Determinants of Economic Growth in Hong Kong: The Role of Stock Market Development

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Abstract

We assessed the impact of stock market development on growth in Hong Kong for the period 1986Q2 to 2015Q4. By constructing a composite index of stock market development and controlling for the key determinants of growth, we found stock market development to promote growth both in the short and long run. We further constructed an alternative index of stock market development and found this conclusion to be robust. Our findings are broadly consistent with the growth experience of Hong Kong. Policies meant to promote stock market development may enhance growth in Hong Kong as well.

JEL Codes: C32; E44.

Keywords: Determinants; Economic Growth; Stock Market Development; Hong Kong.

1. Introduction

In this paper, we assess the impact of stock market development on growth in Hong Kong. Stock markets have grown significantly during the past three decades. In response, various studies have explored the significance of stock markets in economic growth. The majority of the studies have established a positive association between stock market development and growth. In theory, stock markets may influence overall economic activities in myriad ways. From savings and investment channel, stock markets ensure efficient savings mobilization and facilitate prudent investment, which are crucial for growth (Greenwood and Smith, 1997). Stock markets ensure liquidity, allowing investors to trade financial assets in a less risky manner (Ho and Iyke, 2017). Market liquidity paves the way for companies to draw capital for operational purposes. This enhances long-term growth (Bencivenga et al., 1996; Levine, 1991; Ho and Iyke, 2017). Stock markets are needed to facilitate the flow of world portfolios from safer low-return capital to riskier high-return capital. This has substantial welfare gains through the expected consumption growth channel (Obstfeld, 1994). Moreover, stock markets are effective in promoting the quality of corporate governance by addressing the principal-agent problem, thereby enhancing business activities (Jensen and Murphy, 1990).

In contrast, stock markets may adversely influence economic activities in a number of ways. Stock markets provide greater access to liquidity which may hamper the savings rate by enhancing the returns on investment (Demirgüc-Kunt and Levine, 1996). Stock markets reduce the uncertainty linked to investment, thereby making investment more enticing to risk-averse agents and reducing the demand for precautionary savings (Demirgüc-Kunt and Levine, 1996). Also, the incidence of excessive stock price volatility may contribute to an inefficient resource allocation and increases in the interest rate in response to higher uncertainty. This will compromise the quantity and productivity of the investment, thus inhibiting growth (DeLong et al., 1989; Arestis et al., 2001). Additionally, highly liquid stock markets breed high rates of stock turnover. This stifles the need to affirm corporate control, hence compromising the quality of corporate governance (Jensen and Murphy, 1990).

The importance of stock markets in the economy appears therefore to be a divisive issue at best. The empirical literature has not yielded any conclusive evidence either. For instance, while studies such as Atje and Jovanovic (1993), Levine and Zervos (1996; 1998), Beck and Levine (2004), Rioja and Valev (2004), and Akinlo and Akinlo (2009) find stock market development to enhance growth, others such as Singh (1997), Harris (1997), Gilchrist et al. (2009), Næs et al. (2011), and Farmer (2012) find stock market development to be irrelevant or sometimes hurt growth. The divisive nature of both the theoretical and empirical literature leaves the role of stock markets in the economy widely open for further probing. This paper explores the impact of stock market development on growth in Hong Kong. This country has pursued extensive reforms leading to rapid growth in its stock market for more than three decades. Today, the Hong Kong stock market is among the largest and most liquid markets around the world [World Federation of Exchanges (WFE), 2017]. During the expansion phase of the Hong Kong stock market, the country also experienced strong growth (World Bank, 2016). These developments make Hong Kong a suitable candidate for the examination of the stock market–growth debate. Although existing studies have examined this topic, they are mostly based on panel and cross-country data. However, it is a known fact that by combining countries with different economic, socio-political, and institutional structures in a panel or cross-country setting, important country-specific information is lost. To be able to isolate important country-specific information in a panel data setting, the researcher must make appropriate assumptions and choose the right models (Hsiao, 2005). Also, cross-country data does not allow the researcher to explore economic relationships over time (Kramer, 1983). Taking all these into consideration, the previous studies may have not adequately produced important links between stock markets and the economy, particularly in Hong Kong.

Against this backdrop, we reassess the impact of stock market development on growth in Hong Kong during the period 1986Q2 to 2015Q4, by using time series approaches. Specifically, we utilize the autoregressive distributed lags (ARDL) approach which allows us to explore both the short- and the long-run impact of stock market development on growth. Since stock markets have different facets, we construct an index of stock market development based on the market capitalization ratio, total value traded ratio, and turnover ratio using the principal component analysis (PCA) method. We then controlled for structural changes and key determinants of growth and found stock market development to promote growth both in the short and long run. In order to ensure the robustness of our results, we further construct an alternative index of stock market development via the means-removed method. Using this alternative index of stock market development, we find our conclusion to hold. A common thread running through the results is that only the size of the impact of stock market development on growth depends on the choice of the stock market development index. Our results are broadly consistent with the growth experience of Hong Kong during the past three decades. The stock market in Hong Kong has developed rapidly alongside the pace of growth during the past decades. Our findings imply that policies meant to promote stock market development may also enhance economic growth in Hong Kong.

In the next section, we outline the development of the stock market in Hong Kong vis-à-vis the evolution of the country's gross domestic product (GDP). In section 3, we review the relevant literature. Then, in section 4, we present the methodology and the data. Section 5 reports our main empirical results, and a sensitivity analysis of these results. Section 6 provides the conclusion.

2. The development of the Hong Kong stock market

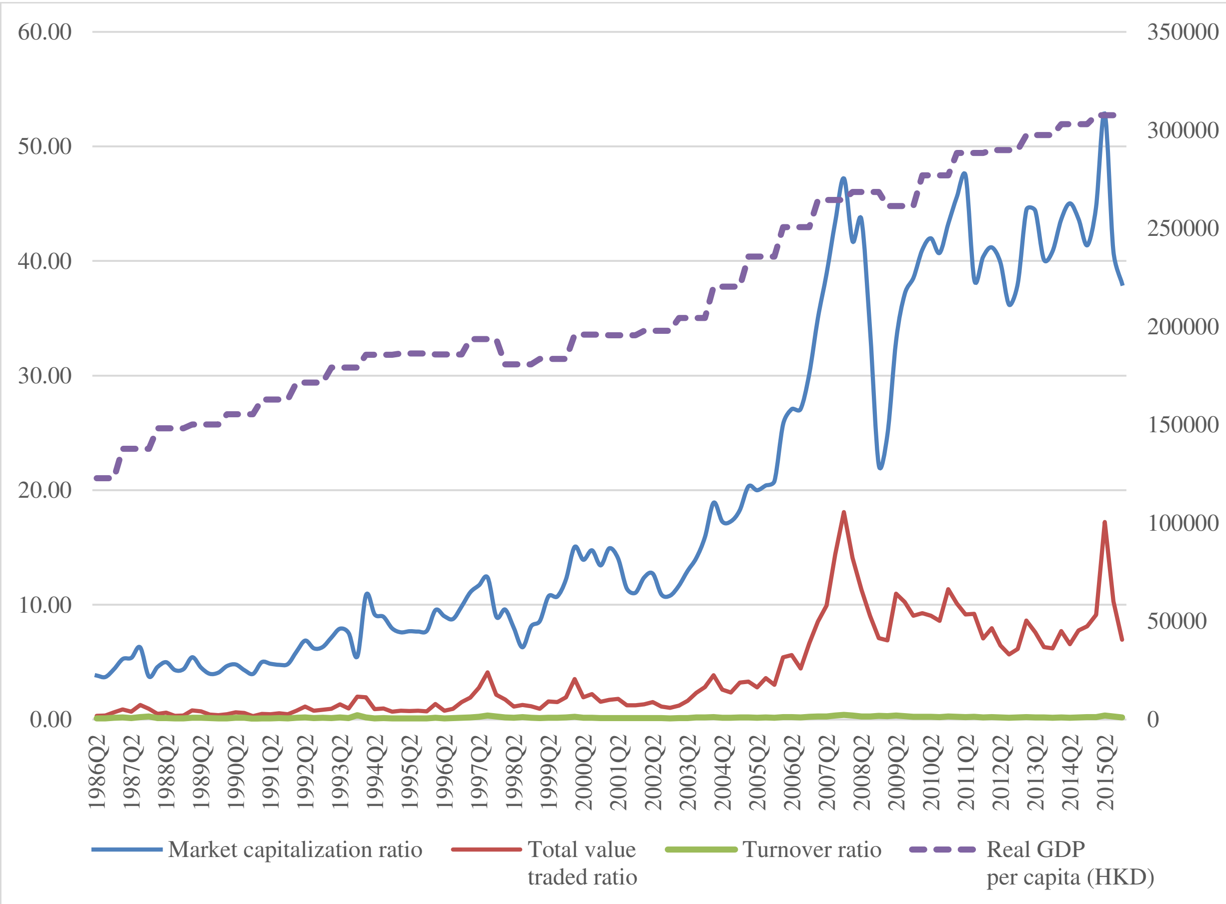
The Hong Kong stock market has experienced over a hundred and fifty years of development. The trading activities of securities were recorded in 1866 after the establishment of first Companies Ordinance (see Schenk, 2001). As the share trading activities started to increase, the first stock exchange was formally established in 1981. It was known as the Association of Stockbrokers in Hong Kong. Later it was renamed the Hong Kong Stock Exchange in 1914 [Hong Kong Exchanges and Clearing Limited (HKEx), 2016a]. However, the share trading activities in the exchange was considered as insignificant during the early periods. It only started to flourish during 1970s owing to a number of factors including the reassurance from Mainland China about the political future of Hong Kong, the open-door policy adopted by Mainland China that enhanced Hong Kong as the financial gateway, and the increasing international capital flows into Asia, including Hong Kong (see Jao, 2003, Uddin et al. 1998). As a result, three more stock exchanges were set up during the period 1960s and 1970s (see Tsang, 2004).

Starting from the late 1980s, a series of major reforms and developments in the Hong Kong stock market were initiated by the government. For example, the four stock exchanges were unified as the Hong Kong Stock Exchange to reduce unhealthy competition among them (HKEx, 2016a). In addition, the Securities and Futures Commission was established in 1989 to serve as an independent statutory body regulating the securities and futures markets (Arner et al., 2010). Later in 1999, a second board called the Growth Enterprise Market was launched to provide a capital formation platform for start-up companies. In the same year, the stock and futures exchanges together with their clearing houses were merged under one single holding company, namely the Hong Kong Exchanges and Clearing Limited (HKEx) to reduce operation costs and increase international competitiveness. It was later demutualized and went public by way of introduction in 2000 (HKEx, 2016a). Also, due to the increasing interactions of stock markets between Hong Kong and Mainland China, further reforms were carried out. For instance, in 2012, a joint venture of the HKEx, the Shanghai Stock Exchange and the Shenzhen Stock Exchange was formed to jointly develop the financial products and related services. In 2014, the Shanghai-Hong Kong Stock Connect was formally launched to provide a platform for mutual stock access between Shanghai and Hong Kong. More recently, the Shenzhen-Hong Kong Stock Connect was also launched in 2016 to further improve the stock trading activities between Hong Kong and Mainland China (HKEx, 2016a; 2016b).

As a result of all these major reforms and developments, the stock market in Hong Kong has grown tremendously over the past few decades. For example, the absolute size of the stock market, measured by the market capitalization, increased significantly from HK$ 285,121 million in 1986Q2 to HK$ 24,565,117 million in 2015Q4 (HKEx, 2016c). In 2015, HKEx was ranked as the eighth largest stock market in the world, just behind the economic giants such as the United States, Europe, the United Kingdom, Mainland China and Japan (WFE, 2017). The growth of the stock market is even more phenomenal when we consider the size of stock market relative to its economy. As measured by market capitalization ratio, the international ranking improved from fourth-highest in 1989 to the highest in the world in 1999. It remained to have the highest ranking in the world during the period 1999 to 2015 [see World Development Indicators (WDI), 2016]. The impressive growth in market capitalization is mainly due to the increasing listing of Mainland enterprises in Hong Kong since 1990s, and the continuous expansion of Hong Kong companies into overseas markets (see Lee and Poon, 2005; Ho and Odhiambo, 2015). In addition to the size of the stock market, the liquidity of the stock market also improved during this period. As measured by the total value traded ratio, the ranking improved from the sixth highest in 1986 to the highest in the world in 2007. It remained the most liquid market during 2007 to 2015 (see WDI, 2016). When liquidity is measured by turnover ratio, however, the market's liquidity dropped slightly from the ninth in 1986 to twelfth in 2015 (WDI, 2016). Based on the above indicators, one can argue that Hong Kong has an extremely large and liquid stock market in the world.

The phenomenal growth in the Hong Kong stock market is also associated with a high and sustainable economic growth in the country over the past few decades. Despite the negative impacts of the Asian Financial Crisis in 1997/98, the outbreak of the epidemic virus in 2003, the global financial crisis in 2008, and the recent European sovereign debt crisis, the real GDP per capita has shown an increasing trend. It increased from HK$ 122,723 in 1986Q2 to HK$ 307,483 in 2015Q4, representing a 2.5 times increase during this period [International Financial Statistics (IFS), 2016]. Such economic improvement has uplifted Hong Kong to become a high-income economy according the standard of the World Bank (2017). Figure 1 shows the various indicators of stock market development and the economic performance in Hong Kong during 1986Q2 to 2015Q4. Could it be that the Hong Kong stock market was the key driver of this economic expansion? In the rest of the paper, we attempt to answer this question.

Figure 1: Evolution of the stock market and economic performance in Hong Kong during 1986Q2 to 2015Q4



Sources: IFS (2016) and HKEx (2016c)

3. Literature Review

The nature of the relationship between stock market development and economic growth has been widely documented in the existing literature. Some of the studies show that there exists a positive relationship between stock market development and economic growth (see, for example, Atje and Jovanovic, 1993; Levine and Zervos, 1996; 1998; Arestis et al., 2001; Minier, 2003; Beck and Levine, 2004; Adjasi and Biekpe, 2006; Akinlo and Akinlo, 2009; Chong et al., 2010; Cooray, 2010; Masoud and Hardaker, 2012, Ngare et al., 2014).

Atje and Jovanovic (1993), by using cross-growth regression framework in 40 countries covering the period 1980 to 1988, find that stock market exerts a large and positive effect on both the level and growth rate of economic activities. Levine and Zervos (1996) examine the association between stock market and economic growth in 41 countries, including Hong Kong, for the period 1976 to 1993. The results of their pooled cross-country, time-series regressions show that stock market development has a positive impact on the long-run economic growth. Later in another study, Levine and Zervos (1998) employ cross-country regression for 47 countries, including Hong Kong. They find that stock market size and liquidity have a positive influence on the current and future rates of economic growth. Arestis et al. (2001) find the positive influence of stock markets on economic growth to be stronger than the positive influence of banks. Minier (2003), based on the dataset of Levine and Zervos (1998), shows that stock market development is positively associated with economic growth in those countries with high levels of stock market capitalization such as Hong Kong. Rioja and Valev (2004), also share a similar view with Minier (2003) by showing that stock market development has a strong positive influence on economic growth in the more developed economies. Beck and Levine (2004) find similar evidence of a positive impact of stock markets on economic growth in their panel data study. Adjasi and Biekpe (2006) investigate the relationship of stock market development and economic growth in 14 African countries. They find that stock market development and economic growth are positively related. Akinlo and Akinlo (2009), using the ARDL bounds testing approach, find that stock market development exerts a positive impact on economic growth in seven sub-Saharan countries. Cooray (2010), using the stock market augmented model for a cross section of 35 developing countries, finds that size, liquidity and activities of stock market enhance economic growth. Recently studies such as Masoud and Hardaker (2012), and Ngare et al. (2014) also find that stock market development and economic growth are positively related.

On the contrary, there are some studies showing that stock market development does not enhance economic growth (see Singh, 1997; Harris, 1997, Levine and Zervos, 1998; Naceur and Ghazouani, 2007, Naceur et al., 2008). The findings from these studies suggest that in the early stage of stock market development, the underdeveloped financial systems may affect the quality of association between stock market development and economic growth. For example, Singh

(1997), while examining the role of stock markets on the economic growth in developing economies during the period 1980s and 1990s, argues that stock market development is unlikely to help in achieving faster long-term economic growth in most of the countries. In the same vein, Harris (1997), while examining the empirical relationship between stock markets and economic growth in 49 countries covering the period 1980 to 1991, finds no clear evidence that stock market development is associated with per capita output growth in the whole sample and in the sub-samples. Although, in their study, Levine and Zervos (1998) find that stock market liquidity is systematically associated with long-term growth, they also find no such link between stock market size or volatility and long-term growth. Similarly, Naceur and Ghazouani (2007) assess the impact of stock market on economic growth for a sample of 11 MENA countries over a varying period 1979 to 2003. By using GMM techniques, they find that there is no significant relationship between stock market development and growth under less-developed financial systems. Later on, a related study conducted by Naceur et al. (2008), using annual data from 11 MENA countries covering the period 1979 to 2005, find that stock market liberalization has no effect on economic growth. Highly-developed stock markets breed highly sophisticated products that may not be suitable as investment vehicles in the long-term. A loss in investor confidence in these highly-sophisticated products may lead to stock market crashes due to sharp shrinkages in stock market liquidity and severe economic downturns such as the one that the global economy experienced between 2007 and 2009 (see Gilchrist et al., 2009; Næs et al., 2011; Farmer, 2012). Moreover, as stock markets continue to develop, they become more volatile. Stock market volatility is likely to hurt long-term growth than improve it (see Stock and Watson, 2012).

The divisive nature of the existing literature leaves the stock market-growth nexus open for further examination. This paper joins the previous studies by re-examining the stock market-growth relationship for Hong Kong. As seen from the evolution of the Hong Kong Stock market vis-à-vis the GDP, there is a potential positive link between the stock market and economic growth in this country. However, a formal empirical examination of this link has been conducted by previous studies using cross-sectional or panel data. Such data may not adequately reflect the country's unique experience. As stated earlier, by combining countries with different economic, socio-political, and institutional structures in a panel or cross-country setting, important country-specific information is lost (Hsiao, 2005; Kramer, 1983). Hence, we move away from this tradition by using time series techniques to uniquely document the stock mark-growth link for Hong Kong, thereby providing further insights into the topic.

4. Methods and Data

4.1 Empirical Specification

To examine the role of stock market development in growth for Hong Kong, we fit a standard growth model of the form:

$$lnY_t = \eta_0 + \eta_1 lnHC_t + \eta_2 lnPC_t + \eta_3 lnSMD_t + \eta_4 lnINF_t + \eta_5 lnGOV_t + \eta_6 DUM_t + \epsilon_t \quad (1)$$

where lnY_t is the logarithm of real GDP per capita at period t, $lnHC_t$, $lnPC_t$, $lnSMD_t$, $lnINF_t$, and $lnGOV_t$ are the logarithms of human capital, physical capital, stock market development, inflation, and government expenditure at period t, respectively; DUM_t is the dummy variable that captures the presence of structural breaks; η_i are the parameters of the model, and ϵ_t is an iid error term.

The motivation for using these variables as controls is informed by the literature. First of all, the size of a country's human capital stock is vital for its growth (see Lucas, 1988; Barro, 1991). Therefore, in a growth regression, human capital should be included. Following Psacharopoulos (1994) and Barro (2001), we include human capital in our model. Secondly, all growth models emphasize the role of physical capital in economic growth (see Barro, 1991; Mankiw et al., 1992; Moral-Benito, 2012; León-González and Vinayagathasan, 2015; Iyke, 2017, for instance). The fast-growing countries, today boast substantial stock of physical capital. Besides, Grossman and Helpman (1991a) find productivity growth to be an increasing function of physical capital stock. Most growth models have underscored the role of inflation in economic growth. For example, De Gregorio (1992), Fischer (1993), Sbordone and Kuttner (1994), and Smyth (1994), argue that inflation has a negative impact on economic growth. Higher inflationary environments are not conducive for general business activities and the performance of the economy. Finally, it is well known that countries whose governments pile up huge debts are unable to progress. The growth experiences of the heavily indebted poor countries come to mind. Therefore, most empirical studies have recommended the inclusion of this variable (see Barro, 2003; Aghion et al., 2009).

During the study period 1986Q2 to 2015Q4, international and domestic events such as the Asian financial crisis, the outbreak of the epidemic virus in Hong Kong, the global financial crisis, and the European sovereign debt crisis may generate exogenous shocks that distort the path of the underlying series in our model. Therefore, we consider the presence of structural breaks in the underlying series by including a dummy variable (DUM) in the model. It takes the value of zero before a structural change and one after.

A crucial requirement is to establish the integration properties of the variables in the model. If the variables are integrated of orders other than zero, estimating *Eq.* (1) results in some important information being lost. Specifically, if these variables are integrated of orders other than zero, they may have a common long-run relationship. This means that, if unaccounted for, the short-run dynamics of *Eq.* (1) are excluded. We sidestep this problem by examining the integration properties of the series and testing for potential cointegration among the variables.

To do this, we employ the autoregressive distributed lag (ARDL) bounds testing procedure developed by Pesaran et al. (2001). This approach is known to offer desirable statistical benefits, when compared to its competitors. Amongst these benefits are: It is applicable regardless of whether the variables are integrated of orders zero, one, a mixture, or fractional; pretesting for the order of integration is not a requisite, plus it has better finite sample properties (see Pesaran et al., 2001).

Cointegration can be tested by reformulating $Eq.$ (1) into the following general $ARDL$ equation:

$$\Delta lnY_t = \phi_0 + \phi_1 DUM_t + \sum_{i=1}^{q} \phi_{2i}\,\Delta lnY_{t-i} + \sum_{i=0}^{q} \phi_{3i}\,\Delta lnHC_{t-i} + \sum_{i=0}^{q} \phi_{4i}\,\Delta lnPC_{t-i} + \sum_{i=0}^{q} \phi_{5i}\,\Delta lnSMD_{t-i} + \sum_{i=0}^{q} \phi_{6i}\,\Delta lnINF_{t-i} + \sum_{i=0}^{q} \phi_{7i}\,\Delta lnGOV_{t-i} + \delta_1 lnY_{t-1} + \delta_2 lnHC_{t-1} + \delta_3 lnPC_{t-1} + \delta_4 lnSMD_{t-1} + \delta_5 lnINF_{t-1} + \delta_6 lnGOV_{t-1} + \mu_t \quad (2)$$

where μ, ϕ, δ, and Δ are, respectively, the white-noise error term, the short-run coefficients, the long-run coefficients, and the first difference operator. In addition, t and q denote, respectively, time period and the maximum number of lags in the model. Written in this form, ΔlnY_t denotes the growth rate of real GDP per capita.

There exists cointegration among the variables in *Eq.* (2), if at least one of the δs is significantly different from zero. The joint restriction of the δs to be zero (i.e. the null hypothesis of no cointegration) generally follows a non-standard asymptotic F-distribution. Hence, Pesaran et al. (2001) have derived two sets of critical values under this null hypothesis. The first set of critical values are constructed under the assumption that variables in the ARDL model are integrated of order zero, I(0). The second set of critical values are constructed under the assumption that variables in the model are integrated of order one, I(1). We do not reject the null hypothesis of no cointegration relationships when the calculated F-statistic falls below the lower-bound values. Similarly, we reject the null hypothesis of no co-integration when the calculated F-statistic is greater than the upper-bound values. However, the test is inconclusive, when the F-statistic falls between the lower and upper bounds.

Once there exists cointegrating relationship among the variables, we have to estimate the corresponding error correction model in the spirit of the Engle-Granger representation theorem. The equivalent error correction model for *Eq.* (2) will be of the following form:

$$\Delta lnY_t = \phi_0 + \phi_1 DUM_t + \sum_{i=1}^{q} \phi_{2i}\, \Delta lnY_{t-i} + \sum_{i=0}^{q} \phi_{3i}\, \Delta lnHC_{t-i} + \sum_{i=0}^{q} \phi_{4i}\, \Delta lnPC_{t-i} + \sum_{i=0}^{q} \phi_{5i}\, \Delta lnSMD_{t-i} + \sum_{i=0}^{q} \phi_{6i}\, \Delta lnINF_{t-i} + \sum_{i=0}^{q} \phi_{7i}\, \Delta lnGOV_{t-i} + \delta ECM_{t-1} + \mu_t \quad (3)$$

where all the variables and parameters retain their definitions. ECM_{t-1} is the one-period lag error correction term. δ is the coefficient of the error correction term, which must be negative, statistically significant, and below unity in absolute terms.

4.2 Data

We use quarterly data covering the period 1986Q2 to 2015Q4. Our choice of this sample period is motivated by data availability. As specified in *Eq.* (1), we use the following variables: real GDP per capita (Y), human capital (HC), physical capital (PC), stock market development (SMD), inflation (INF), and government expenditure (GOV). These are, respectively, defined as gross secondary enrolment ratio, fixed capital formation as a percentage of GDP, stock market development calculated by using the PCA or means-removed method, quarterly growth rate of consumer price index and government spending as a percentage of GDP. The data on these variables are taken from the Census and Statistics Department of Hong Kong (2016), International Financial Statistics (IFS) (2016), and Penn World Table version 8.1. All the variables are seasonally adjusted. To construct the index of stock market development using the PCA method (i.e. SMD_PCA), we extract three popular indicators of the stock market: market capitalization ratio (MCR), total value trade ratio (TVR), and turnover ratio (TOR).[1] We then extract the eigenvectors of MCR, TVR and TOR, transpose and multiply the eigenvectors to the transpose of the raw data of MCR, TVR and TOR. The resulting stock market development index will be a matrix of the form 1xq, where q is the number of columns. As a final step, we transpose this matrix into the form qx1. To construct the index of stock market development using the means-removed method (i.e. SMD_MR), we average the means-removed values of MCR, TVR and TOR in two-steps. First, we compute the means-removed values of MCR, TVR, and TOR. For example, the means-removed values of MCR at time t will be $M\hat{C}R_t = (MCR_t - \overline{MCR})/|\overline{MCR}|$, where $\overline{MCR}$ is the mean of MCR (i.e. MCR over the period 1986Q2 to 2015Q4), and $|.|$ is the absolute value operator. Second, once the means-removed values of MCR, TVR, and TOR are obtained, we average them by rows to obtain the index of stock market development. Table 1 shows the descriptive statistics of the variables used in the paper.

Table 1: Descriptive Statistics of the Variables

Statistic	lnY	lnHC	lnPC	lnSMD_PCA	lnSMD_MR	lnINF	lnGOV
Mean	12.243	4.394	3.205	2.244	0.000	0.493	2.353
Median	12.185	4.362	3.192	2.106	-0.325	0.639	2.364
Maximum	12.636	4.660	3.570	3.687	2.122	1.593	2.581
Minimum	11.718	4.298	2.945	0.867	-0.766	-3.119	2.157
Std. Dev.	0.250	0.083	0.114	0.861	0.696	0.825	0.110
Skewness	0.002	1.689	0.833	0.108	0.933	-1.224	-0.045
Kurtosis	1.989	5.333	3.772	1.637	2.884	5.360	2.057
Jarque-Bera	5.068	83.548	16.706	9.437	17.340	57.342	4.447
P-value	0.079	0.000	0.000	0.009	0.000	0.000	0.108

[1] See also Karimo and Ogbonna (2017).

Sum	1456.976	522.860	381.396	267.040	0.000	58.711	280.015
Sum Sq. Dev.	7.373	0.817	1.543	87.487	57.179	80.339	1.432
Observations	119	119	119	119	119	119	119

Note: Std. Dev. and Sum Sq. Dev. denote, respectively, standard deviation and sum of squared deviations.

5. Results

5.1 Tests for Order of Integration of the Variables

We begin the empirical analysis by testing for the stationary properties of the variables. This is necessary because the ARDL approach requires the variables to be integrated of at most order one. To do this, we employed the Perron and Zivot-Andrews tests developed by Perron (1997), and Zivot and Andrews (1992) respectively. The results are reported in Table 2. The results show that none of the variables are integrated of orders greater than one at the conventional levels of significance.

Table 2: Tests for Unit Roots of the Variables

	Perron Statistic (Lag)				Zivot-Andrews Statistic (Lag)			
Variables	Drift	Break Date	Drift and Trend	Break Date	Drift	Break Date	Drift and Trend	Break Date
lnY	-4.030(4)	1997Q4	-3.968(4)	1997Q4	-4.009(4)	1998Q1	-3.951(4)	1998Q1
ΔlnY	-13.033(0)***	1998Q1	-13.225(0)***	1998Q1	-4.932(3)*	2003Q1	-5.106(3)**	1999Q1
lnHC	-3.166(0)	2007Q4	-4.400(0)	2011Q2	-3.174(0)	2008Q1	-3.715(0)	2011Q2
ΔlnHC	-10.786(0)***	2002Q4	-11.558(0)***	2011Q1	-10.831(0)***	2003Q1	-11.333(0)***	2011Q1
lnPC	-2.878(4)	1993Q4	-4.377(4)	1998Q2	-2.988(4)	1994Q1	-4.316(4)	1998Q4
ΔlnPC	-5.132(4)*	1998Q2	-6.630(6)**	1998Q2	-5.153(4)**	1998Q3	-5.147(4)**	1998Q3
lnSMD_PCA	-4.290(0)	2004Q3	-5.101(0)	2005Q4	-4.309(0)	2004Q4	-5.126(0)**	2006Q1
ΔlnSMD_PCA	-11.932(0)***	2008Q4	-12.001(0)***	2008Q4	-9.299(1)***	2008Q1	-9.260(1)***	2008Q1
lnSMD_MR	-5.392(0)**	2005Q4	-5.798(0)**	2006Q3	-5.434(0)***	2006Q1	-5.907(0)***	2006Q4
ΔlnSMD_MR	NA	NA	NA	NA	NA	NA	NA	NA
lnINF	-6.809(0)***	2009Q2	-5.785(0)**	2009Q2	-5.370(0)***	2009Q3	-5.133(0)**	2003Q4
ΔlnINF	NA	NA	NA	NA	NA	NA	NA	NA
lnGOV	-4.874(4)	2004Q1	-4.853(4)	2004Q1	-4.936(4)**	2004Q2	-4.870(4)*	2004Q2
ΔlnGOV	-5.273(3)**	2002Q2	-5.533(3)*	2004Q1	NA	NA	NA	NA

Notes:
(i) *, **, and *** denote significance at 10%, 5%, and 1%, respectively.
(ii) Δ is a first difference operator.
(iii) NA denotes not applicable.

5.2 Test for Cointegration

We examine the cointegrating relationships among the variables using the ARDL bounds testing approach. An optimal lag of 3 is selected using the Akaike information criterion (AIC). Using the optimal lag of 3, we perform the cointegration test and report the results in Table 3. The calculated F-statistic is approximately 4.205. This is greater than the upper bound critical value of 3.79 at 5% significance level. Hence, the variables in *Eq.* (2) are cointegrated, meaning that there exists an error correction model of the form in *Eq.* (3).

Table 3: Results of Cointegration Test

Dependent Variable	Function	F-statistic	Cointegration Status
lnY	F(lnY | lnHC, lnPC, lnSMD_PCA, lnINF, lnGOV)	4.205**	Cointegrated

Critical Value Bounds for 5 independent variables		
Significance	Lower Bound	Upper Bound
10%	2.26	3.35
5%	2.62	3.79
1%	3.41	4.68

Notes: ** denotes significance at 5%. The critical value bounds correspond to the asymptotic critical values for unrestricted intercept and no trend in Table CI(iii) p. 300 of Pesaran et al. (2001). lnSMD_PCA is the stock market development indicator calculated using the PCA method.

5.3 Short- and Long-run Estimates

Since the variables are cointegrated, we estimate *Eqs.* (2) and (3), the long- and short-run models, respectively. Using the AIC, the preferred model is ARDL(1, 0, 1, 0, 0, 1). The short- and long-run estimates for this ARDL model are reported in Tables 4 and 5, respectively. For these results to be reliable, they should pass all the diagnostic tests. Table 6 reports the diagnostic tests, namely: Serial correlation, normality, heteroskedasticity, and the specification of the correct functional form. The tests show that the short- and long-run estimates are reliable. Although the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) plots show evidence of parameter instability, they return to well within the critical bounds later on (see Figures 2 and 3). Besides, since the specifications account for this instability, the CUSUM and CUSUMSQ tests are irrelevant. Thus, using the short- and long-run estimates for forecasting purposes could be useful.

Before looking at the long-run estimates, let us first consider the short-run estimates. The error correction term is negative and statistically significant. It shows that 12.6% of the fluctuations in growth below or above equilibrium are corrected each quarter. This is considerably slow since booms and busts are expected to persist. Positive growth in the stock market and government expenditure appear to promote growth in the short run. Growth in inflation appears to exert a positive but insignificant impact on economic growth in the short run. The basic determinants of growth, namely human capital and physical capital affect growth differently. The former affects growth positively, while the latter affects growth negatively. However, their effects are insignificant in the short run.

We now turn to the long-run estimates. These are reported in Table 5. The human capital has a positive impact on growth, and this is statically significant at 10%. A percentage increase in human capital leads to nearly 0.46% increase in growth, other factors remaining the same. The positive impact of human capital estimated here is consistent with previous studies (see, for instance, Barro, 1991; Grossman and Helpman, 1991b; Bodman and Le, 2013; Teixeira and Queirós, 2016; Ho, 2018). Next, the coefficient of the stock market development index is positive and statistically significant at 1% in the long run. The estimated coefficient implies that a percentage increase in stock market development leads to nearly 0.27% increase in growth, other things remaining unchanged. Some of the previous studies have found stock market development to be associated with growth as well. These studies include Atje and Jovanovic (1993), Levine and Zervos (1996, 1998), Arestis et al. (2001), Minier (2003), Beck and Levine (2004), Adjasi and Biekpe (2006), Akinlo and Akinlo (2009), Chong et al. (2010), Cooray (2010), Masoud and Hardaker (2012), and Ngare et al. (2014). Finally, the coefficient of government expenditure is positive and significant at 5% in the long run. A percentage increase in government expenditure leads to approximately 0.60% increase in growth in the long run, given that other factors remain the same. Other studies have documented similar evidence (see, among others, Easterly and Rebelo, 1993; Hansson and Henrekson, 1994; Fölster and Henrekson, 2006; Bergh and Karlsson, 2010).

Table 4: Short-run Estimates for ARDL(1, 0, 1, 0, 0, 1)

Dependent Variable: lnY	Coefficient	Standard Error	t-statistic
ΔlnHC	0.024	0.070	0.348
ΔlnPC	-0.008	0.023	-0.334

ΔlnSMD_PCA	0.033***	0.011	3.133
ΔlnINF	0.000	0.003	0.073
ΔlnGOV	0.153***	0.020	7.785
ΔDUM	-0.012	0.007	-1.616
ECM(-1)	-0.126***	0.020	-6.258
R-squared	0.449	Mean dependent variable	0.008
Adjusted R-squared	0.403	S.D. dependent variable	0.022
S.E. of regression	0.017	Akaike information criterion	-5.219
Sum squared residuals	0.032	Schwarz criterion	-4.984
Log likelihood	317.901	Hannan-Quinn criterion	-5.123
F-statistic	9.763	Durbin-Watson statistic	2.186
Prob(F-statistic)	0.000		

Notes: *** denotes 1% significance level. lnSMD_PCA is the stock market development indicator calculated using the PCA method.

Table 5: Long-run Estimates for ARDL(1, 0, 1, 0, 0, 1)

Dependent Variable: lnY	Coefficient	Standard Error	t-statistic
lnHC	0.460*	0.249	1.850
lnPC	-0.326	0.206	-1.580
lnSMD_PCA	0.269***	0.026	10.538
lnINF	0.001	0.022	0.039
lnGOV	0.601**	0.248	2.427
DUM	-0.191	0.133	-1.436

Note: *, **, and *** denote 10%, 5% and 1% significance level respectively.

Table 6: Diagnostic Tests for ARDL(1, 0, 1, 0, 0, 1)

Test	Statistic	P-value
Heteroskedasticity CHSQ(1)	0.658	0.417
Serial Correlation CHSQ(2)	3.512	0.173
Functional Form CHSQ(1)	0.032	0.858
Normality CHSQ(2)	2.659	0.265

Figure 2: Plot of Cumulative Sum of Recursive Residuals (CUSUM)

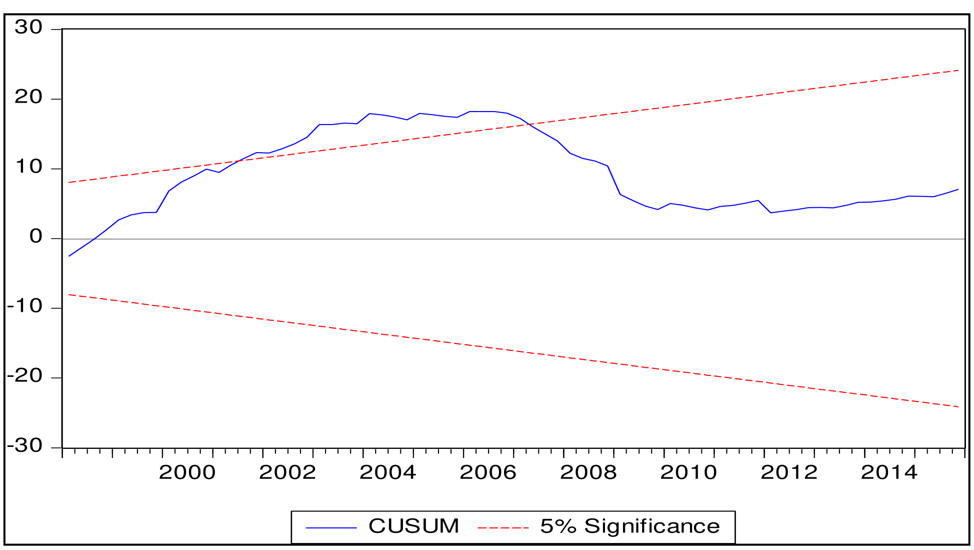
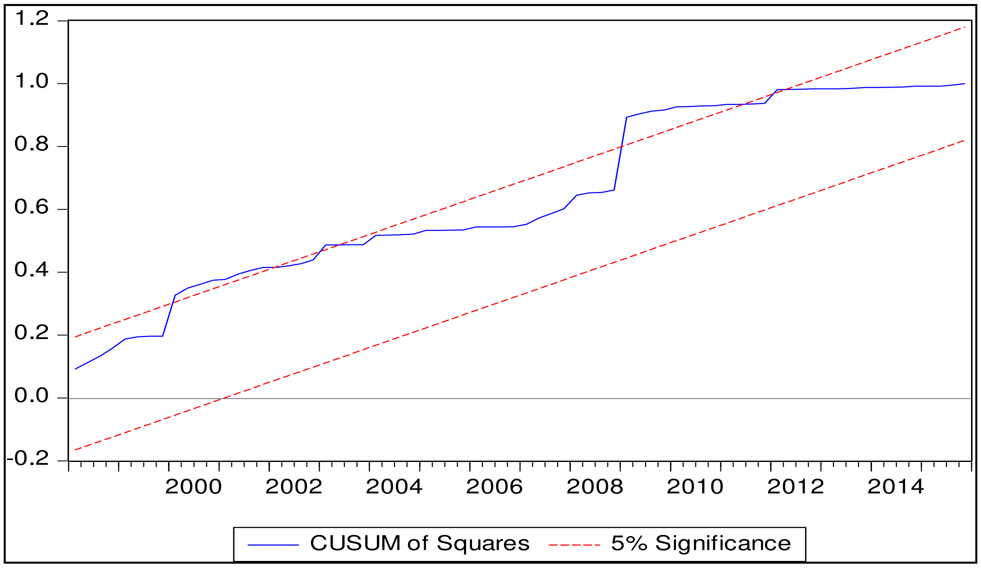


Figure 3: Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ)



5.4 Sensitivity Analysis

One may question whether the results reported above are sensitive to the proxy for stock market development. This may be the case because various proxies for stock market development have idiosyncratic limitations. Therefore, it is important to see what happens to our results if we use a different proxy for stock market development. Here, we use a composite index of stock market development based on the method of means-removed as discussed in the data section. The stationary properties of this variable have been explained in section 4.1. Similar to the earlier results, we test for cointegrating relationship among the variables in our model choosing an optimal lag of 3 based on AIC. The results of the cointegration test are reported in Table 7. The calculated *F*-statistic is approximately 4.917. This value is greater than the upper bound critical value of 4.68 at 1% significance level. This implies that the variables in *Eq.* (1) are cointegrated.

We then estimate the short- and long-run models accordingly, restricting the initial lag length to 3. The AIC selected ARDL(1, 0, 2, 0, 3, 1) as the most preferred model. The corresponding short- and long-run estimates for this ARDL model are reported in Tables 8 and 9, respectively. The diagnostic tests in Table 10 show that the short- and long-run estimates are reliable, though the CUSUMSQ plot shows evidence of parameter instability between 2009 and 2010 (see Figures 4 and 5). As mentioned earlier, the CUSUMSQ test is not relevant because we have modeled the structural breaks. Hence, the short- and long-run estimates may be suitable for forecasting purposes.

Table 7: Results of Cointegration Test for the Alternative Measure of Stock Market Development

Dependent Variable	Function	F-statistic	Cointegration Status
lnY	F(lnY | lnHC, lnPC, lnSMD_MR, lnINF, lnGOV)	4.917***	Cointegrated

Critical value bounds for 5 independent variables		
Significance	Lower Bound	Upper Bound
10%	2.26	3.35
5%	2.62	3.79
1%	3.41	4.68

Notes: *** denotes significance at 1%. The critical value bounds correspond to the asymptotic critical values for unrestricted intercept and no trend in Table CI(iii) p. 300 of Pesaran et al. (2001). lnSMD_MR is the stock market development indicator calculated using the means-removed method.

In the case of the short-run estimates, the error correction term is negative and statistically significant at 1%. The estimate shows that approximately 7.5% of the fluctuations in growth are corrected each quarter. When compared with the previous estimate, the adjustment to equilibrium is relatively slower in this case. Stock market development appears to have a positive impact on growth in the short run, which is consistent with the above results. Inflation rate has a negative but statistically insignificant impact on growth. In contrast, one and two-period lags of inflation have positive impacts on growth. Government expenditure affects growth positively in the short run. Moreover, human capital and physical capital have positive impact on growth in the short run – although only one-period lag of physical capital appears to be statistically significant.

The long-run estimates are reported in Table 9. As with the main results, human capital is statically significant at 1%. Controlling for other factors, a percentage increase in human capital leads to approximately 1.40% increase in growth. The coefficient of the alternative stock market development index is positive and statistically significant at 1% in the long run. A percentage increase in stock market development leads to nearly 0.18% increase in growth, other things remaining the same. Notice that when compared with the previous result, the impact has reduced by approximately 0.09%. Perhaps, this shows that the proxy for stock market development may only affect the size of the impact but not the sign. The coefficients of inflation rate and government expenditure are negative and positive, respectively. They are also statistically significant at 1% and 5%, respectively. Although the sign of the coefficient of inflation is positive in the main results, it is statistically insignificant. The estimates generally show that the proxy for stock market development does not influence the sign of the coefficients in the model except for inflation.

Table 8: Short-run Estimates for ARDL (1, 0, 2, 0, 3, 1)

Dependent Variable: lnY	Coefficient	Standard Error	t-statistic
ΔlnHC	0.042	0.071	0.592
ΔlnPC	0.016	0.024	0.681
ΔlnPC(-1)	0.040*	0.023	1.720
ΔlnSMD_MR	0.011*	0.006	1.753
ΔlnINF	-0.003	0.003	-0.791
ΔlnINF(-1)	0.007**	0.003	2.017
ΔlnINF(-2)	0.008**	0.003	2.395
ΔlnGOV	0.165***	0.019	8.713
DUM	-0.015**	0.007	-2.055
ECM(-1)	-0.075***	0.011	-6.743
R-squared	0.487	Mean dependent variable	0.008
Adjusted R-squared	0.422	S.D. dependent variable	0.022
S.E. of regression	0.017	Akaike info criterion	-5.205
Sum squared residuals	0.029	Schwarz criterion	-4.872
Log likelihood	315.878	Hannan-Quinn criterion	-5.070
F-statistic	7.460	Durbin-Watson statistic	2.022
Prob(F-statistic)	0.000		

Note: *, **, and *** denote, respectively, 10%, 5% and 1% significance level.

Table 9: Long-run Estimates for ARDL (1, 0, 2, 0, 3, 1)

Dependent Variable: lnY	Coefficient	Standard Error	t-statistic
lnHC	1.395***	0.393	3.552
lnPC	-0.624	0.412	-1.513
lnSMD_MR	0.183***	0.049	3.713
lnINF	-0.123***	0.037	-3.300
lnGOV	1.154**	0.555	2.081
DUM	-0.362	0.242	-1.496

Note: ** and *** denote, respectively, 5% and 1% significance level.

Table 10: Diagnostic Tests for ARDL (1, 0, 2, 0, 3, 1)

Test	Statistic	P-value
Heteroskedasticity CHSQ(1)	0.031	0.861
Serial Correlation CHSQ(2)	1.205	0.548
Functional Form CHSQ(1)	1.402	0.239
Normality CHSQ(2)	1.029	0.598

Figure 4: Plot of Cumulative Sum of Recursive Residuals (CUSUM)

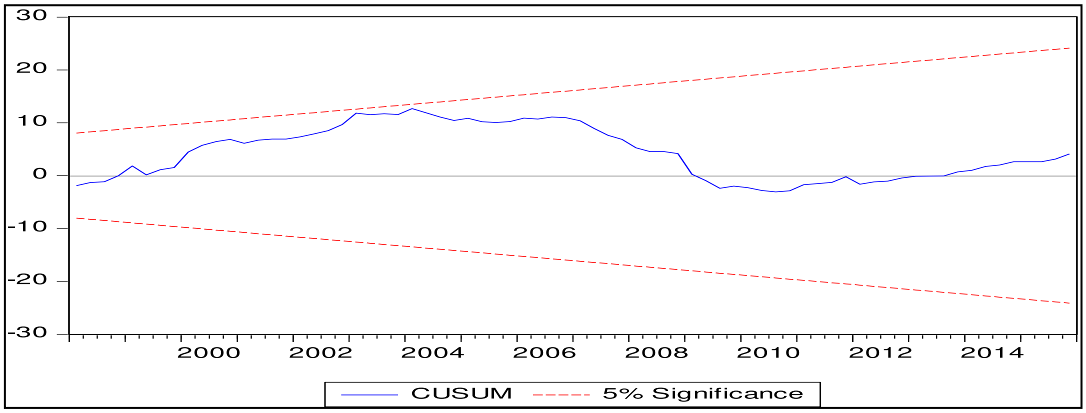
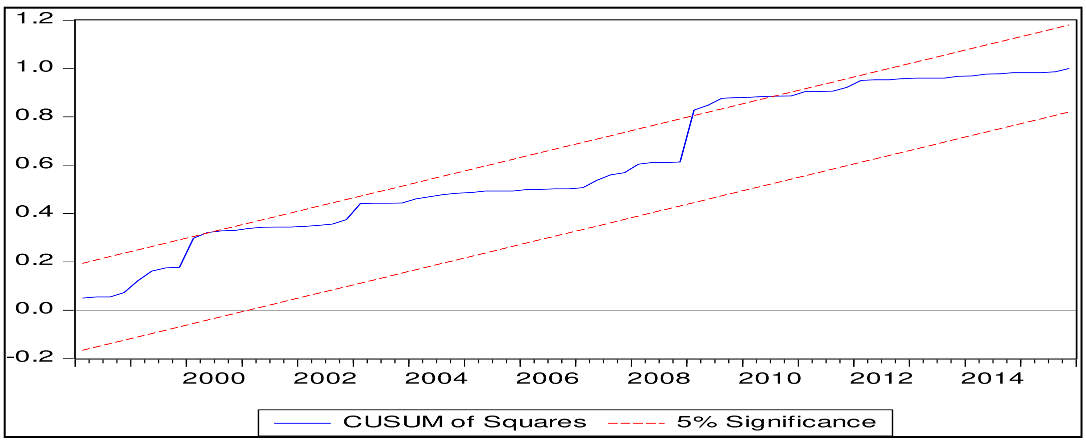


Figure 5: Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ)



6. Conclusion

We set out to assess the impact of stock market development on growth in Hong Kong. This country has pursued extensive reforms leading to rapid growth in its stock market for more than three decades. Today, the Hong Kong stock market is among the largest and most liquid markets around the world. During the expansion phase of the Hong Kong stock market, the country has also seen a strong growth. However, a formal assessment of the link between the country's stock market and its growth has been limited to cross-sectional and panel data studies. Each country has a unique experience. Hence, combining countries in cross-sectional or panel settings may mask the true stock market–growth nexus for individual countries. Furthermore, the general studies regarding the stock market–growth nexus have yielded mixed findings, leaving the relationship open for further examination. This paper revisited the relationship for Hong Kong using time series techniques, thereby reporting the country's unique experience. Since the stock market has different facets, we constructed an index of stock market development using the PCA method. We constructed this index by extracting the three popular stock market indicators, namely: market capitalization ratio, total value of trade ratio, and turnover ratio. To perform a sensitivity analysis of our results, we constructed an alternative index of stock market development which drew on the three stock market indicators using the method of meanWDs-removed. We sidestepped issues of omitted variable bias and structural changes. Using the ARDL approach and a dataset covering the period 1986Q2 to 2015Q4, we found stock market development to exert a positive impact on growth both in the short and long run. Our results suggested that the proxy for stock market development did not influence the sign of the impact of stock market development on growth. Albeit, there was a hint that it may influence the size of the impact. We also found that human capital and government expenditure exerted a positive impact on growth. In contrast, inflation rate exerted a negative impact on growth. These findings are consistent with the existing literature. Based on our findings, we believe that the policymakers in the country should continue to pursue policies that promote stock market development in order to sustain growth. The rapid expansion of the Hong Kong stock market may be tied to the financial liberalization of Mainland China since the early 1990s. During the financial liberalization process of the early 1990s, the Hong Kong Stock Exchange performed a unique role of listing red chips, H-shares, and initial public offerings of Chinese state-owned banks (see Ho and Odhiambo, 2015), which was essential for its drastic expansion. Therefore, to further enlarge the scale and depth of Hong Kong stock market, it may be a good initiative for the stock markets in Hong Kong and the ones in Mainland China to continue to integrate. This is a direction that both economies have already taken. In November 2014, the Shanghai-Hong Kong Stock Connect was launched to establish a cross-broader connectivity in stock trading. In addition, the Shenzhen-Hong Kong Stock Connect was also launched by the end of 2016 (HKEx, 2016b). Owing to these path-breaking initiatives, we expect the Hong Kong stock market to experience another wave of growth, and a positive spillover effect to the economy's growth.

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