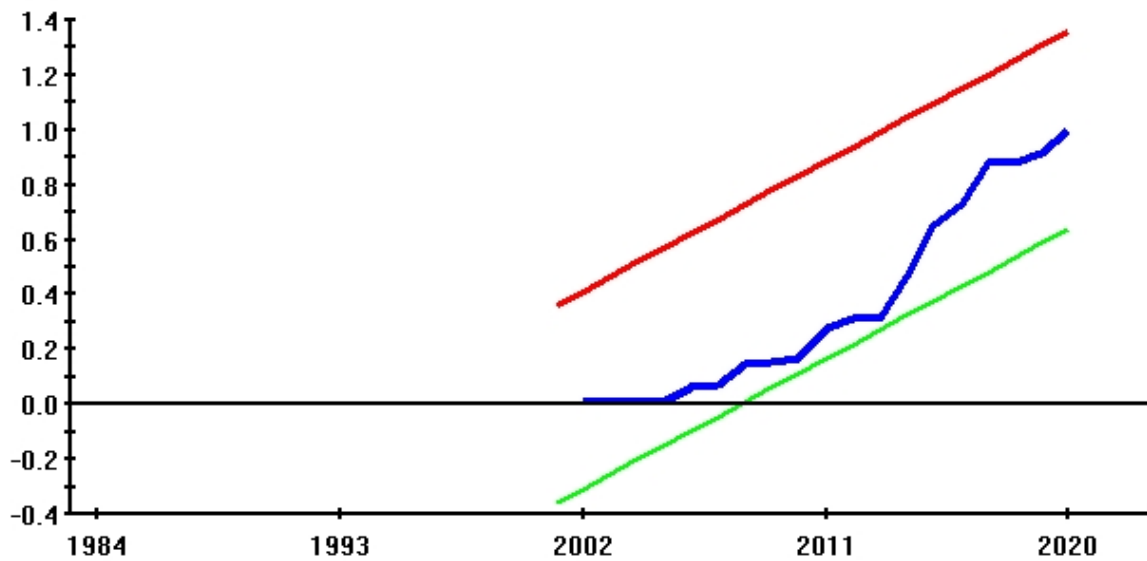
CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 36. Solow Model Augmented with LREMIT, LM2, Interaction Term and 1973 Oil Price Boom

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	6.2678	3.3730	4.7941	2.8535	4.0952	H ₀ is rejected at 5% and 10% significance.
W	43.8747	23.6113	33.5589	19.9745	28.6661	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-Rrn relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (3,2,0,4,1,3) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	8.2610	1.1776	0.000***
TREND	0.030546	0.0014205	0.000***
LREMIT	-0.26239	0.045164	0.000***
LM2	-0.090640	0.024144	0.002***
LREMIT*LM2	0.088608	0.014865	0.000***
LPOPG	0.69070	0.48607	0.179
LGFCF	-0.071169	0.015874	0.001***
OIL	-0.038251	0.038246	0.335

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (3,2,0,4,1,3) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	-0.2907E-3	0.041128	0.994
dLREMIT1	0.13346	0.028917	0.000***
dLM2	-0.10263	0.028199	0.002***
dLREMIT*LM2	0.011551	0.012853	0.381
dLM2*LREMIT1	-0.036057	0.0093788	0.001***
dLM2*LREMIT2	0.0022248	0.0017570	0.222
dLM2*LREMIT3	0.0039492	0.0013077	0.007***
dLPOPG	-8.3598	2.8446	0.009***
dLPOPG1	11.4160	4.3293	0.017**
dLPOPG2	-5.6476	2.7192	0.052*
dLGFCF	-0.048250	0.013337	0.002***
dOIL	-0.11404	0.044291	0.019**
dOIL1	-0.0047070	0.034127	0.892
dOIL2	0.12132	0.029018	0.001***
dTREND	0.034587	0.0038684	0.000***
ecm(-1)	-1.1323	0.14257	0.000***
R ²	0.93942		
R bar squared	0.83223		
DW statistic	2.7211		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

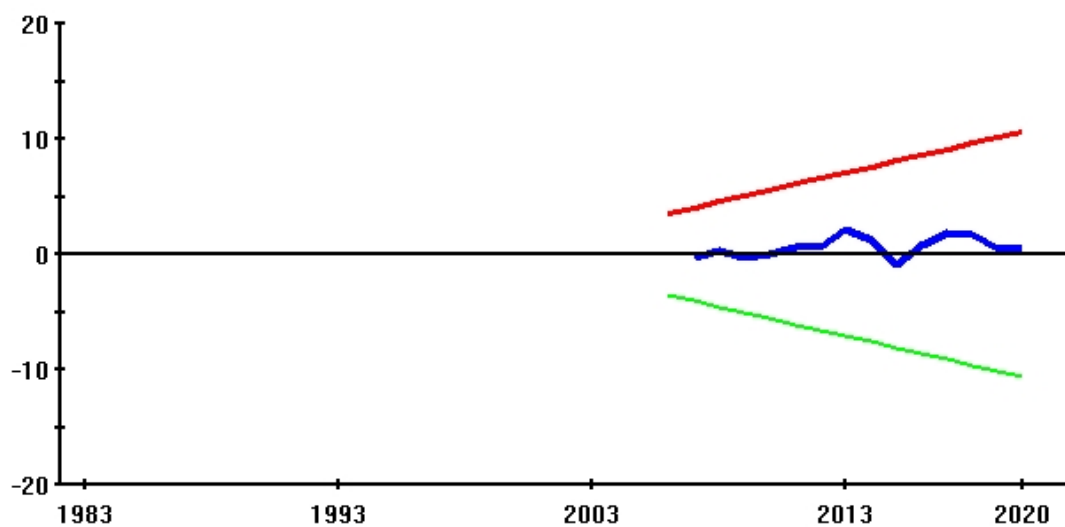
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	2.6653	0.103	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	1.7349	0.201	No serial-autocorrelation present
Heteroscedasticity: LM version	3.5415	0.060	Heteroscedasticity is present
Heteroscedasticity: F version	3.6999	0.062	Heteroscedasticity is present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

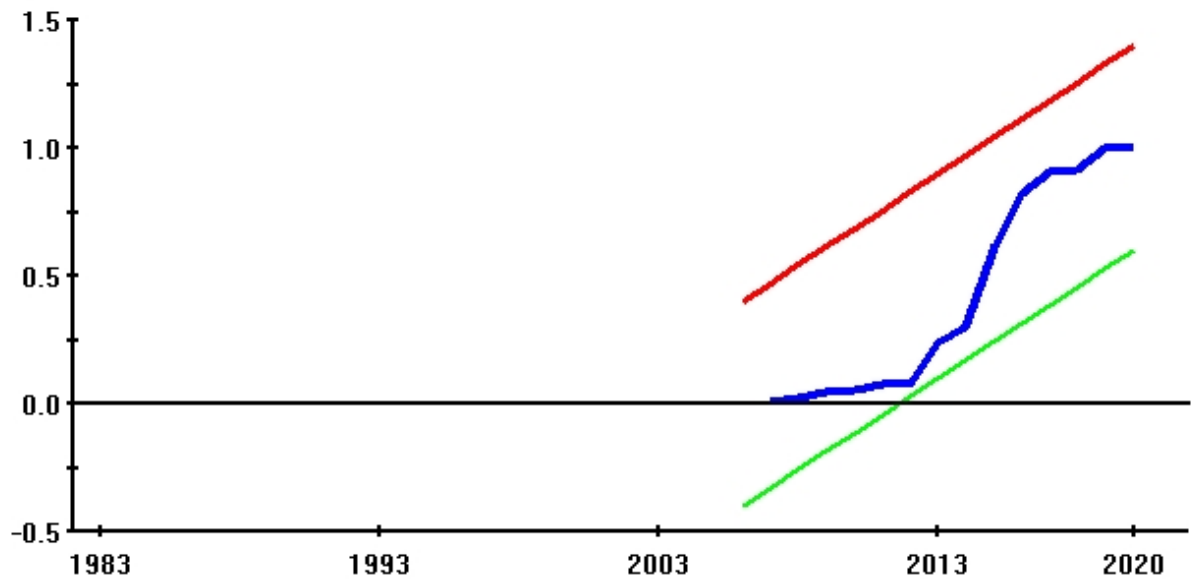
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 37. Solow Model Augmented with LREMIT, LM2 and 2008 Global Financial Crisis

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	6.9671	3.6510	4.9653	3.0488	4.2251	H ₀ is rejected at 5% and 10% significance.
W	41.8025	21.9063	29.7915	18.2927	25.3508	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0,1,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	11.6541	1.7386	0.000
TREND	0.034591	0.0020430	0.000
LREMIT	0.8778E-3	0.010440	0.934
LM2	-0.16859	0.050169	0.003
LPOPG	1.9604	0.73497	0.013
LGFCF	-0.15814	-4.0116	0.001
GFC08	0.50530	0.12111	0.000

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,0,1,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.3301E-3	0.0039343	0.934
dLM2	-0.063398	0.022637	0.009***
dLPOPG	0.73722	0.27846	0.014**
dLGFCF	-0.031071	0.013474	0.029**
dGFC08	-0.0088198	0.013798	0.528
dGFC081	-0.19044	0.026052	0.000***
dGFC082	-0.11861	0.022080	0.000***
dGFC083	-0.046146	0.015002	0.005***
dTREND	0.013008	0.0022676	0.000***
ecm(-1)	-0.37605	0.069501	0.000***
R ²	0.80778		
R bar squared	0.71167		
DW statistic	2.2357		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Diagnostic tests

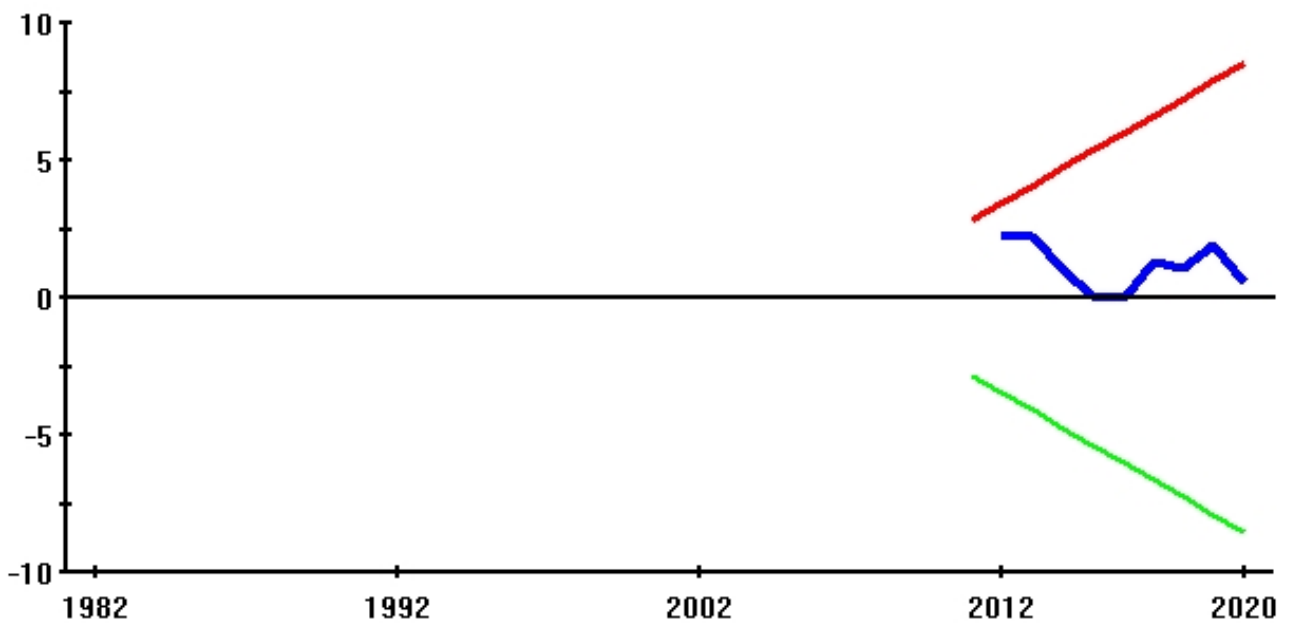
Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	1.7838	0.182	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	1.1650	0.292	No serial-autocorrelation present
Heteroscedasticity: LM version	1.5115	0.219	No heteroscedasticity present

Heteroscedasticity: version	F	1.4907	0.230	No heteroscedasticity present
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Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

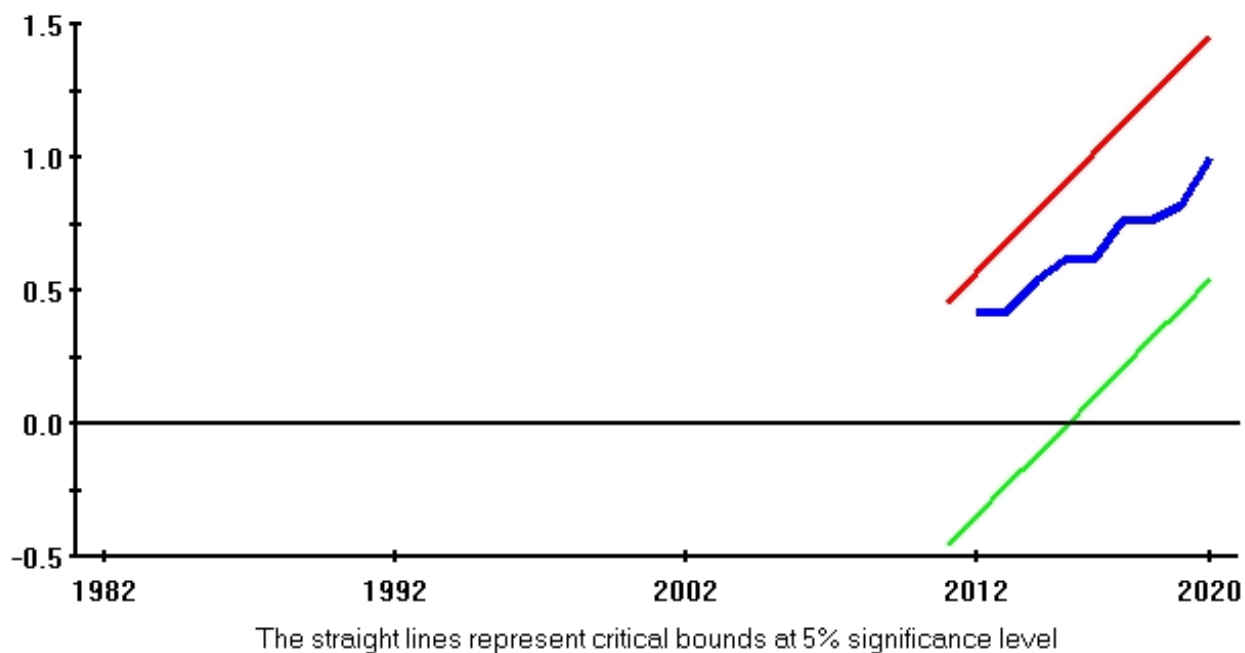
CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 38. Solow Model Augmented with LREMIT, LM2, Interaction Term and 2008 Global Financial Crisis

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	24.5338	3.3730	4.7941	2.8535	4.0952	H ₀ is rejected at 5% and 10% significance.
W	171.7365	23.6113	33.5589	19.9745	28.6661	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,3,4,4,4,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	9.5246	0.70653	0.005***
TREND	0.031782	0.0021221	0.004***
LREMIT	0.062189	0.083125	0.532
LM2	-0.29894	0.058654	0.036**
LREMIT*LM2	-0.010313	0.026605	0.736
LPOPG	0.92374	0.27407	0.078*
LGFCF	-0.062186	0.057006	0.389
GFC08	-0.020823	0.28366	0.948

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,3,4,4,4,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.40986	0.11979	0.009***
dLREMIT1	0.031042	0.13297	0.821
dLREMIT2	0.048243	0.086323	0.592
dLM2	-0.10812	0.016998	0.000***
dLM21	0.27860	0.059241	0.002***
dLM22	0.092167	0.036308	0.035**
dLREMIT*LM2	-0.11484	0.039007	0.019**
dLREMIT*LM21	-0.0050592	0.047436	0.918
dLREMIT*LM22	-0.0053785	0.032618	0.873
dLREMIT*LM23	0.015801	0.010167	0.159
dLPOPG	16.9728	5.0474	0.010**
dLPOPG1	-24.8527	8.2373	0.017**
dLPOPG2	9.7084	11.2263	0.412
dLPOPG3	4.1701	6.5351	0.541
dLGFCF	-0.018899	0.014062	0.216
dLGFCF1	0.054192	0.082917	0.532
dLGFCF2	0.0035444	0.067325	0.959
dLGFCF3	-0.025752	0.026350	0.357
dGFC08	0.012886	0.049298	0.800
dGFC081	0.013382	0.30929	0.967
dGFC082	0.069434	0.22913	0.770
dGFC083	0.081347	0.093099	0.408
dTREND	0.045384	0.0079728	0.000***
ecm(-1)	-1.4280	0.31565	0.002***
R ²	0.99808		
R bar squared	0.96540		
DW statistic	2.7610		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	4.6528	0.031	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	2.7905	0.110	No serial-autocorrelation present
Heteroscedasticity: LM version	2.5800	0.108	No heteroscedasticity present
Heteroscedasticity: F version	2.6223	0.114	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

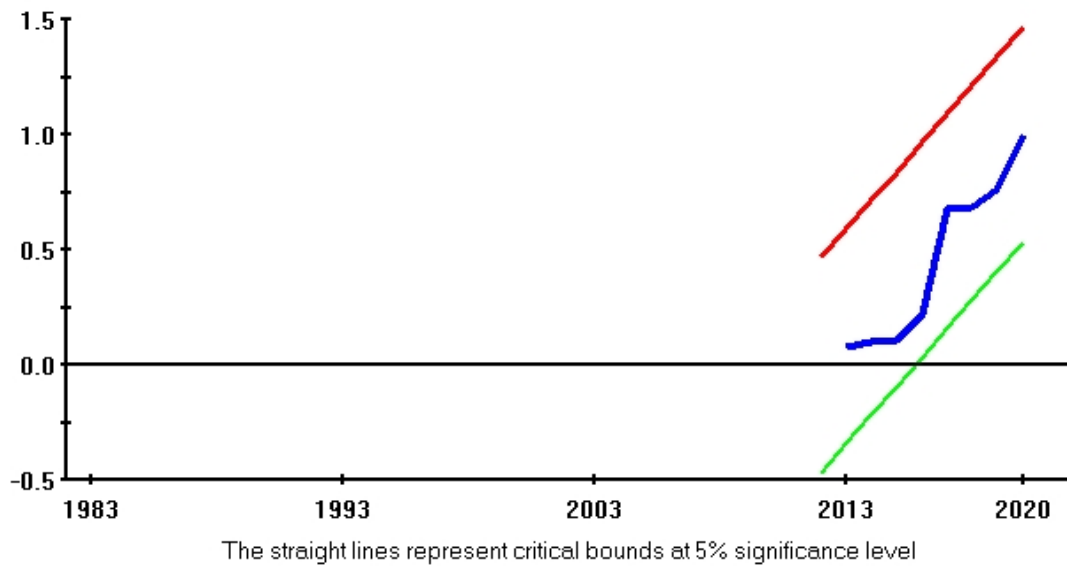
CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 39. Solow Model Augmented with LREMIT and LGDS

Bounds tests

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H_0 : No cointegration)
F	18.5766	4.3859	5.9044	3.6112	4.8414	H_0 is rejected at 5% and 10% significance.
W	92.8829	21.9294	29.5222	18.0558	24.2071	H_0 is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (2,3,3,1,3) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	9.2388	0.81926	0.000***
TREND	0.026178	0.0020332	0.000***
LREMIT	-0.026960	0.0054719	0.003***
LGDS	0.030171	0.0097845	0.022**

LPOPG	1.1711	0.35576	0.017**
LGFCF	-0.064919	0.041173	0.166

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (2,3,3,1,3) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	-0.013198	0.0049405	0.023**
dLREMIT1	0.019281	0.0056530	0.007***
dLREMIT2	0.0078593	0.0032546	0.036**
dLGDS	0.0084597	0.0047154	0.103
dLGDS1	-0.026894	0.0072470	0.004***
dLGDS2	-0.014517	0.0047449	0.012**
dLPOPG	2.2392	0.53794	0.002***
dLGFCF	-0.019279	0.017611	0.299
dLGFCF1	0.046100	0.027079	0.120
dLGFCF2	0.026044	0.015845	0.131
dTREND	0.037752	0.0043293	0.000***
ecm(-1)	-1.4421	0.19667	0.000***
R ²	0.97402		
R bar squared	0.90042		
DW statistic	1.6489		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.060641	0.805	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.012666	0.915	No serial-autocorrelation present
Heteroscedasticity: LM version	6.9963	0.008	Heteroscedasticity is present
Heteroscedasticity: F version	9.0521	0.006	Heteroscedasticity is present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 40. Solow Model Augmented with LREMIT, LGDS and Interaction Term

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	7.5900	3.9622	5.5152	3.2983	4.6095	H ₀ is rejected at 5% and 10% significance.
W	45.5402	23.7734	33.0912	19.7900	27.6570	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (2,0,1,0,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	8.6159	1.3926	0.000***
TREND	0.024119	0.0032701	0.000***
LREMIT	0.038069	0.022889	0.117
LGDS	-0.050972	0.024292	0.053*
LREMIT*LGDS	-0.034845	0.014905	0.034**
LPOPG	0.80979	0.56782	0.174
LGFCF	0.0051114	0.035768	0.888

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LGDS: Long-Run Coefficients

$$LGDP = -0.050972(LGDS) + 0.038069 (LREMIT) - 0.034845(LREMIT * LGDS)$$

$$\begin{aligned} \frac{dLGDP}{dLREMIT} &= 0.038069 - 0.034845(7.7526) \\ &= -0.232070 \end{aligned}$$

Therefore, the joint effect is -0.2321%

Test for significance:

$$H_0: LREMIT*LGDS = 0$$

$$F(\alpha=0.05,9,15) = 2.08621$$

Prob > F = 0.000 (significant at 1%)

Error Correction Model

ECM for ARDL (2,0,1,0,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.030875	0.010842	0.012**
dLGDS	-0.025656	0.011711	0.044**
dLREMIT*LGDS	-0.017539	0.0066742	0.018**
dLPOPG	0.40759	0.25783	0.133
dLGFCF	0.0025727	0.018136	0.889
dTREND	0.012140	0.0015043	0.000***
ecm(-1)	-0.50333	0.079692	0.000***
R ²	0.92087		
R bar squared	0.87339		
DW statistic	2.3852		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LGDS: Short-Run Coefficients

$$LGDP = -0.025656(LGDS) + 0.030875(LREMIT) - 0.017539(LREMIT * LGDS)$$

$$\frac{dLGDP}{dLREMIT} = 0.030875 - 0.017539(7.7526)$$

$$= -0.105098$$

Therefore, the joint effect is -0.1051%

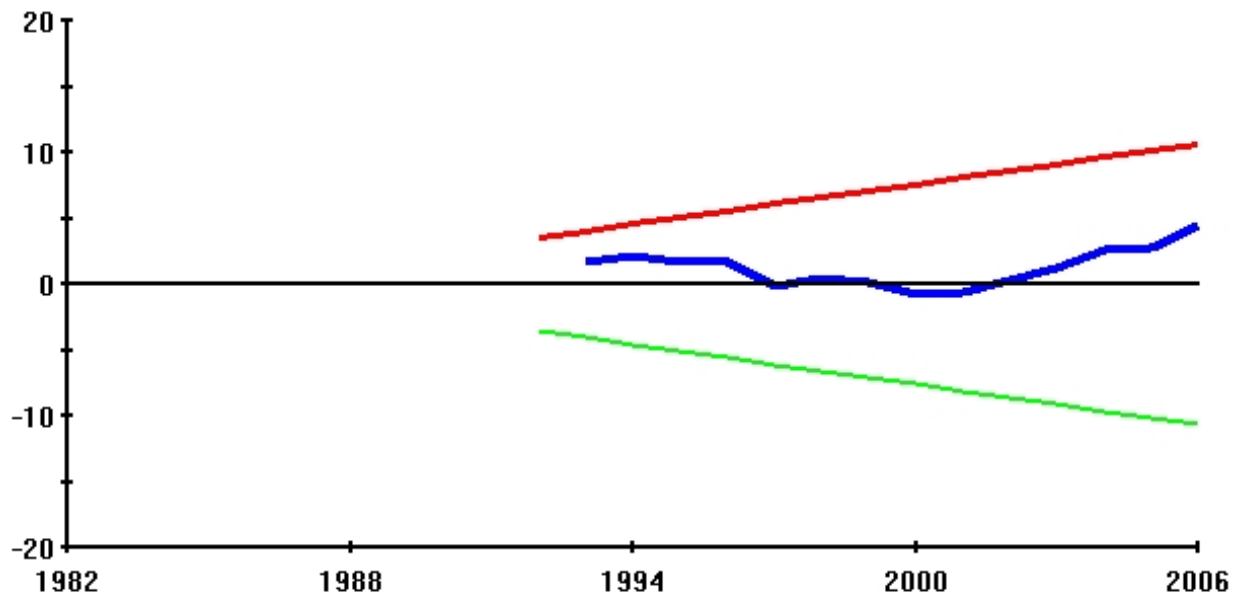
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	3.1955	0.074	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	2.0517	0.174	No serial-autocorrelation present
Heteroscedasticity: LM version	2.2605	0.133	No heteroscedasticity present
Heteroscedasticity: F version	2.2864	0.144	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

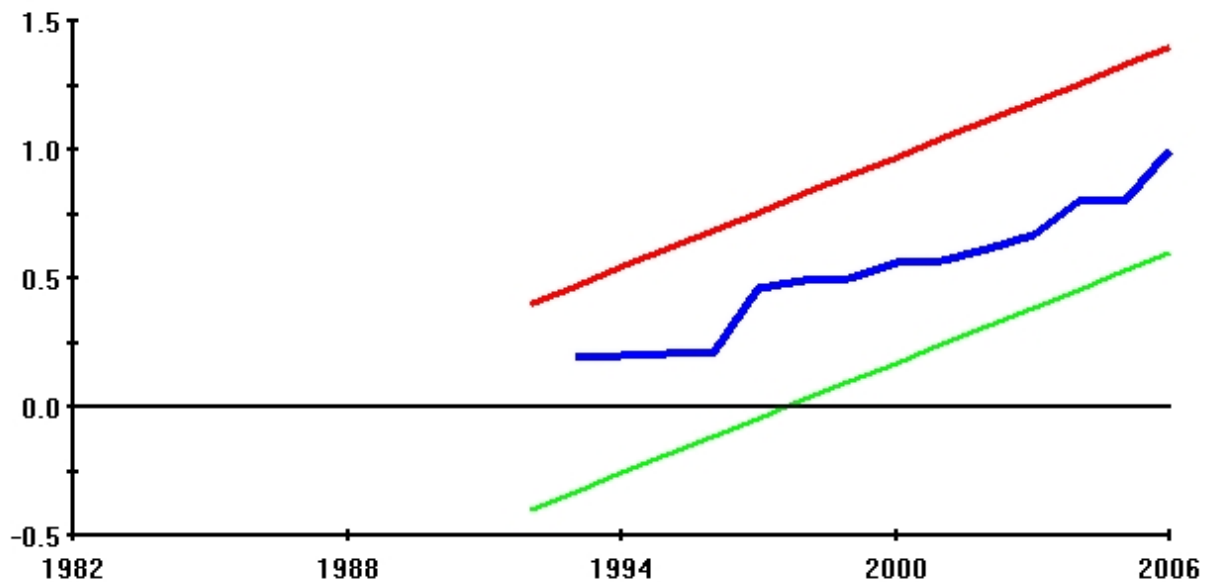
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 41. Solow Model Augmented with LREMIT, LGDS and Financial Liberalisation

Bounds tests

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	4.7251	3.9622	5.5152	3.2983	4.6095	Inconclusive at %5 significance and H ₀ is rejected at 10% significance.
W	28.3503	23.7734	33.0912	19.7900	27.6570	Inconclusive at %5 significance and H ₀ is rejected at 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,2,0,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	15.2770	3.7139	0.001***
TREND	0.023736	0.0039075	0.000***
LREMIT	0.054981	0.025430	0.047**
LGDS	0.0059709	0.014435	0.685
LPOPG	3.3808	1.4562	0.035**
LGFCF	-0.039224	0.048358	0.430
FINLIB	-0.11689	0.054237	0.048**

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,2,0,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLGDS	0.0025804	0.0063083	0.688
dLREMIT	0.023761	0.0064287	0.002***
dLPOPG	5.3813	1.4981	0.002***
dLPOPG1	-4.1493	1.0448	0.001***
dLGFCF	-0.016951	0.019513	0.398
dFINLIB	-0.050516	0.013950	0.002***
dTREND	0.010258	0.0021456	0.000***
ecm(-1)	-0.43216	0.12727	0.004***

R ²	0.91902
R bar squared	0.87043
DW statistic	3.0411

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

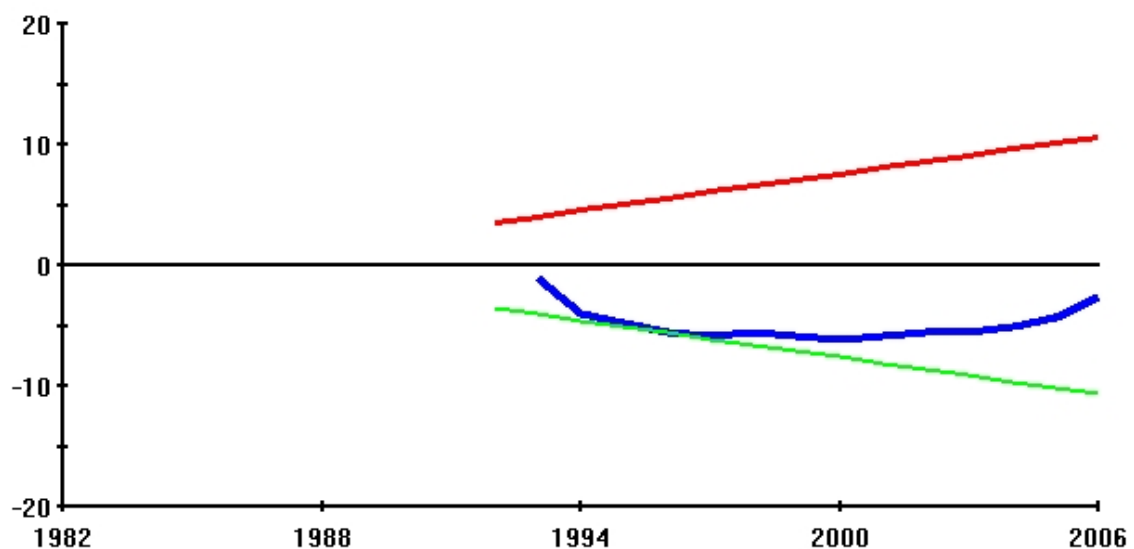
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	12.9394	0.000	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	15.0201	0.002	Serial-autocorrelation is present
Heteroscedasticity: LM version	5.9005	0.015	Heteroscedasticity is present
Heteroscedasticity: F version	7.1054	0.014	Heteroscedasticity is present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

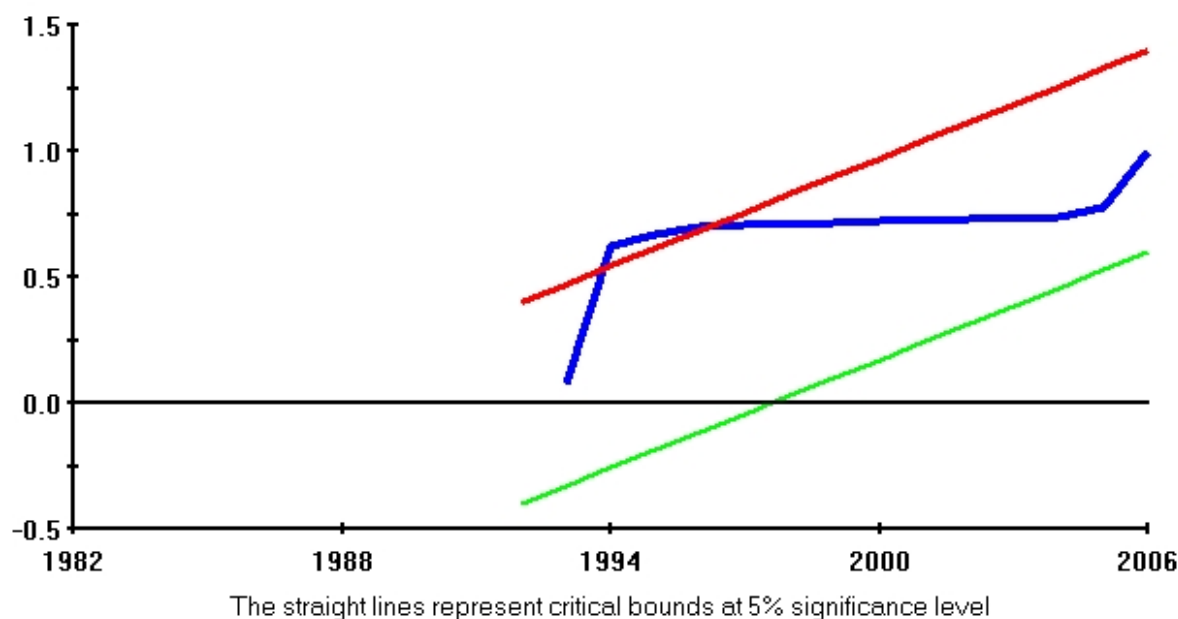
CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 42. Solow Model Augmented with LREMIT, LGDS, Interaction Term and Financial Liberalisation

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	11.9202	3.7930	5.3447	3.1051	4.4592	H ₀ is rejected at 5% and 10% significance.
W	83.4415	26.5512	37.4128	21.7356	31.2141	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (2,2,1,2,0,1,2) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	12.4193	2.1728	0.001
TREND	0.018877	0.0050338	0.007
LREMIT	0.20497	0.071621	0.024
LGDS	-0.11118	0.043877	0.039
LREMIT*LGDS	-0.083726	0.031659	0.033
LPOPG	2.1453	0.83024	0.036
LGFCF	-0.010574	0.050452	0.840
FINLIB	-0.083885	0.025168	0.013

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LGDS: Long-Run Coefficients

$$LGDP = -0.11118(LGDS) + 0.20497(LREMIT) - 0.083726(LREMIT * LGDS)$$

$$\begin{aligned} \frac{dLGDP}{dLREMIT} &= 0.20497 - 0.083726(7.7526) \\ &= -0.444124 \end{aligned}$$

Therefore, the joint effect is -0.4412%

Test for significance:

$$H_0: LREMIT*LGDS = 0$$

$$F(\alpha=0.05, 17, 7) = 2.59473$$

Prob > F = 0.000 (significant at 1%)

Error Correction Model

ECM for ARDL (2,2,1,2,0,1,2) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.051924	0.010984	0.000***
dLREMIT1	-0.026717	0.0094588	0.015**
dLGDS	-0.024867	0.0094009	0.021**
dLREMIT*LGDS	-0.018056	0.0057366	0.008***
dLREMIT*LGDS1	0.0055501	0.0027796	0.069*
dLPOPG	0.97049	0.29171	0.006***
dLGFCF	-0.022376	0.016677	0.205
dFINLIB	0.0029770	0.020060	0.884
dFINLIB1	0.054552	0.016747	0.007***
dTREND	0.0085394	0.0026875	0.008***
ecm(-1)	-0.45238	0.067441	0.000****
R ²	0.99592		

R bar squared 0.99881
 DW statistic 2.7713

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LGDS: Short-Run Coefficients

$$LGDP = -0.024867(LGDS) + 0.051924(LREMIT) - 0.018056(LREMIT * LGDS)$$

$$\frac{dLGDP}{dLREMIT} = 0.051924 - 0.018056(7.7526)$$

$$= -0.088057$$

Therefore, the joint effect is -0.0881%

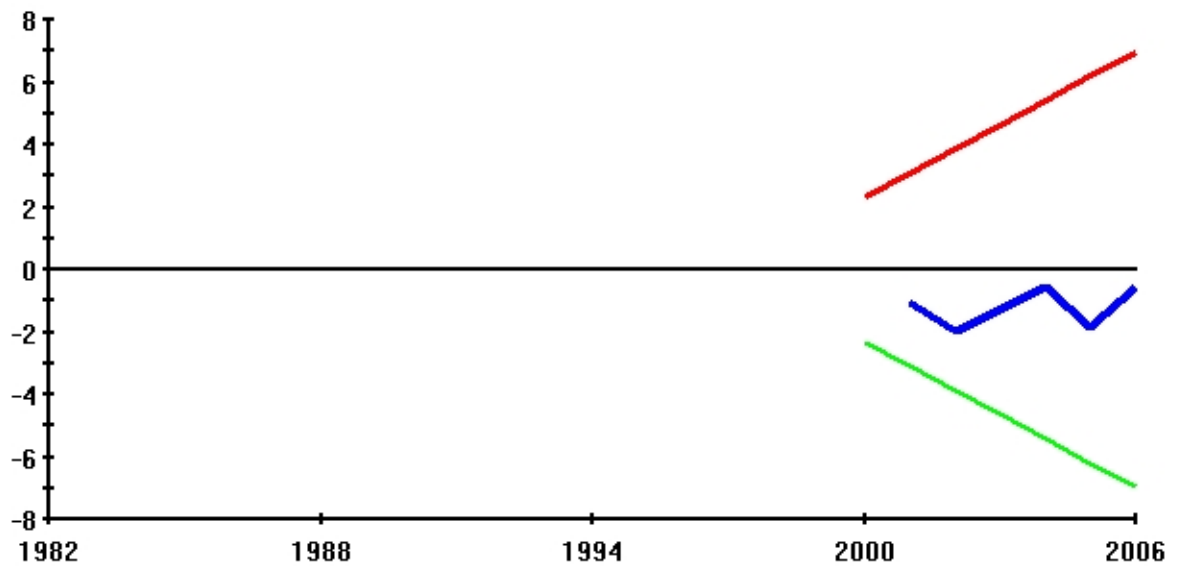
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	8.0855	0.004	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	2.8681	0.141	No serial-autocorrelation present
Heteroscedasticity: LM version	4.8890	0.027	No heteroscedasticity present
Heteroscedasticity: F version	5.5913	0.027	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

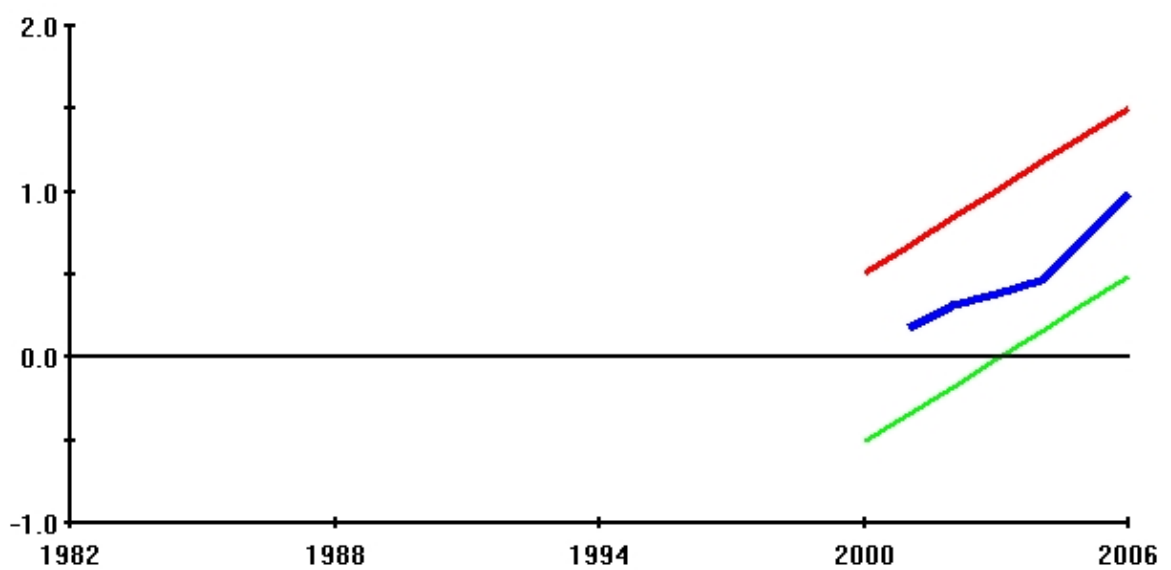
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 43. Solow Model Augmented with LREMIT, LGDS and 1973 Oil Price Boom

Bounds tests

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	15.8311	3.9622	5.5152	3.2983	4.6095	H ₀ is rejected at 5% and 10% significance.
W	94.9866	23.7734	33.0912	19.7900	27.6570	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (2,1,1,2,2,2) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	26.2998	17.9826	0.182
TREND	0.028902	0.013453	0.064*
LREMIT	0.15201	0.14414	0.322
LGDS	-0.047762	0.057411	0.430
LPOPG	7.5217	6.9203	0.309
LGFCF	0.25416	0.19865	0.237
OIL	0.44551	0.38791	0.284

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (2,1,1,2,2,2) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLGDS	-0.0024531	0.0048960	0.625
dLREMIT	0.041648	0.0091191	0.001***
dLPOPG	8.1219	1.8032	0.001***
dLPOPG1	-8.0018	1.9651	0.001***
dLGFCF	-0.0053771	0.017293	0.761
dLGFCF1	-0.024115	0.014675	0.124
dOIL	-0.020705	0.019671	0.312
dTREND	0.0066079	0.0023880	0.016**
ecm(-1)	-0.22863	0.15901	0.174
R ²	0.99873		

R bar squared 0.99619
 DW statistic 2.5782

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

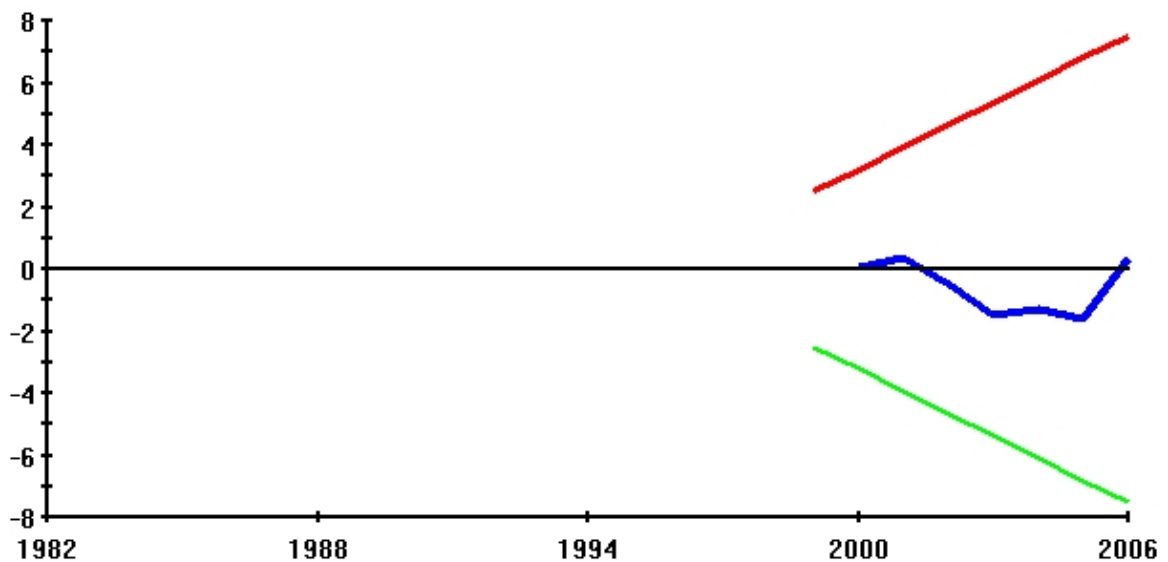
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	11.1761	0.001	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	5.6592	0.049	Serial-autocorrelation is present
Heteroscedasticity: LM version	1.9940	0.158	No heteroscedasticity present
Heteroscedasticity: F version	1.9934	0.171	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

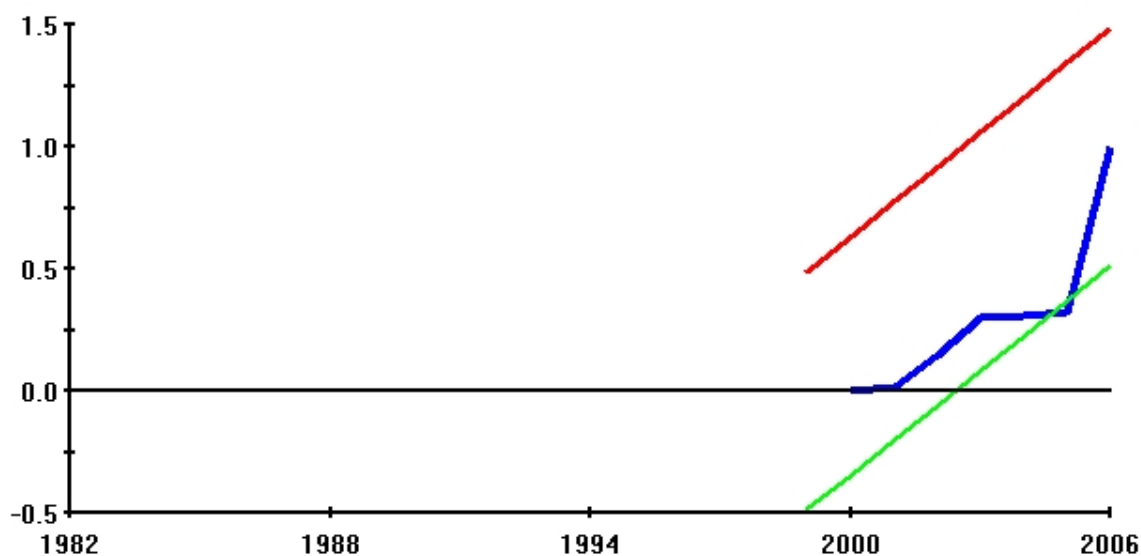
CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 44. Solow Model Augmented with LREMIT, LGDS, Interaction Term and 1973 Oil Price Boom

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	16.5982	3.7930	5.3447	3.1051	4.4592	H ₀ is rejected at 5% and 10% significance.
W	116.1873	26.5512	37.4128	21.7356	31.2141	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (2,1,1,2,2,2,2) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	28.8534	19.3643	0.196
TREND	0.034888	0.015711	0.077*
LREMIT	0.35642	0.27629	0.253
LGDS	-0.19883	0.15671	0.260
LREMIT*LGDS	-0.12026	0.088273	0.231
LPOPG	8.5327	7.4596	0.304
LGFCF	0.086381	0.16013	0.613
OIL	0.41216	0.36924	0.315

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (2,1,1,2,2,2,2) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.059963	0.011519	0.000***
dLGDS	-0.011456	0.0096071	0.258
dLREMIT*LGDS	-0.0069451	0.0061098	0.280
dLREMIT*LGDS1	0.0033823	0.0026854	0.234
dLPOPG	7.9304	2.0609	0.003***
dLPOPG1	-7.3512	2.3134	0.009***
dLGFCF	-0.031258	0.020088	0.148
dLGFCF1	-0.017391	0.013496	0.224
dOIL	-0.035808	0.021125	0.118
dOIL1	-0.075520	0.022538	0.006***
dTREND	0.0082455	0.0027285	0.012**
ecm(-1)	-0.23634	0.15849	0.164
R ²	0.99939		
R bar squared	0.99707		
DW statistic	3.0880		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Diagnostic tests

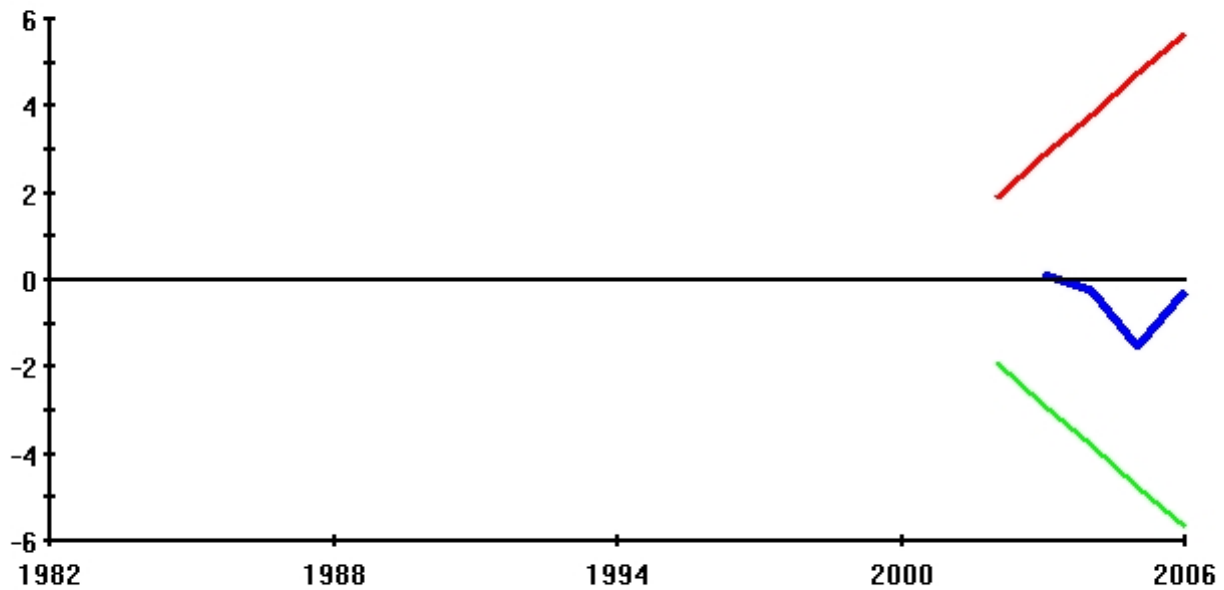
Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	15.1341	0.000	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	6.1359	0.068	Serial-autocorrelation is present
Heteroscedasticity: LM version	2.9947	0.084	Heteroscedasticity is present

Heteroscedasticity: version	F	3.1242	0.090	Heteroscedasticity is present
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Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

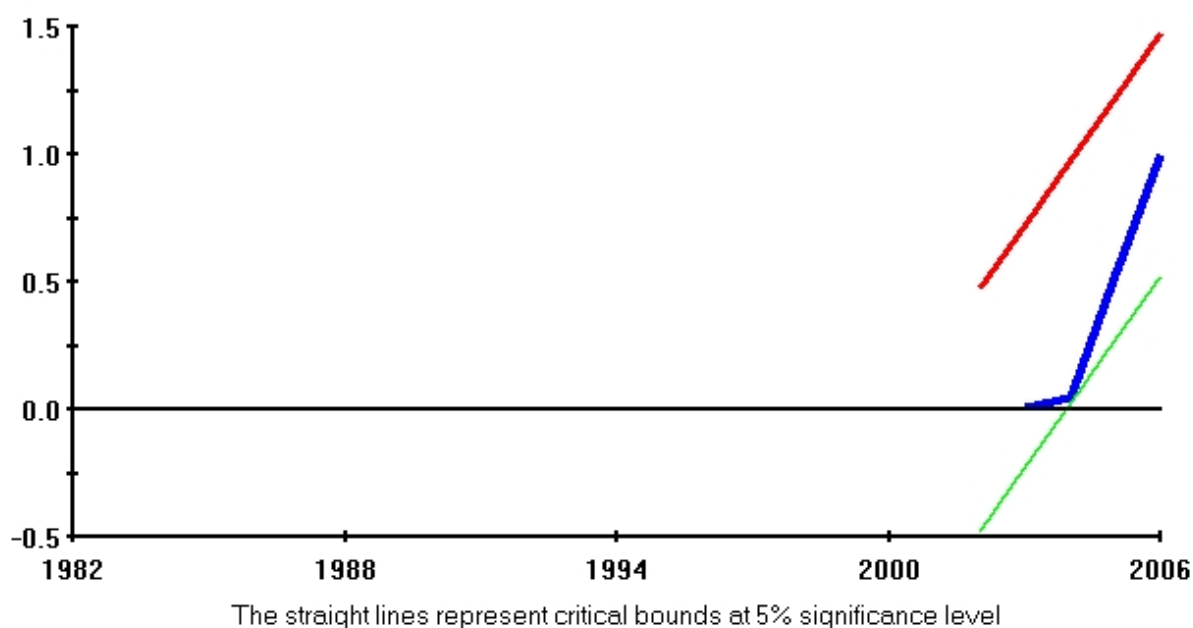
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 45. Solow Model Augmented with LREMIT and LCI

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H_0 : No cointegration)
F	1.8307	4.0405	5.3296	3.3660	4.4809	H_0 cannot be rejected at 5% and 10% significance.
W	9.1534	20.2025	26.6482	16.8298	22.4044	H_0 cannot be rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,4,0) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	22.0891	3.8618	0.000***
TREND	0.039122	0.0043875	0.000***
LCI	-0.062205	0.047079	0.198

LREMIT	0.078937	0.023248	0.002***
LPOPG	6.2876	1.5310	0.000***
LGFCF	-0.12194	0.055985	0.039**

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,4,0) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLCI	-0.016649	0.012261	0.186
dLREMIT	0.021128	0.0060889	0.002***
dLPOPG	4.1687	2.9309	0.166
dLPOPG1	-0.70789	5.1591	0.892
dLPOPG2	-6.5470	4.6778	0.173
dLPOPG3	4.8710	1.8985	0.016**
dLGFCF	-0.032638	0.019145	0.100
dTREND	0.010471	0.0024676	0.000***
ecm(-1)	-0.26765	0.070262	0.001***
R ²	0.54694		
R bar squared	0.37268		
DW statistic	2.0342		

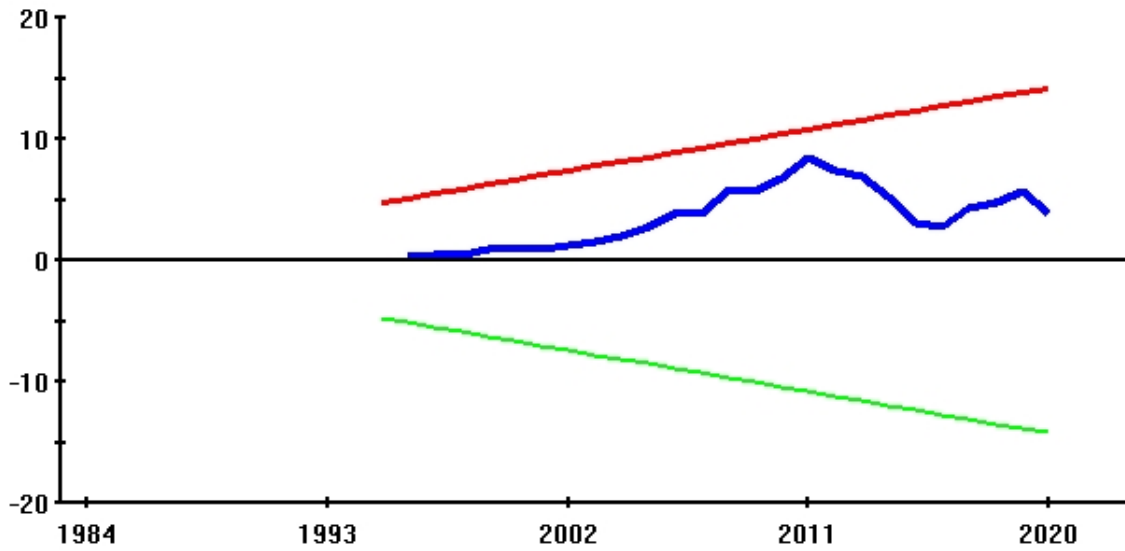
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.30004	0.584	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.20439	0.655	No serial-autocorrelation present
Heteroscedasticity: LM version	8.1153	0.004	Heteroscedasticity is present
Heteroscedasticity: F version	9.8334	0.003	Heteroscedasticity is present

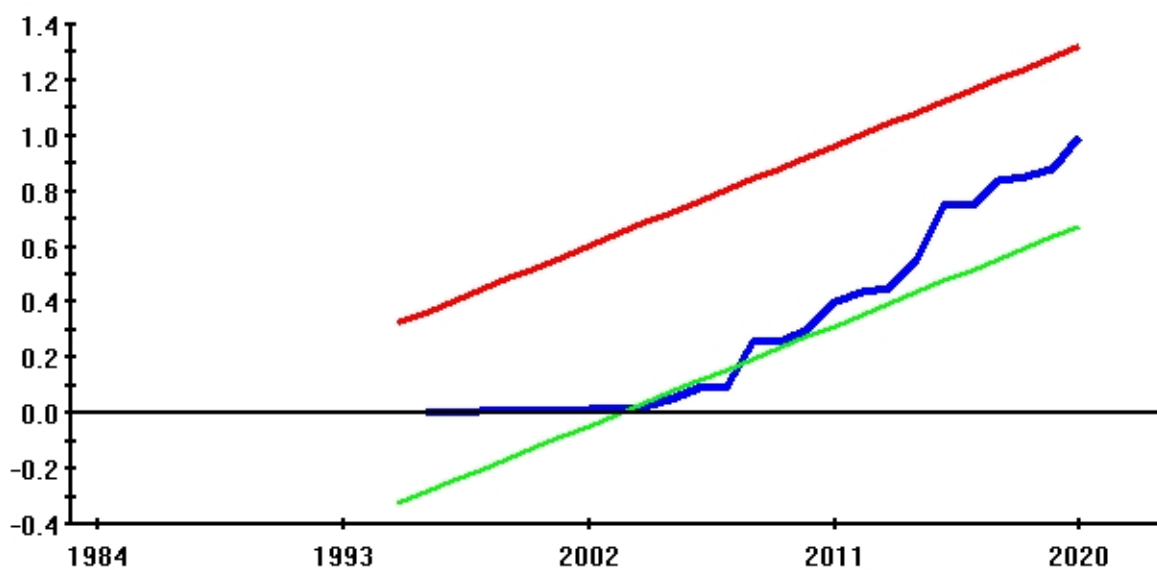
Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 46. Solow Model Augmented with LREMIT, LCI and Interaction Term

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	11.1017	3.6510	4.9653	3.0488	4.2251	H ₀ is rejected at 5% and 10% significance.
W	66.6100	21.9063	29.7915	18.2927	25.3508	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Sviryzdenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,1,4,4,2) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	-5.3860	3.4831	0.150
TREND	0.012204	0.0035486	0.006***
LREMIT	0.32493	0.053418	0.000***
LCI	0.43398	0.056902	0.000***
LREMIT*LCI	0.15248	0.021978	0.000***
LPOPG	-5.1096	1.4429	0.005***
LGFCF	0.11576	0.061552	0.087*

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Sviryzdenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LCI: Long-Run Coefficients

$$LGDP = 0.43398(LCI) + 0.32493(LREMIT) + 0.15248 (LREMIT * LCI)$$

$$\frac{dLGDP}{dLREMIT} = 0.32493 + 0.15248(0.0365)$$

$$= 0.330496$$

Therefore, the joint effect is 0.3305%

Test for significance:

$$H_0: LREMIT*LCI = 0$$

$$F(\alpha=0.05,25,11) = 2.07621$$

Prob > F = 0.000 (significant at 1%)

Error Correction Model

ECM for ARDL (4,1,4,4,4,2) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.16891	0.038746	0.000***
dLCI	0.32416	0.067267	0.000***
dLCI1	-0.072442	0.022103	0.005***
dLCI2	-0.025392	0.013923	0.087*
dLCI3	0.022549	0.012627	0.093*
dLREMIT*LCI	0.090326	0.020357	0.000***
dLCI*LREMIT1	-0.020060	0.0043237	0.000***
dLCI*LREMIT2	-0.013488	0.0022443	0.000***
dLCI*LREMIT3	-0.0069197	0.0013510	0.000***
dLPOPG	-23.5868	8.0524	0.010**
dLPOPG1	14.2199	10.7546	0.205
dLPOPG2	21.5970	8.3627	0.020**
dLPOPG3	-18.0028	4.7212	0.002***
dLGFCF	-0.030581	0.023017	0.203
dLGFCF1	-0.14001	0.035780	0.001***
dTREND	0.010964	0.0035966	0.008***
ecm(-1)	-0.89837	0.16735	0.000***
R ²	0.92907		
R bar squared	0.76788		
DW statistic	2.4481		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LCI: Short-Run Coefficients

$$LGDP = 0.32416(LCI) + 0.16891(LREMIT) + 0.090326(LREMIT * LCI)$$

$$\begin{aligned} \frac{dLGDP}{dLREMIT} &= 0.16891 + 0.090326(0.0365) \\ &= 0.172207 \end{aligned}$$

Therefore, the joint effect is 0.1722%

Diagnostic tests

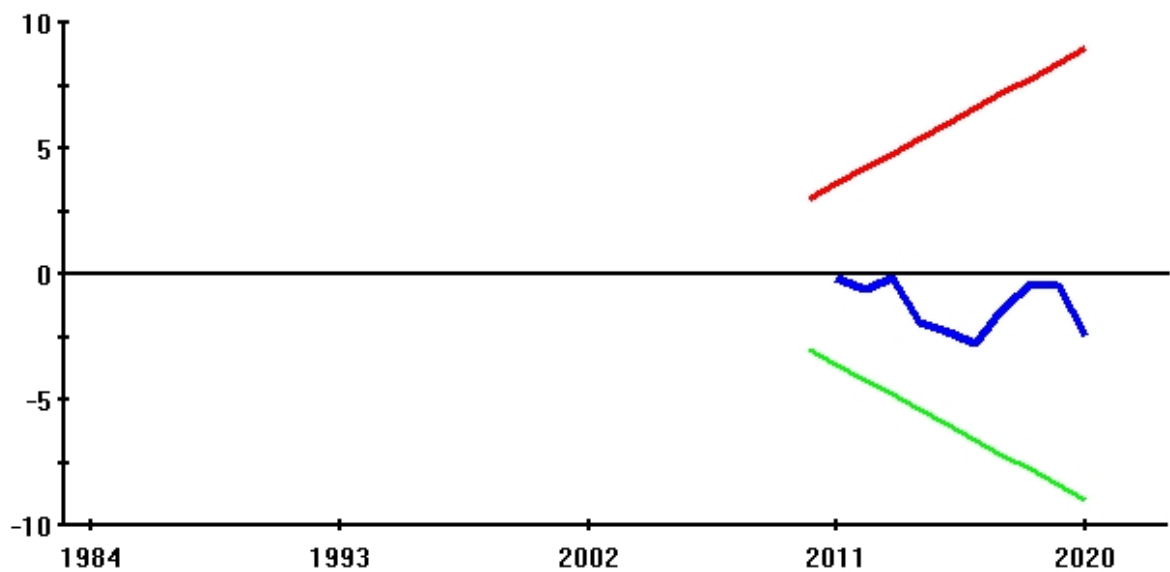
Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	5.8940	0.015	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	1.8948	0.199	No serial-autocorrelation present
Heteroscedasticity: LM version	1.4410	0.230	No heteroscedasticity present

Heteroscedasticity: version	F	1.4184	0.242	No heteroscedasticity present
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Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

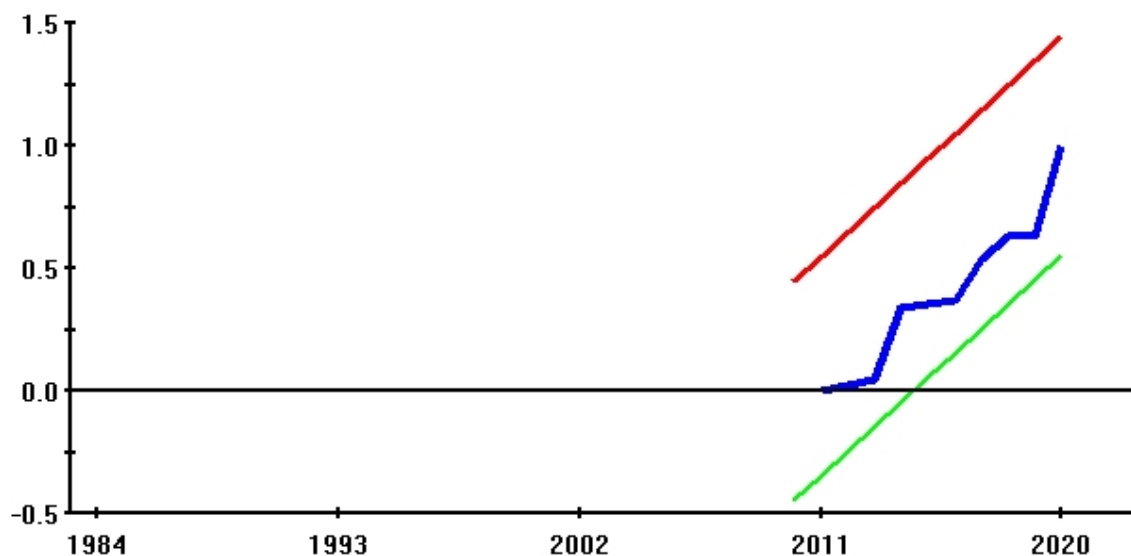
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 47. Solow Model Augmented with LREMIT, LCI and Financial Liberalisation

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	4.6558	3.6510	4.9653	3.0488	4.2251	Inconclusive at %5 significance and H ₀ is rejected at 10% significance.
W	27.9350	21.9063	29.7915	18.2927	25.3508	Inconclusive at %5 significance and H ₀ is rejected at 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,0,4,3,0,3) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	19.7282	3.1867	0.000***
TREND	0.049563	0.0093920	0.000***
LCI	-0.0056489	0.028956	0.848
LREMIT	-0.010757	0.046373	0.820
LPOPG	5.3352	1.2774	0.001***
LGFCF	-1.5612	-0.066651	0.138
FINLIB	-0.19290	0.039305	0.000***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzhenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,0,4,3,0,3) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLCI	-0.0019990	0.010378	0.849
dLREMIT	0.026666	0.0064023	0.001***
dLREMIT1	0.018770	0.0084607	0.039**
dLREMIT2	0.025857	0.0060818	0.000***
dLREMIT3	0.021902	0.0053297	0.001***
dLPOPG	0.18405	2.9661	0.951
dLPOPG1	4.1523	4.8513	0.403
dLPOPG2	-5.1694	2.9473	0.096*
dLGFCF	-0.023586	0.018778	0.224
dFINLIB	-0.029458	0.016262	0.086*
dLFINLIB1	0.065102	0.024235	0.015**
dLFINLIB2	-0.035675	0.020206	0.094*
dTREND	0.017539	0.0038678	0.000***
ecm(-1)	-0.35387	0.12951	0.013**
R ²	0.87129		
R bar squared	0.71041		
DW statistic	2.8148		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

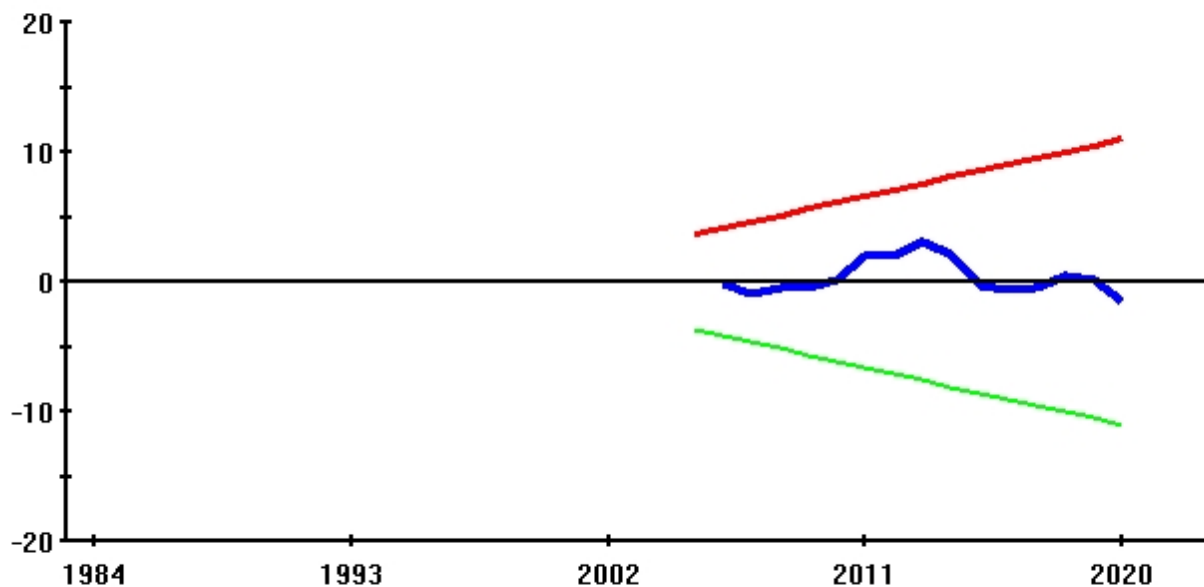
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	10.9888	0.001	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	6.3370	0.024	Serial-autocorrelation is present
Heteroscedasticity: LM version	0.36529	0.546	No heteroscedasticity present
Heteroscedasticity: F version	0.34899	0.558	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydenka, 2016; World Bank, 2022a).. The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

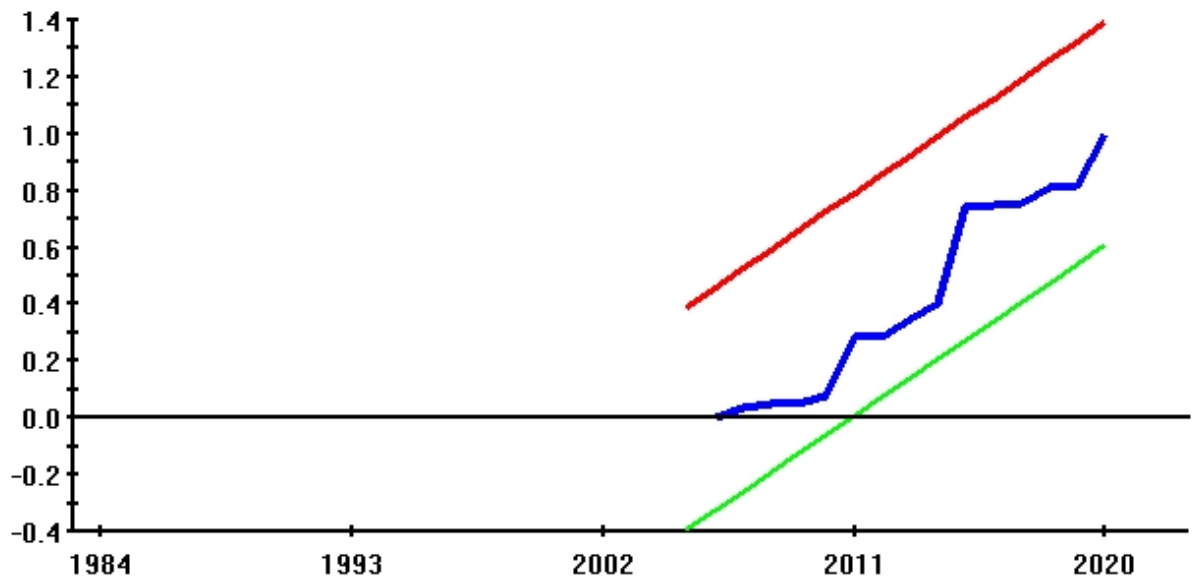
CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 48. Solow Model Augmented with LREMIT, LCI, Interaction Term and Financial Liberalisation

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H_0 : No cointegration)
F	12.6458	3.3730	4.7941	2.8535	4.0952	H_0 is rejected at 5% and 10% significance.
W	88.5206	23.6113	33.5589	19.9745	28.6661	H_0 is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,3,3,4,3,4,2) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	9.3413	2.1089	0.000***
TREND	0.032622	0.0027888	0.000***
LREMIT	0.18834	0.079908	0.057*
LCI	0.41087	0.13318	0.022
LREMIT*LCI	0.094390	0.029697	0.019**
LPOPG	-4.5808	2.3877	0.103
LGFCF	-0.24882	0.10049	0.048**
FINLIB	-0.0042811	0.094809	0.965

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Sviryzdenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,3,3,4,3,4,2) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.25728	0.040190	0.000***
dLREMIT1	0.12125	0.036419	0.006***
dLREMIT2	0.096833	0.021972	0.000***
dLREMIT3	0.027191	0.0041826	0.001***
dLCI	0.13491	0.024172	0.000***
dLCI1	-0.067811	0.015737	0.001***
dLCI2	-0.026753	0.0079352	0.006***
dLREMIT*LCI	0.073639	0.012927	0.000***
dLREMIT*LCI1	0.014080	0.010114	0.189
dLREMIT*LCI2	0.015218	0.0054139	0.016**
dLPOPG	-22.8057	4.6746	0.000***
dLPOPG1	31.4248	7.2741	0.000***
dLPOPG2	-8.1671	3.7818	0.052*
dLGFCF	-0.055304	0.017587	0.008***
dLGFCF1	0.041814	0.028364	0.166
dLGFCF2	0.11154	0.028122	0.002***
dLGFCF3	0.049902	0.016580	0.011**
dFINLIB	0.033643	0.021109	0.137
dFINLIB1	0.086709	0.034274	0.026**
dTREND	0.0083495	0.0045974	0.094*
ecm(-1)	-0.56228	0.17313	0.007***
R ²	0.98347		
R bar squared	0.90083		
DW statistic	3.7941		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Sviryzdenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

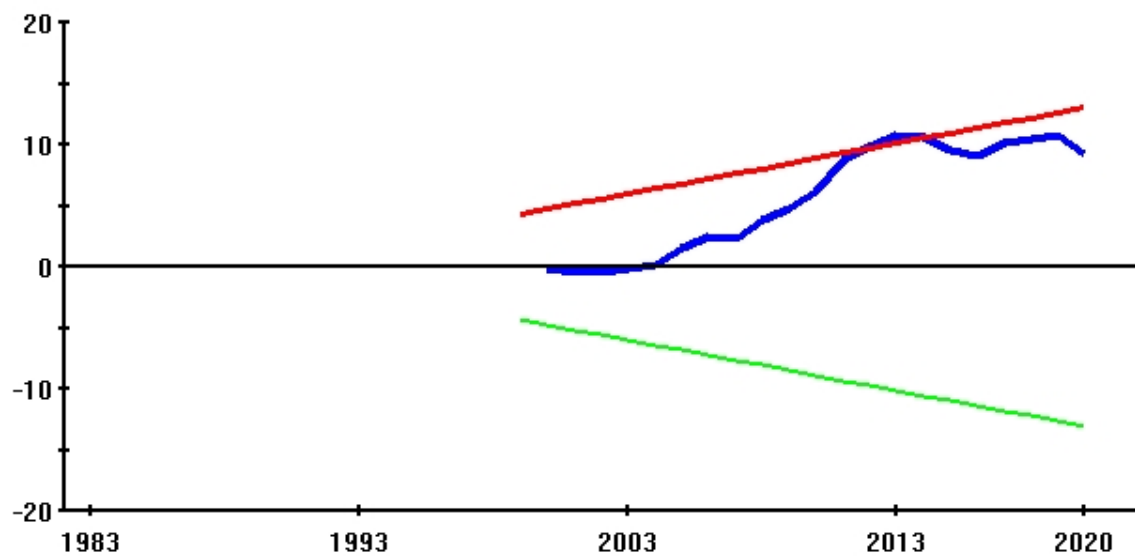
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	34.3242	0.000	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	64.1376	0.000	Serial-autocorrelation is present
Heteroscedasticity: LM version	0.013322	0.908	No heteroscedasticity present
Heteroscedasticity: F version	0.012607	0.911	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Sviryzdenka, 2016; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

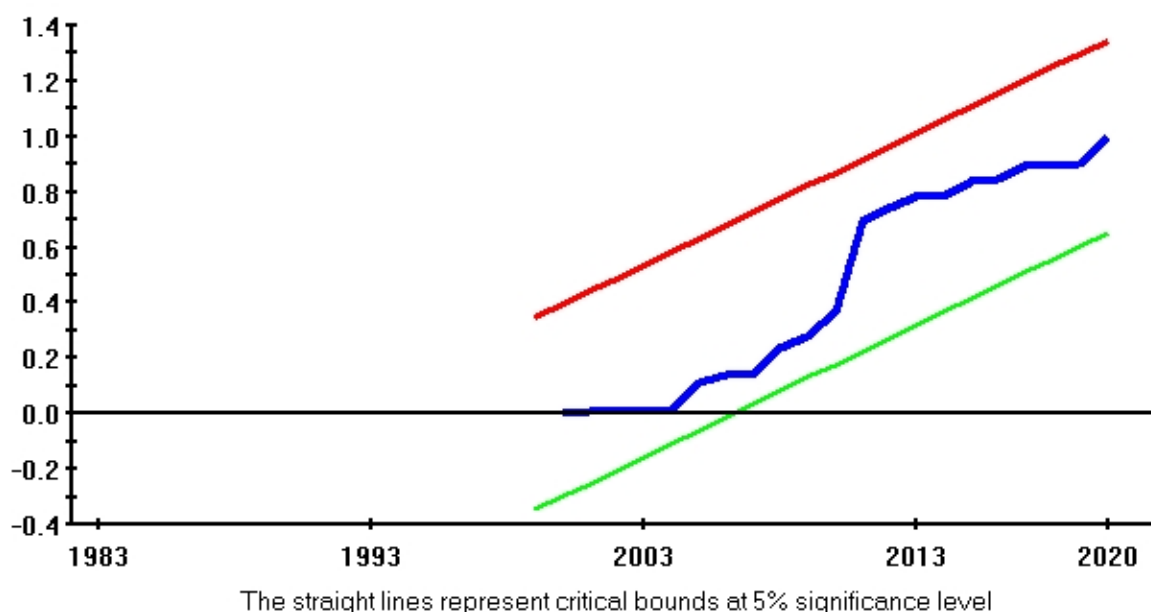
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



Appendix 49. Solow Model Augmented with LREMIT, LCI and 1973 Oil Price Boom

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H ₀ : No cointegration)
F	4.1722	3.6510	4.9653	3.0488	4.2251	Inconclusive at %5 and 10% significance.
W	25.0334	21.9063	29.7915	18.2927	25.3508	Inconclusive at %5 and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,0,4,3,0,3) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	18.1820	2.9489	0.000***
TREND	0.043451	0.0057326	0.000***
LCI	-0.0027035	0.027727	0.924

LREMIT	0.014285	0.030841	0.650
LPOPG	4.7622	1.1695	0.001***
LGFCF	-0.085095	0.040888	0.055*
OIL	0.24434	0.087092	0.013**

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,0,4,3,0,3) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLCI	-0.0011590	0.011885	0.923
dLREMIT	0.031094	0.0071894	0.000***
dLREMIT1	0.013197	0.010144	0.210
dLREMIT2	0.015649	0.0061031	0.020**
dLREMIT3	0.018847	0.0061130	0.006***
dLPOPG	-2.9272	3.5859	0.425
dLPOPG1	9.4688	6.1658	0.142
dLPOPG2	-8.1569	3.8565	0.049**
dLGFCF	-0.036481	0.021995	0.115
dOIL	-0.014626	0.037266	0.699
dOIL1	-0.095084	0.031983	0.008***
dOIL2	-0.026535	0.025896	0.319
dOIL3	-0.073339	0.029151	0.022**
dTREND	0.018628	0.0035311	0.000***
ecm(-1)	-0.42871	0.10600	0.001***
R ²	0.87129		
R bar squared	0.71041		
DW statistic	2.8148		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Diagnostic tests

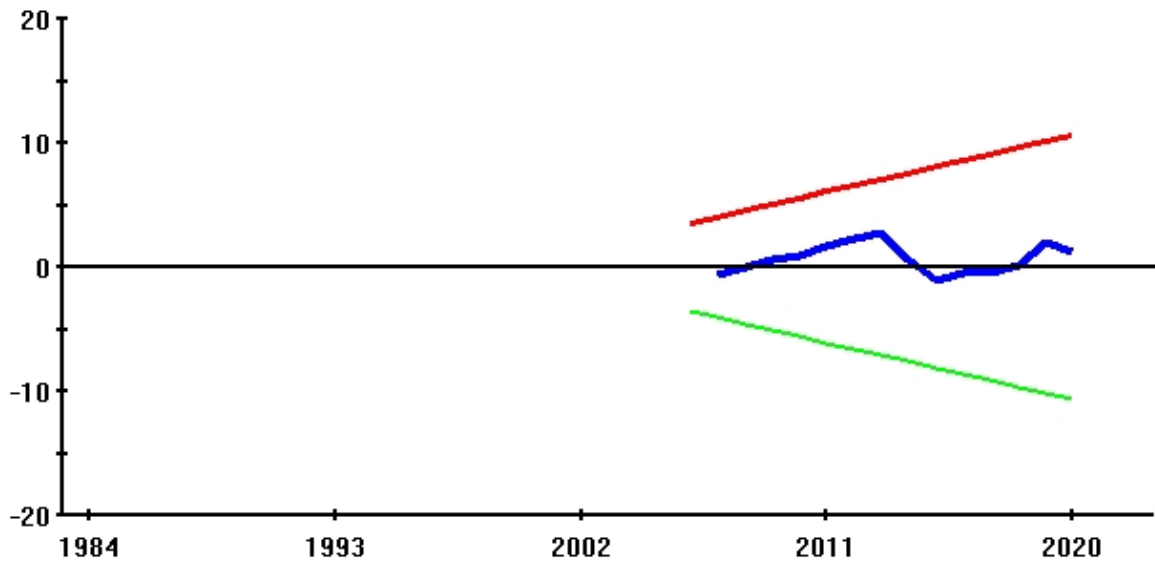
Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	12.7874	0.000	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	7.3938	0.017	Serial-autocorrelation is present
Heteroscedasticity: LM version	4.1146	0.043	Heteroscedasticity is present
Heteroscedasticity: F version	4.3792	0.044	Heteroscedasticity is present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a).. The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if

the p -value < 0.05 and rejected at the 10% level if the p -value < 0.1 . If the p -value > 0.05 , the null hypothesis cannot be rejected at the 5% level and if the p -value > 0.1 , the null hypothesis cannot be rejected at the 10% level.

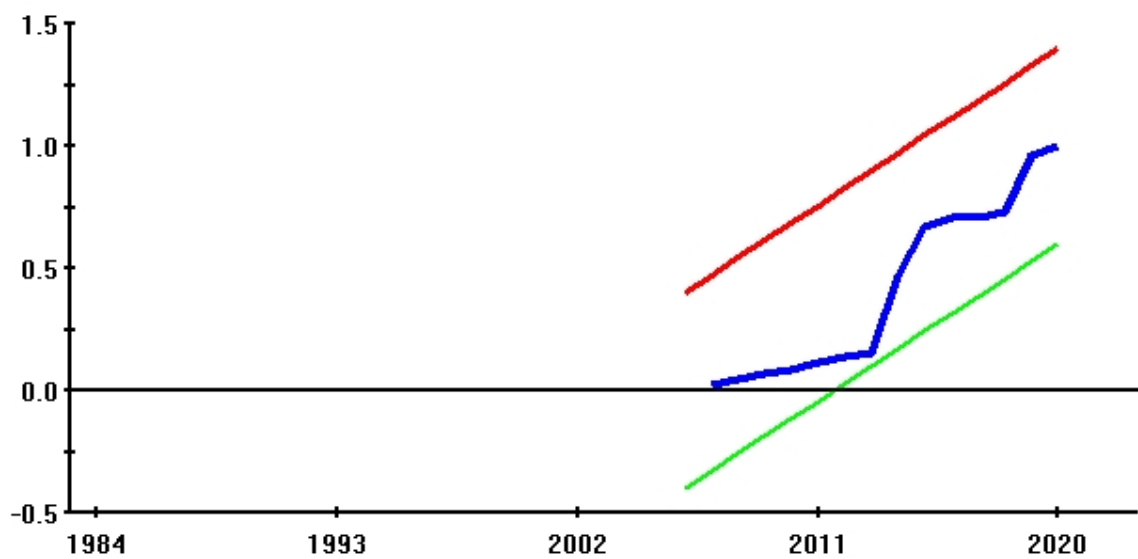
CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 50. Solow Model Augmented with LREMIT, LCI, Interaction Term and 1973 Oil Price Boom

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	21.5698	3.3730	4.7941	2.8535	4.0952	H ₀ is rejected at 5% and 10% significance.
W	150.9888	23.6113	33.5589	19.9745	28.6661	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzhenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (4,4,4,4,3,1,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	0.039926	0.0033091	0.000***
TREND	15.8746	2.3125	0.000***
LREMIT	0.46963	0.12663	0.014**
LCI	0.62422	0.22476	0.039**
LREMIT*LCI	0.18425	0.056892	0.023**
LPOPG	-12.1031	5.6181	0.084*
LGFCF	0.12998	0.10810	0.283
OIL	-0.075000	0.10149	0.493

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzhenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (4,4,4,4,3,1,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.43331	0.062165	0.000***
dLREMIT1	0.10164	0.017861	0.000***
dLREMIT2	0.059033	0.0084068	0.000***
dLREMIT3	0.038114	0.0047087	0.000***
dLCI	0.22990	0.037467	0.000***
dLCI1	-0.095963	0.025468	0.003***
dLCI2	-0.019876	0.015172	0.217
dLCI3	0.036886	0.013033	0.016

dLREMIT*LCI	0.12187	0.018655	0.000***
dLPOPG	-47.2278	8.4907	0.000***
dLPOPG1	61.2179	13.5268	0.001***
dLPOPG2	-8.8303	9.3592	0.366
dLPOPG3	-6.8704	3.7987	0.098*
dLGFCF	-0.079446	0.018631	0.001***
dLGFCF1	-0.17845	0.036863	0.001***
dLGFCF2	0.031962	0.015170	0.059*
dOIL	-0.044169	0.039617	0.289
dOIL1	-0.13437	0.036550	0.004***
dOIL2	-0.095306	0.032963	0.015**
dOIL3	-0.12633	0.026320	0.001***
dTREND	-0.0059641	0.0074884	0.443
ecm(-1)	-0.56917	0.16051	0.005***
R ²	0.99993		
R bar squared	0.99946		
DW statistic	2.0804		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

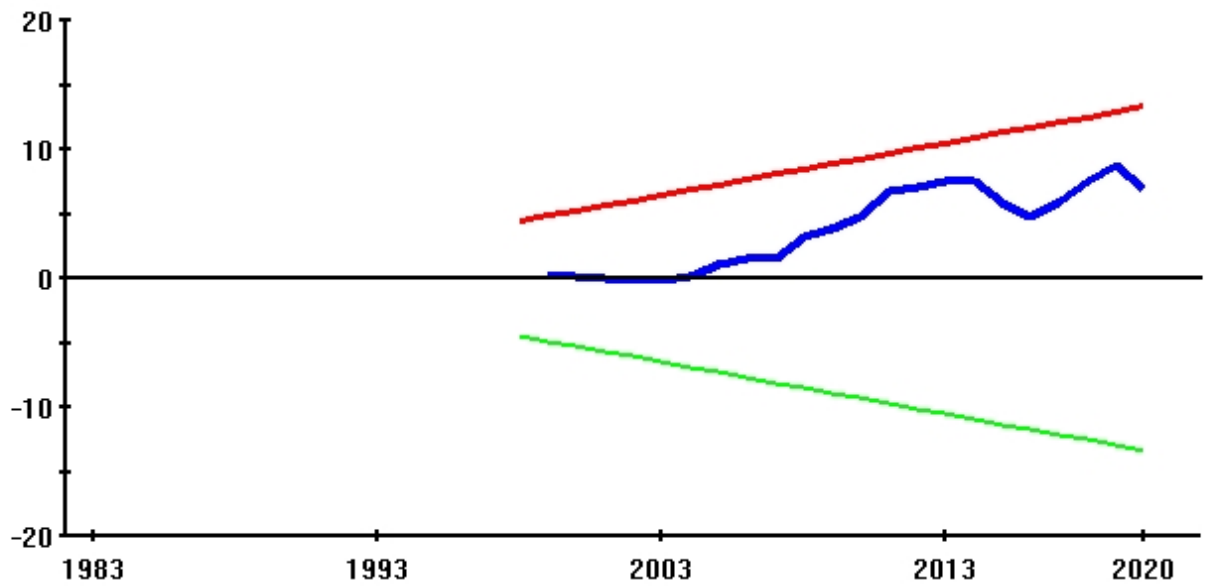
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.68447	0.408	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.40354	0.532	No serial-autocorrelation present
Heteroscedasticity: LM version	0.13859	0.710	No heteroscedasticity present
Heteroscedasticity: F version	0.13159	0.719	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

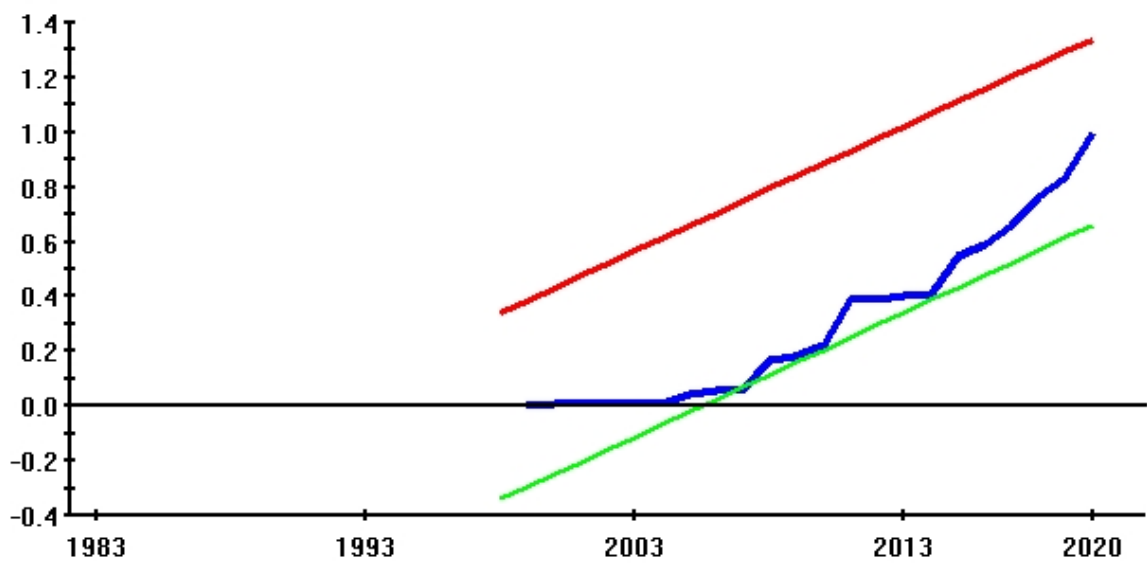
CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Appendix 51. Solow Model Augmented with LREMIT, LCI and 2008 Global Financial Crisis

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	6.2617	3.6510	4.9653	3.0488	4.2251	H ₀ is rejected at 5% and 10% significance.
W	37.5704	21.9063	29.7915	18.2927	25.3508	H ₀ is rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzhenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (1,0,0,0,1,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	15.8893	2.2922	0.000***
TREND	0.037662	0.0036010	0.000***
LCI	-0.0016863	0.035465	0.962
LREMIT	-0.0081656	0.016707	0.629
LPOPG	3.8850	0.90695	0.000***
LGFCF	-0.26217	0.044591	0.000***
GFC08	0.65849	0.21391	0.005***

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzhenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Error Correction Model

ECM for ARDL (1,0,0,0,1,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLCI	-0.4521E-3	0.0095038	0.962
dLREMIT	-0.0021894	0.0044391	0.626
dLPOPG	1.0417	0.29558	0.002***
dLGFCF	-0.035420	0.016033	0.036**
dGFC08	-0.012594	0.016395	0.449
dGFC081	-0.18739	0.030422	0.000***
dGFC082	-0.11931	0.025805	0.000***
dGFC083	-0.054928	0.016993	0.003***
dTREND	0.010098	0.0023381	0.000***
ecm(-1)	-0.26812	0.066709	0.000***

R ²	0.74498
R bar squared	0.61747
DW statistic	1.9350

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Sviryzdenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant at the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

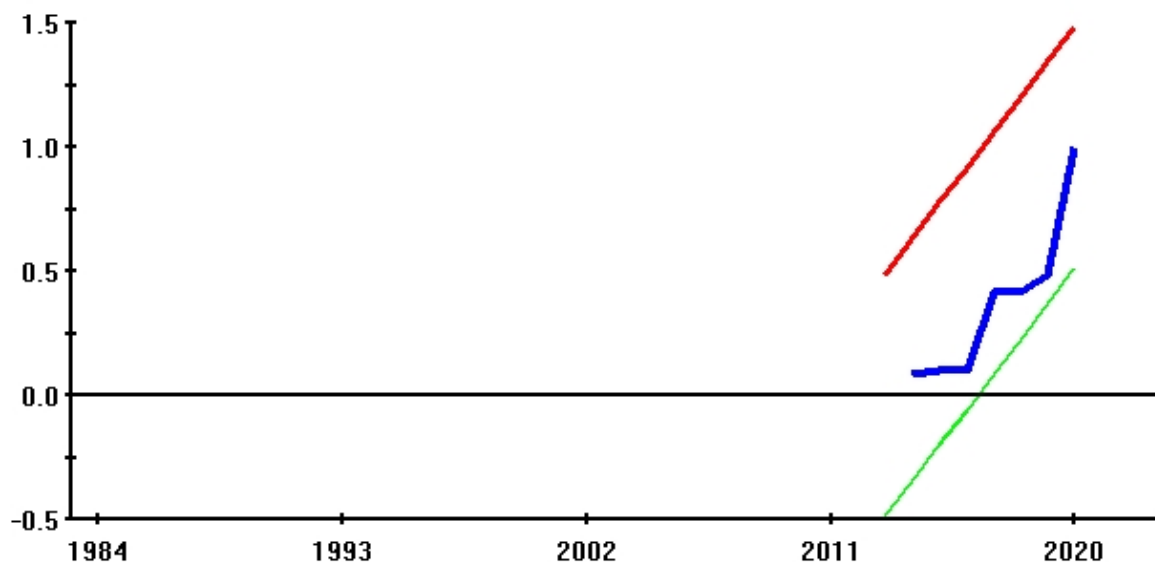
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	0.56997	0.450	No serial-autocorrelation present
Diagnostic test: serial correlation: F version	0.35985	0.554	No serial-autocorrelation present
Heteroscedasticity: LM version	1.6888	0.194	No heteroscedasticity present
Heteroscedasticity: F version	1.6739	0.204	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Sviryzdenka, 2016; World Bank, 2022a). The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

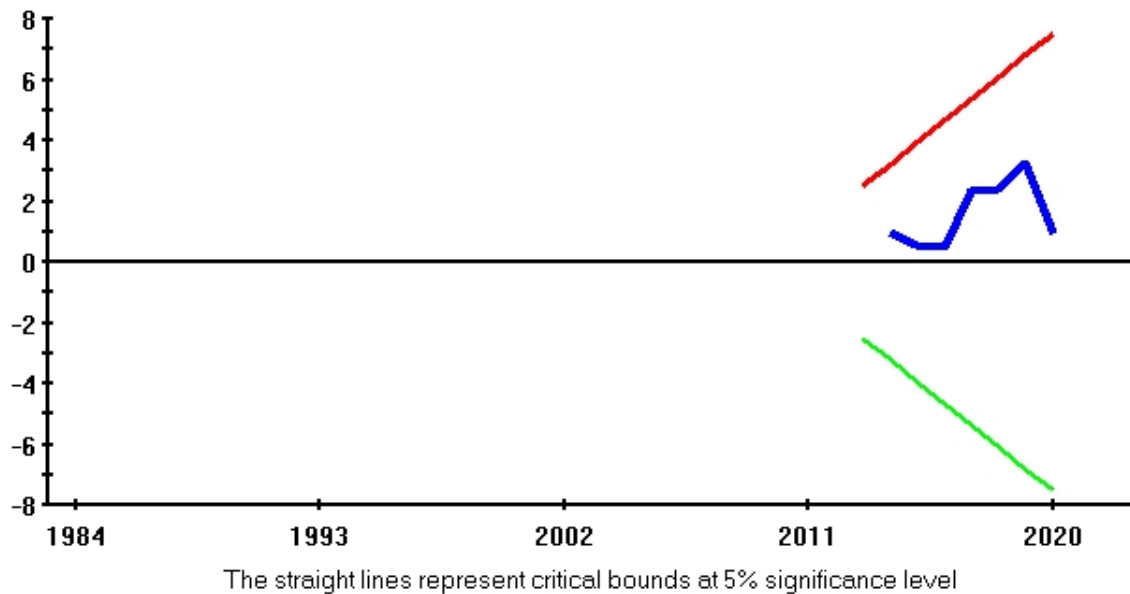
CUSUM and CUSUMSQ

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Recursive Residuals



Appendix 52. Solow Model Augmented with LREMIT, LCI, Interaction Term, and 2008 Global Financial Crisis

Bounds test

	Statistic value	95% lower bound	95% upper bound	90% lower bound	90% upper bound	Outcome (H₀: No cointegration)
F	5.3408	3.3730	4.7941	2.8535	4.0952	H ₀ cannot be rejected at 5% and 10% significance.
W	37.3859	23.6113	33.5589	19.9745	28.6661	H ₀ cannot be rejected at 5% and 10% significance.

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydenka, 2016; World Bank, 2022a). The null hypothesis of no cointegration or no long-run relationship is rejected at 5% significance level (95% confidence interval) if the F statistic is above the 95% upper bound. If the F statistic falls between the 95% lower bound and the 95% upper bound, the test is inconclusive. If the F statistic falls below the 95% lower bound, the null hypothesis cannot be rejected. The same applies to the hypotheses at the 10% significance level (90% confidence interval) and to the W statistic at the 5% and 10% significance levels.

Estimated Long-Run Coefficients

ARDL (3,4,4,3,4,3,4) approach to cointegration			
Dependent variable: LGDP			
Variable	Coefficient	Standard error	P-value
CONS	11.8465	2.5023	0.000
TREND	0.011076	0.0022529	0.008
LREMIT	0.39892	0.027388	0.000
LCI	0.27080	0.026715	0.001
LREMIT*LCI	0.12813	0.0098785	0.000
LPOPG	-3.4226	0.77150	0.011
LGFCF	0.024369	0.028892	0.446
GFC08	0.18693	0.13595	0.241

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Sviryzdenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LCI: Long-Run Coefficients

$$LGDP = 0.27080(LCI) + 0.39892(LREMIT) + 0.12813(LREMIT * LCI)$$

$$\frac{dLGDP}{dLREMIT} = 0.39892 + 0.12813(0.0365)$$

$$= 0.403597$$

Therefore, the joint effect is 0.4036%

Test for significance:

$$H_0: LREMIT*LCI = 0$$

$$F(\alpha=0.05,32,4) = 3.81742$$

Prob > F = 0.000 (significant at 1%)

Error Correction Model

ECM for ARDL (3,4,4,3,4,3,4) approach to cointegration			
Dependent variable: dLGDP			
Variable	Coefficient	Standard error	P-value
dLREMIT	0.76640	0.23290	0.008**
dLREMIT1	-0.15585	0.056356	0.020**
dLREMIT2	-0.16853	0.057909	0.016**
dLCI	0.37118	0.10926	0.007***
dLCI1	-0.18843	0.050266	0.004***
dLCI2	-0.10217	0.034205	0.014**
dLCI3	0.059714	0.027115	0.052*
dLREMIT*LCI	0.21260	0.064384	0.008***
dLREMIT*LCI1	-0.072911	0.016511	0.001***
dLREMIT*LCI2	-0.062255	0.018084	0.006***
dLREMIT*LCI3	-0.0075236	0.0031614	0.039**
dLPOPG	-55.2282	17.5511	0.010**

dLPOPG1	45.3022	16.9499	0.023**
dLPOPG2	30.7125	14.0893	0.054*
dLPOPG3	-32.7672	10.7850	0.013**
dLGFCF	-0.074780	0.030029	0.032**
dLGFCF1	-0.20296	0.078554	0.027**
dLGFCF2	0.091473	0.052129	0.110
dGFC08	0.062050	0.050408	0.247
dGFC081	-0.25343	0.21410	0.264
dGFC082	-0.33514	0.16756	0.073*
dGFC083	-0.20274	0.078352	0.027**
dTREND	0.026023	0.0074971	0.006***
ecm(-1)	-2.3496	0.57400	0.002***
R ²	0.97022		
R bar squared	0.73198		
DW statistic	2.6092		

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a). A variable is significant at the 1% level if the p-value < 0.01 and is denoted as ***. A variable is significant and the 5% level if the p-value < 0.05 and is denoted as **. A variable is significant at the 10% level if the p-value < 0.1 and is denoted as *.

Calculation of Effect of Interaction Between LREMIT and LCI: Short-Run Coefficients

$$LGDP = 0.37118 (LCI) + 0.76640(LREMIT) + 0.21260 (LREMIT * LCI)$$

$$\frac{dLGDP}{dLREMIT} = 0.76640 + 0.21260(0.0365)$$

$$= 0.7741560$$

Therefore, the joint effect is 0.7742%

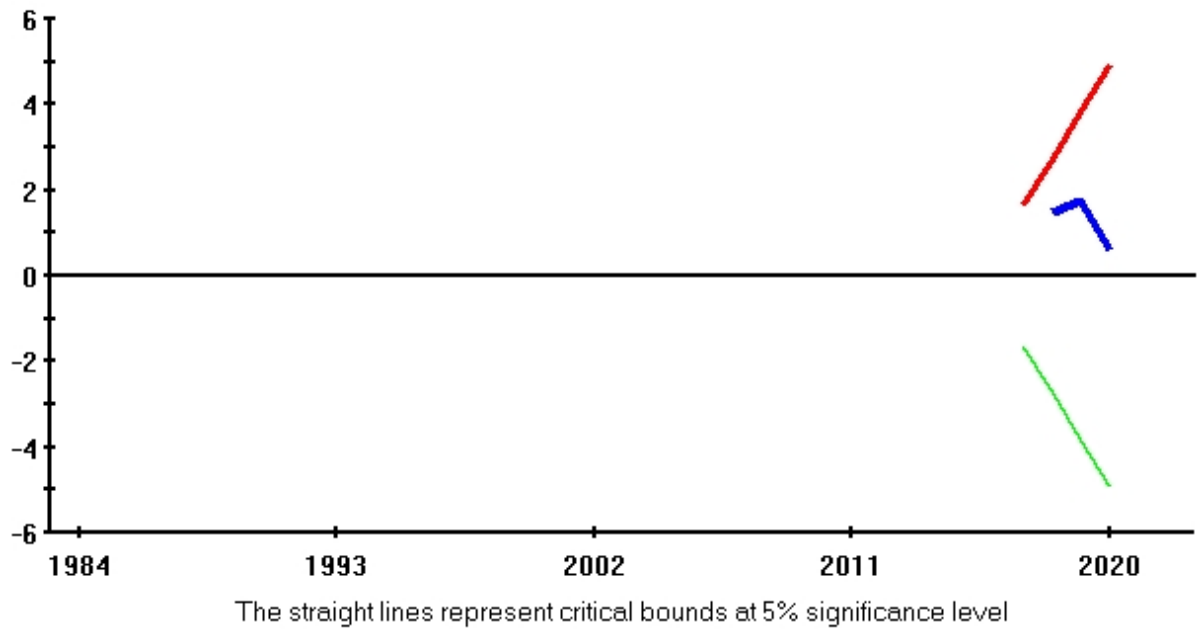
Diagnostic tests

Statistic	Statistic value	P-value	Result at 5% significance
Diagnostic test: serial correlation: LM version	19.0060	0.000	Serial-autocorrelation is present
Diagnostic test: serial correlation: F version	3.1687	0.173	No serial-autocorrelation present
Heteroscedasticity: LM version	1.8995	0.168	No heteroscedasticity present
Heteroscedasticity: F version	1.8940	0.177	No heteroscedasticity present

Notes for Table: Source: (Feenstra, Inklaar & Timmer, 2015; Svirydzenka, 2016; World Bank, 2022a).. The null hypothesis of no serial autocorrelation or heteroscedasticity for all statistics in the table are rejected at the 5% level if the p-value < 0.05 and rejected at the 10% level if the p-value < 0.1. If the p-value > 0.05, the null hypothesis cannot be rejected at the 5% level and if the p-value > 0.1, the null hypothesis cannot be rejected at the 10% level.

CUSUM & CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals

