

# Banking Sector Development And Economic Growth In Hong Kong: An Empirical Investigation

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## ABSTRACT

*In this study, we examine the dynamic relationship between bank-based financial development and economic growth in Hong Kong. We attempt to answer one critical question: Does the relationship between bank-based financial development and economic growth in Hong Kong follow a supply-leading or a demand-following response? In other words, which sector drives economic development in Hong Kong – the real sector or the nominal sector? Unlike the majority of previous studies, this study uses the newly developed ARDL-bounds testing approach to examine this linkage. The ARDL-bounds testing approach has numerous advantages over other cointegration techniques, especially when a short time-series dataset is used. In order to test the robustness of the empirical results, two proxies of bank-based financial development have been used; namely: 1) the domestic credit provided by the banking sector as a ratio of GDP and 2) the banks' deposit as a ratio of GDP. Our empirical results show that the relationship between bank-based financial development and economic growth in Hong Kong is sensitive to the proxy used to measure the banking sector development. When domestic credit provided by the banking sector is used as a proxy for bank-based financial development, a distinct supply-leading response is found to prevail. However, when the banks' deposit is used as a proxy for bank development, a demand-following response is found to predominate. These results hold, irrespective of whether the causality is estimated in the short run or in the long run.*

**Keywords:** Hong Kong; Banking Sector Development; Economic Growth; ARDL-bounds Testing Approach

## INTRODUCTION

The debate regarding the causal relationship between financial development and economic growth has been ongoing since the nineteenth century. Central to the debate is whether it is the growth of the financial sector that drives the growth of the real sector or whether it is the growth of the real sector that leads the development of the financial sector (Odhiambo, 2008). The theoretical foundation of this debate can be traced back to the work of Schumpeter (1912). In an effort to analyze the importance of technological innovation in economic growth, he emphasised the crucial role of the banking system in facilitating investment in innovation and productive investment. On the contrary, Robinson (1952) argued that finance does not exert a causal impact on growth; instead, it is financial development that follows economic growth – as a result of higher demand for financial services. Although many studies have investigated the causal relationship between financial development and economic growth, the results are still ambiguous. Most of the previous empirical studies on the relationship between finance and growth have been dominated by cross-country studies – until recently. However, it is now clear that cross-country studies conducted by lumping together countries at different stages of financial and economic development may not satisfactorily address the country-specific effects.

The current study is intended to contribute to the debate on the relationship between financial development and economic growth with its focus on the Hong Kong experience. The next section discusses the trends in banking development and economic growth in Hong Kong, followed by a section giving the theoretical and empirical

underpinning of the finance-growth nexus, a section outlining the empirical model specification, estimation techniques and the analysis of the empirical results, and finally, a conclusion.

### **Banking Sector Development And Economic Growth in Hong Kong**

Little more than a barren rock at the beginning of the twentieth century, Hong Kong has since then developed into a vibrant international financial centre. The territory has a well-developed and highly sophisticated banking sector with a wide range of financial instruments. It has one of the highest concentrations of banking institutions in the world. Over 70 of the largest 100 banks in the world have an operation in Hong Kong (Hong Kong Monetary Authority, 2012). It maintains a three-tier banking system which comprises licensed banks, restricted licensed banks, and deposit-taking companies – all under the supervision of the Hong Kong Monetary Authority (HKMA). Currently, there are 199 authorised institutions. Among these authorised institutions, 154 are licensed banks, 20 are restricted licensed banks, and 25 are deposit-taking companies.

There are a number of significant events, including structural reforms, financial policy initiatives, and banking consolidation, that have served to shape the Hong Kong banking industry over the past few decades. Regarding the banking structure, it has moved from a monolithic system to a three-tier banking system since 1981 – with further refinement taking place in 1990 (Jao, 2003). The first tier comprises licensed banks, with restricted licensed banks and deposit-taking companies as the second and the third tiers, respectively. The degree of prudential supervision varies directly with the scope of the banking business. The most strictly regulated banks - licensed banks - can take all types of deposits. For the other two tiers with less-demanding regulations, deposit-taking is confined to time deposits.

The central bank functions have been shared by a number of public and private agencies. In 1993, the Hong Kong Monetary Authority was established by merging the Exchange Fund Office with the Commissioner of Banking Office. It was widely regarded as the central bank of Hong Kong – with the responsibility for maintaining currency and banking stability.

Major financial policy initiatives were undertaken to stimulate the competition in the banking sector. They included the deregulation of interest rates, the relaxation of one branch policy for foreign banks, and the relaxation of market-entry criteria. Interest rates on bank deposits have been regulated by a set of interest rate rules issued by the Hong Kong Association of Banks (HKAB), under HKAB ordinance, since 1964 (Kwan, 2003). The interest rate rules were in full operation until 1994, when the rules were first relaxed by removing the interest ceiling on certain types of time deposits. After the local economy had recovered from the Asian financial crisis, the Hong Kong Monetary Authority announced steps to abolish the interest-rate rules entirely in order to further enhance market competition. The remaining interest-rate rules, interest-rate ceilings on time deposits of less than seven days, and all current and savings account interest-rates rules were deregulated and completed in 2001.

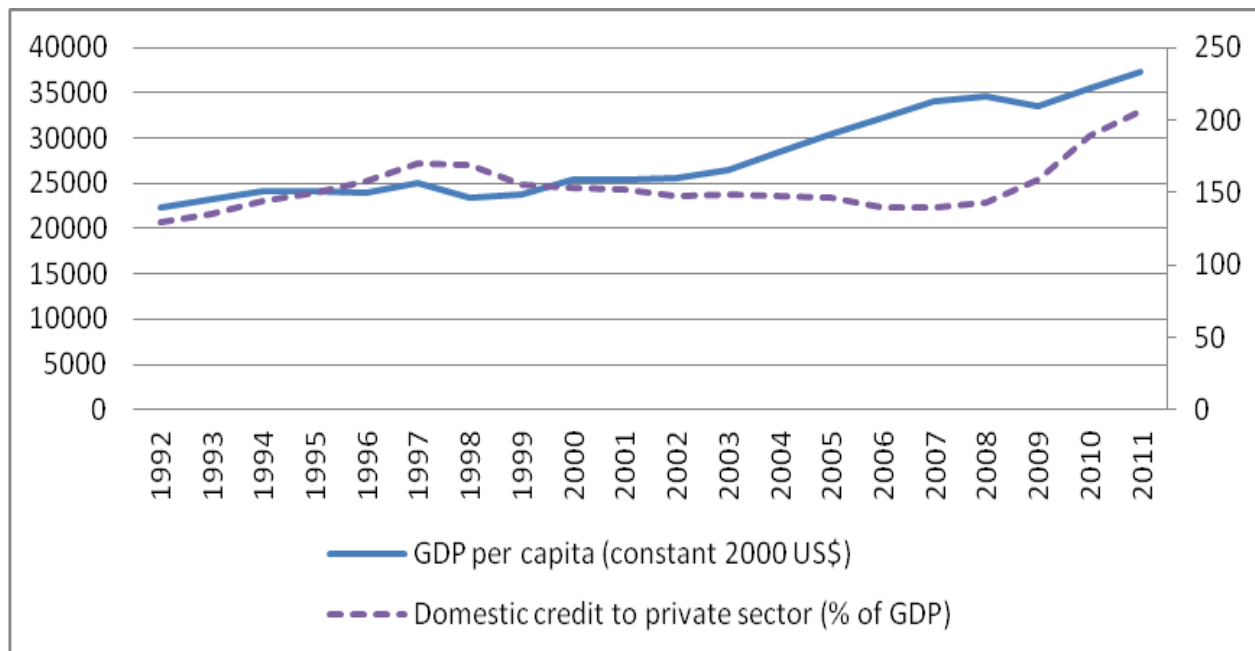
To provide a level playing field for local and foreign participants, the one-branch restriction for foreign banks was partially relaxed to a three-branch condition in 1999 (Jiang et al., 2003). There was a complete removal of any limitation on the number of branches and offices for foreign banks in 2001. In order to attract a broader range of domestic and international financial institutions to conduct banking business in the territory, the market-entry criteria were relaxed in 2002 (Jiang et al., 2003). These included reducing the asset-size criterion for foreign banks and relaxing the criteria for locally incorporated restricted licensed banks and deposit-taking companies to upgrade to licensed-bank status.

Financial liberalization, together with technological progress, globalization, and the motives of cost savings and revenue enhancement, has encouraged bank consolidation. There have been a number of bank mergers and acquisitions that have taken place in the territory in recent years. With the consolidation of locally incorporated licensed banks, the number of licensed banks has now decreased from 31 in 2000 to 23 in 2007 (HKMA, 2012). For example, there has been a consolidation in the ten-member banks of the Bank of China Group into the Bank of China (Hong Kong) in 2001. This has now been listed on the Hong Kong's stock exchange since July 2002 (Jiang et al., 2004:5). In addition to mergers and acquisitions between large-sized and medium-sized banks, there were deals involving smaller banks and overseas banks acquiring small local banks – as a gateway to the mainland China market.

In addition to the consolidation of locally incorporated licensed banks, the number of authorised institutions was greatly reduced by 45% - from 361 in 1997 to 199 in 2012 (HKMA, 2012). The decline was mainly the result of the consolidation of overseas banks and the restructuring of foreign parent banks, which had experienced financial difficulties. For example, the restructuring of Japanese and other Asian banks after the Asian financial crisis led to the consolidation and withdrawal of their overseas operation in Hong Kong.

The bank consolidation in Europe also resulted in a reduction in the number of foreign banks and their related deposit-taking companies in Hong Kong. At the same time, the bank concentration ratio, as measured by the market shares of the largest banks in deposits of the largest five banks, also increased - from 56.7 in 1992 to 71.9 in 2002 (Jiang et al., 2004:7). These indicators show that the banking sector appeared to have a high and increasing degree of concentration with potential room for further market power by large banks.

The general trend of banking development in Hong Kong, as proxied by domestic credit to private sector as the percentage of GDP (DC/GDP), indicates that the Hong Kong banking sector has developed considerably. Figure 1 shows the trends of GDP per capita and domestic credit to private sector over the period 1992-2011.



**Figure 1: The Trends of GDP Per Capita and Domestic Credit to Private Sector from 1992 to 2011**  
 Source: World Development Indicators (2012)

As shown in Figure 1, the DC/GDP increased gradually from 130 in 1992 to 170 in 1997. There was a downward adjustment after the Asian financial crisis, the burst of “dot come bubble”, and the September 11 Tragedy in 2001 that led to a drop to 148 in 2002. During the years 2009-2011, a marked banking development took place in Hong Kong, with the highest number of 206 being recorded in 2011.

The growth of the banking sector in Hong Kong has also been accompanied by a rapid growth of the real sector. Hong Kong has achieved an “economic miracle” during the past few decades. As shown in Figure 1, the real per capita GDP has increased almost two-fold over the past two decades – from USD 20,188 in 1990 to USD 37,352 in 2011. The average growth rate in per capita real terms was 2.4 percent during the 1990s. This rate later increased to 3.5 percent in the 2000s.

When Hong Kong was ceded to the British in 1842, its economic base was an entrepôt trading port for South China and the overseas Chinese community, with only limited domestic manufacturing activities. However, the civil war on the mainland of China and the ultimate Communist victory in 1949 caused fundamental changes in

Hong Kong. With the massive inflow of resources of labour, capital, and entrepreneurial skill – especially from Shanghai, they transformed the economy from an entrepôt to an industrial city (Krause, 1988).

In the post-war era, Hong Kong developed large export-dependent domestic manufacturing sectors. In the 1980s, it gradually moved from manufacturing into banking and financial services (Young, 1992). Hong Kong has achieved rapid economic growth during the last few decades. Together with Singapore, Taiwan, and South Korea, these now comprise the new industrialised countries (NICs) of the East.

## **LITERATURE REVIEW**

Over the past several years, the role of financial development in economic growth has been a focus of attention which has attracted both theoretical and empirical studies to investigate the causal relationship between the two. Schumpeter (1912) argues that the role played by financial intermediaries in mobilizing funds, evaluation and selecting projects, managing risks, monitoring entrepreneurs and facilitating transactions should be seen as the critical elements in fostering technological innovations and economic growth. Goldsmith (1969) argues that the positive correlation between financial development and growth is mainly due to the efficient use of the capital stock. McKinnon and Shaw (1973) propose the significance of financial development in promoting economic growth – through high capital productivity. In this paradigm, financial development is seen as a necessary precondition for economic growth. However, some economists hold skeptical views on the decisive role played by financial development. Robinson (1952) argues that finance does not exert any causal impact on growth. Instead, financial development follows economic growth as a result of higher demand for financial services. When an economy grows, more financial institutions, financial products, and services emerge in the market – in response to the higher demand for financial services. Lucas (1988) asserts that the role of the financial sector in economic growth is over-emphasised. In this paradigm, finance plays a minor role in economic growth and is merely a by-product, or an outcome of growth. On the contrary, Patrick (1966) contends that a supply-leading relationship exists in the early stage of economic development, as causation runs from financial development to economic growth, while a demand-following relationship prevails in the later stage as the feedback causality is reversed. In this paradigm, economists believe that economic growth and financial development can complement each other, showing a bi-directional causality between financial deepening and economic growth. They maintain that financial development is indispensable to economic growth; while economic growth requires a well-functioning and efficient financial system. Another paradigm in the literature regarding the causal relationship between financial development and economic growth is that they are not causally related at all (Graff, 1999). This implies that neither of the two has any significant effect on the other and that the empirically observed correlation between them is merely the result of a historical peculiarity. In other words, even though economies grow as the financial sector grows, the two sectors follow their own individual paths.

The empirical evidence shows that there is support for all the competing perspectives. There is no general consensus regarding the direction of causality between financial development and economic growth. There are four categories in the literature regarding the causal relationship between bank-based financial development and economic growth. The first category is known as the finance-led growth response. In this case, bank-based financial development is considered to be a determinant of economic growth and the causation runs from financial development to economic growth. The empirical studies consistent with this view include those of Bittencourt (2012), Lee (2012), Colombage (2009), Odhiambo (2008), Liu and Hsu (2006), Habibullah and Eng (2006), Chang and Caudill (2005), Beck and Levine (2004), Calderón and Liu (2003), Agbetsiafa (2003), Bhattacharya and Sivasubramanian (2003), Arestis et al. (2001), Xu (2000), Levine et al. (2000), Choe and Moosa (1999), Odedokun (1999), Darrat (1999), Levine and Zervos (1998), Ahmed and Ansari (1998), Rousseau and Wachtel (1998), De Gregorio and Guidotti (1995), King and Levine (1993), and Jung (1986), among others.

The second category is known as the growth-led response, which maintains that bank-based financial development follows economic growth. In other words, economic growth causes financial institutions to change and develop. The empirical studies include those of Hassan et al. (2011), Odhiambo (2010), Colombage (2009), Chakraborty (2008), Zang and Kim (2007), Ang and McKibbin (2006), Liang and Teng (2006), Thangavelu et al. (2004), Waqabaca (2004), Agbetsiafa (2003), Shan et al. (2001), Demetriades and Hussein (1996), and Jung (1986), among others.

The third category maintains that both bank-based financial development and economic growth Granger-cause each other and that there is a bi-directional causality between these two variables. The empirical studies include those of Bangake and Eggoh (2011), Hassan et al. (2011), Wolde-Rufael (2009), Abu-Bader and Abu-Qarn (2008), Odhiambo (2005), Hondroyiannis et al. (2005), Calderón and Liu (2003), Shan et al. (2001), and Demetriades and Hussein (1996), among others.

The fourth category is that financial development and economic growth are not causally related at all. The empirical studies include those of Ibrahim (2007), Chang (2002), and Shan et al. (2001), among others. Table 1 shows the overview of previous studies on the relationship between banking development and economic growth.

**Table 1: Overview of Previous Studies on the Relationship between Banking Development and Economic Growth**

<b>Finance-led Growth</b>			
<b>Author</b>	<b>Country/ Countries of Study</b>	<b>Methodology</b>	<b>Empirical Findings</b>
Bittencourt 2012	Argentina, Bolivia, Brazil and Peru from 1980 to 2007	Panel time-series analysis	Financial development promotes economic growth.
Lee 2012	The US, the UK, Germany, France, Japan and Korea	Time-series analyses	All countries show that financial systems lead economic growth, except for Korea.
Colombage 2009	Canada, Japan, Switzerland, the UK and the US over the period 1995 to 2006	Vector error-correction models	A uni-directional causality running from financial market development to economic growth except for Canada.
Odhiambo 2008	Kenya during the period 1991-2005	Co-integration and error-correction techniques	A distinct uni-directional causal flow from economic growth to financial development.
Liu & Hsu 2006	Taiwan, Korea and Japan over period 1981:1 to 2001:3	Generalized method of moments and principal component analysis	Finance aggregate has positive effects on Taiwan's economy.
Habibullah & Eng 2006	13 Asian developing countries for the period 1990-1998	Dynamic panel Generalized method of moments	Financial intermediation promotes economic growth.
Chang & Caudill 2005	Taiwan from 1962 to 1998	Vector autoregressive (VAR) model	Causality running from financial development to economic growth.
Beck & Levine 2004	40 countries over the period 1976-1998	Dynamic panel data analysis	Expansion of both banks and stock markets has a positive influence on economic growth.
Calderón & Liu 2003	109 developing and industrial countries from 1960 to 1994	Geweke decomposition test on pooled data	Financial development enhances economic growth for all countries.
Agbetsiafa 2003	Eight Sub-Saharan African countries	Error-correction model	Unidirectional causality from finance to growth in Ghana, Nigeria, Senegal, South Africa, Togo and Zambia.
Bhattacharya & Sivasubramanian 2003	India over the period 1970-1999	Co-integration analysis	Financial sector development leads GDP and not the other way round.
Arestis et al. 2001	France, Germany, Japan, United Kingdom and the United States	Time series analysis	Bank-based financial systems are more able to promote long-term growth than capital-market-based ones.
Xu 2000	41 countries between 1960-1993	Vector auto-regressive approach	Financial development is important to growth.
Levine et al. 2000	74 countries during the period 1960-1995	Both traditional cross-section, instrumental variable procedures and dynamic panel techniques	Financial intermediary development is positively associated with economic growth.
Choe & Moosa 1999	Korea over the period 1970-1992	Causality and non-nested model selection tests	Financial development leads economic growth.
Odedokun 1999	22 industrial countries and 100 developing countries over the period of 1961-90	Two-stage Least Square and fixed effects methods	Expansion in the size of monetary sector is found to have beneficial effects on the production taking place in the real sector and also on the overall economic growth.
Darrat 1999	Saudi Arabia, Turkey and the United Arab Emirates over the period 1964-1993	Multivariate Granger-causality tests	Financial deepening is a necessary causal factor of economic growth.

Levine & Zervos 1998	47 countries from 1976 to 1993	Cross-country regressions	Banking development is positively and robustly correlated with current and future rates of economic growth.
Ahmed & Ansari 1998	India, Pakistan and Sri Lanka over the period 1973 – 1991	Granger causality tests	Financial sector development causes economic growth.
Rousseau & Wachtel 1998	The United States, the United Kingdom, Canada, Norway and Sweden over the 1870-1929 period	Granger causality tests	There is a leading role for the intermediation variables in real sector activity.
De Gregorio & Guidotti 1995	Over 100 countries	Ordinary Least Square	Financial development leads to improved growth performance in a large cross-country sample.
King & Levine 1993	80 countries over the period 1960-1989	Cross-sectional approach	The level of financial development is a good predictor of economic growth.
Jung 1986	56 countries, both developed and developing	Vector auto-regressive approach	The less developed countries are characterized by causal direction running from financial to economic development.

**Growth-led Finance**

<b>Author</b>	<b>Country/ Countries of Study</b>	<b>Methodology</b>	<b>Empirical Findings</b>
Hassan et al. 2011	168 countries during the period of 1980-2007	Panel estimations and multivariate time-series models	A one-way causality from growth to finance for Sub-Saharan Africa and East Asia & Pacific in the short run.
Odhiambo 2010	Tanzania over the period 1969-2006	Trivariate causality model	The growth of the real sector drives the development of the financial sector.
Colombage 2009	Canada, Japan, Switzerland, the UK and the US over the period 1995 to 2006	Vector error-correction models	Canadian results hold that overall economic growth leads to the development of capital markets.
Chakraborty 2008	India over the period 1996Q3 to 2005Q1	Time series analysis	Economic growth causes financial development in India.
Zang & Kim 2007	Same panel data set used by Levine et al. 2000	Sims-Geweke causality tests	Economic growth precedes subsequent financial development.
Ang & McKibbin 2006	Malaysia from 1960-2001	Cointegration and causality tests	Financial deepening is an outcome of the growth process.
Liang & Teng 2006	China from 1952-2001	Multivariate vector autoregressive model	A unidirectional causality from growth to finance.
Thangavelu et al. 2004	Australia over the period of 1960-1999	Time series methodology of vector autoregressive model and Granger causality test	Evidence of causality from economic growth to the development of the financial intermediaries.
Waqabaca 2004	Fiji from 1970-2000	Vector autoregressive model	Direction of causation running predominantly from economic growth to financial development.
Agbetsiafa 2003	Eight Sub-Saharan African countries	Error-correction model	Unidirectional causality from growth to finance in Ivory Coast and Kenya.
Shan et al. 2001	Nine OECD countries and China	Granger causality procedure	One way causality from economic growth to financial development is found in Canada, China and Italy.
Demetriades & Hussein 1996	16 countries	Time series techniques	A few countries show economic growth systematically causes financial development.
Jung 1986	56 countries, both developed and developing	Vector auto-regressive approach	The developed countries are characterized by causal direction running from economic to financial development.

**Bi-directional**

<b>Author</b>	<b>Country/ Countries of Study</b>	<b>Methodology</b>	<b>Empirical Findings</b>
Bangake & Eggoh 2011	71 developed and developing countries over the period of 1960 -2004	Panel vector error-correction models	Confirms results of a bi-directional causality between finance and growth.
Hassan et al. 2011	168 countries during the period of 1980-2007	Panel estimations and multivariate time-series models	A two-way causality relationship between finance and growth for most regions in the short run except for Sub-Saharan and East Asia & Pacific.
Wolde-Rufael 2009	Kenya for the period 1966-2005	Granger causality test	Three out of the four measures of financial development show two-way Granger causality.
Abu-Bader & Abu-Qarn 2008	Egypt during the period 1960-2001	Trivariate vector autoregressive (VAR) framework	Financial development and economic growth are mutually causal.
Odhiambo 2005	Tanzania	Johansen-Juselius cointegration method and vector error-correction mechanism	There is bidirectional causality between financial development and economic growth.
Hondroyannis et al. 2005	Greece during the period 1986-1999	Vector autoregressive (VAR) framework	There exists a bidirectional causality between finance and growth in the long run.
Calderón & Liu 2003	109 developing and industrial countries from 1960 to 1994	Geweke decomposition test on pooled data	Evidence of bidirectional causality is found when the sample is split into developing and industrial countries.
Shan et al. 2001	Nine OECD countries and China	Granger causality procedure	Bi-directional causality is found in Australia, Denmark, Japan, the US and the UK.
Demetriades & Hussein 1996	16 countries	Time series techniques	Most of the evidence supports the view of bi-directional relationship.

**No Relationship**

<b>Author</b>	<b>Country/ Countries of study</b>	<b>Methodology</b>	<b>Empirical Findings</b>
Ibrahim 2007	Malaysia over the period from 1985-2003	Time series analysis	An insignificant relation between development of financial intermediary and GDP.
Chang 2002	Mainland China over period 1987Q1 to 1999Q4	Multivariate vector autoregressive models	The results suggest independence between financial development and economic growth.
Shan et al. 2001	Nine OECD countries and China	Granger causality procedure	No Granger causality, in either direction, is found in France and New Zealand.

**ESTIMATION TECHNIQUES AND EMPIRICAL ANALYSIS**

Before the proxies of bank-based financial development and real GDP per capita were tested for co-integration – using the ARDL-bounds testing approach – the data sets of these variables were tested for stationarity using the Philips-Peron, ADF and ADF-GLS tests. All the data used in this study span the period from 1980 to 2011 and were obtained from the various issues of the International Financial Statistics (IFS) Yearbook and World Development Indicators. The results of the stationarity tests in levels are presented in Table 2.

Table 2: Stationarity Tests of Variables in Levels

Variable	No Trend	Trend
<b>Stationarity Tests of Variables in Levels - Phillips-Perron (PP) Test</b>		
Ly/N	0.009940	-1.342222
LDCPB/GDP	-1.151153	-1.712698
LBD/GDP	0.063565	-2.430138
<b>Stationarity Tests of Variables in Levels – Dickey-Fuller - GLS Test</b>		
Ly/N	0.298443	-1.742057
LDCPB/GDP	-1.215006	-1.731733
LBD/GDP	-0.422384	-2.563316
<b>Stationarity Tests of Variables in Levels – ADF Test</b>		
Ly/N	0.169499	-1.548146
LDCPB/GDP	-1.280145	-1.615598
LBD/GDP	0.063565	-2.766237

Notes:

- 1) The truncation lag for the PP tests is based on Newey and West (1987) bandwidth.
- 2) \*\* and \*\*\* denote 5% and 1% levels of significance, respectively.
- 3) Critical values for Dickey-Fuller GLS test are based on Elliot-Rothenberg-Stock (1996, Table 1).

As shown in Table 2, the Phillips-Perron, ADF and ADF-GLS tests conducted on the two proxies of bank development and economic growth reject the stationarity in levels. Based on these results, we can conclude that the variables are not integrated of order zero  $I(0)$ . The variables are, therefore, differenced once in order to test for stationarity on differenced variables. The results of the stationarity tests on the first difference are reported in Table 3.

Table 3: Stationarity Tests of Variables on First Difference

Variable	No Trend	Trend
<b>Stationarity Tests of Variables on First Difference - Phillips-Perron (PP) Test</b>		
DLy/N	-3.759457**	-3.720750**
DLDCPB/GDP	-4.113504***	-3.722142**
DLBD/GDP	-4.238172***	-3.705473**
<b>Stationarity Tests of Variables on First Difference – Dickey-Fuller - GLS Test</b>		
DLy/N	-3.795388***	-3.953571***
DLDCPB/GDP	-3.086406***	-3.429576**
DLBD/GDP	-3.321442***	-3.446662**
<b>Stationarity Tests of Variables on First Difference – ADF Test</b>		
DLy/N	-3.026626***	-3.281011**
DLDCPB/GDP	-3.419717**	-3.68524**
DLBD/GDP	-4.241010***	-5.517308***

Notes:

- 1) The truncation lag for the PP tests is based on Newey and West (1987) bandwidth.
- 2) \*\* and \*\*\* denote 5% and 1% levels of significance, respectively.
- 3) Critical values for Dickey-Fuller GLS test are based on Elliot-Rothenberg-Stock (1996, Table 1).

The results of the unit root tests, reported in Table 3, show that all three variables are integrated of order 1 - and not of order two - or higher.

### Cointegration Test – ARDL-bounds Testing Procedure

In order to test for the existence of co-integration between the two proxies of bank development and economic growth, the recently developed ARDL-bounds testing approach is used. The ARDL model used in this study can be expressed as follows (see Odhiambo, 2009a):



Model 1 – Causality between DLCPB and DLy/N

$$\Delta \ln y / N_t = a_0 + \sum_{i=1}^n a_{1i} \Delta \ln y / N_{t-i} + \sum_{i=0}^n a_{2i} \Delta \ln \text{DCPB} / \text{GDP}_{t-i} + a_3 \ln y / N_{t-1} + a_4 \ln \text{DCPB} / \text{GDP}_{t-1} + \mu_{1t} \dots \dots \dots (1)$$

$$\Delta \ln \text{DCPB} / \text{GDP}_t = \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta \ln \text{DCPB} / \text{GDP}_{t-i} + \sum_{i=0}^n \beta_{2i} \ln y / N_{t-i} + \beta_3 \ln y / N_{t-1} + \beta_4 \ln \text{DCPB} / \text{GDP}_{t-1} + \mu_{2t} \dots \dots \dots (2)$$

Model 2- Causality between DLBD/GDP and DLy/N

$$\Delta \ln y / N_t = a_0 + \sum_{i=1}^n a_{1i} \Delta \ln y / N_{t-i} + \sum_{i=0}^n a_{2i} \Delta \ln \text{BD} / \text{GDP}_{t-i} + a_3 \ln y / N_{t-1} + a_4 \ln \text{BD} / \text{GDP}_{t-1} + \mu_{1t} \dots \dots \dots (3)$$

$$\Delta \ln \text{BD} / \text{GDP}_t = \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta \ln \text{BD} / \text{GDP}_{t-i} + \sum_{i=0}^n \beta_{2i} \ln y / N_{t-i} + \beta_3 \ln y / N_{t-1} + \beta_4 \ln \text{BD} / \text{GDP}_{t-1} + \mu_{2t} \dots \dots \dots (4)$$

where y/N = Real GDP per capita, DCPB/GDP = Domestic credit provided by the banking sector as a % of GDP, BD/GDP = Banks deposit as a % of GDP, and Δ = first difference operator.

In order to test for the cointegration relationship, using the ARDL-bounds testing approach, two steps are followed. The first step involves examining the order of lags on the first differenced variables in equations (1) and (2) - using the Akaike Information Criterion (AIC) and the Schwartz-Bayesian Criterion (SBC). The results of our AIC and SBC tests (not reported here) show that the optimal lag of Model 1 is three, while that of Model 2 is lag one. In the second step, we apply the bounds F-test to equations (1) and (2) in order to establish whether there exists any long-run relationship between the variables under consideration. The results of the bounds test are reported in Table 4.

**Table 4: Bounds F-test for Cointegration**

Dependent Variable	Function		F-test Statistic			
<b>Model 1 – BDCP/GDP and y/N</b>						
DLy/N	DLy/N(DLBDCP/GDP )		2.250			
DLBDCP/GDP	DLBDCP/GDP(DLy/N)		8.960***			
<b>Model 2 – BD/GDP and y/N</b>						
DLy/N	DLy/N(DLBD/GDP)		5.766***			
DLBD/GDP	DLBD/GDP (DLy/N)		2.600			
<b>Asymptotic Critical Values</b>						
	1 %		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Pesaran et al. (2001), p. 300, Table CI(ii) Case II	4.94	5.58	3.62	4.16	3.02	3.51

Note: \*\*\* denote statistical significance at the 5% and 10% levels, respectively.

The results reported in Table 4 show that there exists a long-run relationship between each of the two proxies of the banking sector development and economic growth. Specifically, the results show that there is a unique co-integrating vector between banking sector development and economic growth in both Model 1 and Model 2. This finding is confirmed by the F-statistics in the DLBC/GDP equation (Model 1) and the DLy/N equation (Model 2), which are found to be both greater than the critical F-statistics at the 1 % level of significance.

**Granger Non-Causality Test**

Following the confirmation of a long-run co-integration relationship between bank development proxies and economic growth, we proceed to the next step – examining for causality between these variables. For this purpose, the following dynamic Granger-causality model, based on the error-correction mechanism, is used (see also Odhiambo, 2008, Narayan and Smyth, 2008; Odhiambo, 2010).

Model 1 – Causality between DLCPB/GDP and DLy/N

$$\Delta Iny / N_t = \delta_0 + \sum_{i=1}^n \delta_{1i} \Delta Iny / N_{t-i} + \sum_{i=0}^n \delta_{2i} \Delta InDCPB / GDP_{t-i} + ECM_{t-1} + v_{1t} \dots \dots \dots (5)$$

$$\Delta InDCPB / GDP_t = \lambda_0 + \sum_{i=1}^n \lambda_{1i} \Delta InDCPB / GDP_{t-i} + \sum_{i=0}^n \lambda_{2i} \Delta Iny / N_{t-i} + ECM_{t-1} + v_{2t} \dots \dots \dots (6)$$

Model 2- Causality between DLBD/GDP and DLy/N

$$\Delta Iny / N_t = \delta_0 + \sum_{i=1}^n \delta_{1i} \Delta Iny / N_{t-i} + \sum_{i=0}^n \delta_{2i} \Delta InBD / GDP_{t-i} + ECM_{t-1} + v_{1t} \dots \dots \dots (7)$$

$$\Delta InBD / GDP_t = \lambda_0 + \sum_{i=1}^n \lambda_{1i} \Delta InBD / GDP_{t-i} + \sum_{i=0}^n \lambda_{2i} \Delta Iny / N_{t-i} + ECM_{t-1} + v_{2t} \dots \dots \dots (8)$$

where ECM<sub>t-1</sub> = the lagged error-correction term obtained from the long-run equilibrium relationship.

From equations 5-8, the direction of the causality between the two proxies of bank-based financial development and economic growth is determined by the F-statistic and the lagged error-correction term. While the F-statistic represents the short-run causal effect, the t statistic on the coefficient of the lagged error-correction term represents the long-run causal relationship (see Narayan and Smyth, 2006; Odhiambo, 2008; Odhiambo, 2009b). The results of these causality tests are reported in Table 5.

**Table 5: Granger Non-causality Tests**

Dependent Variable	Causal Flow	F-statistic	t-test on ECM	R <sup>2</sup>
<b>Model 1 – DBDCP/GDP and Dy/N</b>				
Dy/N	DBDCP/GDP → Dy/N	2.2538	-	0.77
DBDCP/GDP	Dy/N → DBDCP/GDP	4.9109**	-2.523**	0.79
<b>Model 2 – DBD/GDP and Dy/N</b>				
Dy/N	DBD/GDP → Dy/N	7.1432***	-2.750**	0.78
DBD/GDP	Dy/N → DBD/GDP	1.5319	-	0.69

Note: \*\*\* denotes statistical significance at the 1% level.

The results reported in Table 5 show that the causal relationship between bank-based financial development and economic growth in Hong Kong depends on the proxy used to measure the level of financial development. When the domestic credit provided by the banking sector is used as a proxy for bank-based financial development, a distinct supply-leading response is found to prevail. The long-run causal flow from bank development to economic growth is confirmed by the coefficient of the lagged error-correction term, which is found to be negative and statistically significant. The short-run causal flow, on the other hand, is confirmed by the F-statistic, which is found to be statistically significant. However, when the banks’ deposit is used as a proxy for bank development, causality changes from a supply-leading response to a demand-following response. In other words, economic growth is found to Granger-cause bank development – both in the short run and in the long run. The short-run causal flow is supported by the F-statistic in the bank-development equation, which is confirmed to be statistically significant. The long-run causality, on the other hand, is confirmed by the coefficient of the lagged error-correction term in the bank-development equation, which is confirmed to be negative and statistically significant.

## CONCLUSION

In this study, we have examined the relationship between bank-based financial development and economic growth – using the Hong Kong time-series data. The study has attempted to answer one critical question: Does the relationship between bank-based financial development and economic growth in Hong Kong follow a supply-leading or a demand-following response? Hong Kong has developed into a vibrant international financial centre. The territory has a well-developed and highly sophisticated banking sector with a wide range of financial instruments. Unfortunately, very few studies have attempted to examine the dynamic causal relationship between bank-based financial development and economic growth in Hong Kong. Some of the previous studies also suffer from methodological deficiencies. For example, some previous studies have over-relied either on the residual-based co-integration test associated with Engle and Granger (1987) or on the maximum-likelihood test associated with Johansen (1988) and Juselius (1990). Yet, it is now well known that these co-integration techniques may not be appropriate when the sample size is too small (see Narayan and Smyth, 2005; Odhiambo, 2009a). Using the newly developed ARDL-bounds testing approach, the current study finds that the relationship between bank-based financial development and economic growth is sensitive to the proxy used to measure the banking-sector development. When the domestic credit provided by the banking sector is used as a proxy for bank-based financial development, a distinct supply-leading response is found to prevail. However, when the banks deposit is used as a proxy for bank development, a demand-following response is found to prevail. These results hold, irrespective of whether the causality is estimated in the short run or in the long run.

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