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Final Report

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Executive Summary

Abstract

This research has comprehensively evaluated the development of the nine new towns in Hong Kong, focusing on their impacts on economic output and regional equity, in order to provide evidence-based policy recommendations to better strike a balance between efficiency and inclusiveness in the upcoming development of new towns (e.g. Northern Metropolis). In so doing, the following research objectives have been fulfilled:

1) To evaluate the impacts of new town development on different sectors of the economy using computable general equilibrium modelling.
2) To compare the economic outputs of regions completing new town development using regression analysis.
3) To measure the income inequality of regions completing new town development using decomposition measurements and indicators.
4) To project the evolutionary trend of the gaps between capital gains and economic gains of regions undertaking new town development using the transitional dynamics approach.

Semi-decennial census statistics at the Tertiary Planning Unit level between 1976 and 2016 are collected from the website of the Census and Statistical Department of Hong Kong. It is served as the major data source to achieve the research objectives (i.e., research objective 2, part of research objective 3, and part of research objective 4) in this study. The GDP index in Hong Kong (from the Census and Statistical Department of Hong Kong), covering the period from 1980 to 2020 and the housing price index from the Rating and Valuation Department of Hong Kong are collected to achieve the research objective 4. Besides, the 5% population census in 2001 and 2006 at the household level is obtained from the Census and Statistical Department of Hong Kong to achieve part of the research objective 3.

Key Findings of the Research

The present study is the pioneering research to explore how the development of new towns impacts the development of Hong Kong, which fulfils four objectives.

For Objective 1, It is estimated that the Northern Metropolis plans would generate a 6% annual increase in residential housing units compared to the target of the Long Term Housing Strategy, resulting in a 3.63% GDP growth, a 3.29% increase in welfare gain and an 8.24% increase in employment compared with the base year.

For Objective 2, the major findings are:

- Many new towns confront a serious problem in which the population as of today almost reaches the planned limit.

- The contributions of Yuen Long, Fanling-Sheung Shui to the economy outperform the other new towns.

- The contribution of the new towns to the economic growth declines sharply, from the double digits in the 1970s to single-digit in the 1990s.

- The size of new towns did not significantly impact economic growth.

- The economic growth of the simultaneous development of new towns was far better than that of the periodic development.

For Objective 3, we find that:

- The inequality of new towns decline in the past four decades, which is built upon the outflows of low-income families and the inflows of middle- or high-income families.
- The development of the new towns has led to an imbalanced development between the new towns and the other areas in the New Territories.

For Objective 4, we find that there is no sign of housing price bubbles (i.e. capital gain does not far exceeds economic gain) in New Towns, although some housing price bubbles are found to appear in the New Territories that are outside the new town areas.

While numerous statistical results have been derived in this research, findings can be summarized into two particular aspects, namely 1) the successful experiences we have gained from past new tows development; and 2) the potential improvements we can make for future

new town development.

The Successful Experiences from Past New Town Development

This study found that the first decade is the crucial time window to lift up the economic outputs (through large-scale construction and infrastructure). Moreover, the new towns are effective to accommodate the increasing population and to keep housing price at moderate growth rates without generating bubbles. It is noteworthy that the succeeding development of public services such as rail transit (MTR) has induced gentrification in the new towns and attracted middle-/high- income population inflows. The successful experience of new town development in the past few decades encompasses a good direction to pave the way for the development of the Northern Metropolis.

The Potential Improvements for Future New Town Development

Despite the success achieved by the past new towns, several lessons are worthy of attention. First, the industry in the new towns could only boost the momentum of development in the first ten years, which made their contribution to economic growth not sustainable in the succeeding periods. Second, the new towns have brought imbalanced regional development (both intra-region and inter-region) across the New Territories. The multi-stage development strategy of new towns exacerbates such imbalance within and between different areas. Third, large scale infrastructure construction in new towns gave rise to the outflow of low-income people, generating some inequality problems within the new towns.

Layman Summary of Policy Implications and Recommendations

Gear Up New Town Development

Many new towns are facing the problem that the population as of today almost reaches the planned limit. Based on the ratio of current population to planned population, the new towns can be categorized into three groups: close to saturation, nearly saturation, severe and neutral. As for the group of “close to saturation”, Tsuen Wan (with a population of 823,386), Sha Tin (with a population of 665,606), and Tin Shui Wai (with a population of 286,232), approaching 97%, 90%, and 93% of the planned population. For the group of “nearly saturation”, both Tseung Kwan O and Fanling Sheung Shui reach 89% of the planned

population level. Tuen Mun, Tai Po is in the group of "serve", reaching 75% and 78% of the planned level. Among the existing new towns, Tung Chung lies in the group of "neutral", where it only reaches 39% of the planned population. Subject to the scale of the planned new towns such as Hung Shui Kiu, Kwu Tung North, and Fanling North, the government should speed up the Northern Metropolis Development.

Economic performance of new towns

First, Yuen Long and Fanling-Sheung Shui, at which these two new towns start to operate, outperform the other new towns. Yuen Long and Fanling-Sheung Shui are located far away from the city centre but contribute the most to the economy. The government may consider speeding up the Northern Metropolis development to grasp the opportunity of potential urban agglomeration and economy of scale in synergized new town development, thus providing a new growth engine for Hong Kong.

Second, for the potential new towns/new development areas, our regression model suggests that government should enlarge the fiscal expenditure to promote more job opportunities and to foster the development of more balanced economic structures.

Third, the Hong Kong government should not simply replicate the previous new town development model, as the momentum of the old models to the economic growth declined sharply, from the double digits in the 1970s to single-digit in the 1990s. Large-scale development of multiple new towns in the New Territories simultaneously (Northern Metropolis) is likely to bring about more significant and sustained growth opportunities.

Fourth, as for the existing new towns, size does not significantly contribute to the economy because there are few industries in new towns. Considering that the plan for new towns and the Northern Metropolis Development Plan target at embracing new economic opportunities and challenges, the regression model which focuses on the association between size of the developed urban areas and economic growth provides some suggestions: Hong Kong's economic growth is negatively associated with the size of the urban areas in Hong Kong Island and Kowloon, indicating that economic development weights too much on the traditional CBD and urban areas. Our findings support that the Hong Kong government should seek a sufficiently large new development area in the New Territories for the planned new towns and sustainable economic growth. Besides, simultaneous development of new

towns has much better economic outcomes than staged development.

New town development and Inequality

Inequality is a long-standing problem in Hong Kong. By employing Theil's indices, the inequality of New Towns and New Territories (excluding New Towns) can also be identified. Theil's indices for these two areas show different patterns. Theil's indices of New Town show that they approach zero (i.e., towards equality) in the last four decades. On the other hand, the indices of New Territories (excluding New Towns) has a different pattern. However, Theil's indices in both districts indicate an imbalanced development. A follow-up study is conducted to discuss how large infrastructure development (e.g., MTR) drives such inequality in the new towns. Our findings suggest the Hong Kong government should not simply replicate the previous development model which is to develop new towns first and then carry out large infrastructure. It brings more harm than good to the existing low-income households in the area, as they cannot enjoy the convenience from the large-scale infrastructure like MTR. The government may consider negotiating with the MTR Corporation to provide some public housing nearby MTR stations to accommodate the affected low-income people.

Housing development and management in New Towns

Despite the skyrocketing housing prices, we do not find signs of housing bubbles in the new towns. Our findings suggest that the government should keep an eye on the housing market in the potential areas that would be developed as new towns, such as Hung Shui Kiu, Fanling North, Kwu Tung North and New Territories North. The current lessons and experiences of housing development and management in the new towns will enable enhancing liveability in the compact high-density environment in Hong Kong.

研究摘要

本研究全面評估香港九個新市鎮的發展，重點關注其對經濟產出和區域公平的影響，以提供循證政策建議，以更好地平衡即將推出的新市鎮發展（例如北部都會區）的效率和包容性。在此過程中，實現了以下研究目標:

1) 使用可計算一般均衡模型評估新市鎮開發對不同經濟部門的影響。
2) 使用回歸分析比較完成新市鎮開發地區的經濟產出。
3) 使用分解測量和指標來衡量完成新市鎮開發地區的收入不平均。
4) 使用過渡動力學方法預測新市鎮開發區域的資本收益和經濟收益差距的演變趨勢。

1976 年至 2016 年期間城鎮規劃單位每十年一次的人口普查統計數據來自香港政府統計處的網站，它是實現本研究研究目標（即研究目標 2、部分研究目標 3 和部分研究目標 4）的主要數據源。為實現研究目標 4，我们收集了涵蓋 1980 年至 2020 年期間的香港 GDP 指數（來自香港政府統計處）和來自香港差餉估價署的房價指數。此外，2001 年和 2006 年住戶層面的 5%人口普查是從香港政府統計處獲得的，以實現部分研究目標 3。

主要研究結果

本研究是探索新市鎮發展如何影響香港發展的開創性研究，實現了四個目標。

對於目標 1，據估計，與長期住房戰略的目標相比，北部都會區計劃將產生與基準年相比 6% 的住宅單位年增長，從而實現 3.63% 的 GDP 增長、3.29% 的福利收益增長和 8.24%的就業人數增加。

對於目標 2，主要發現是:

• 許多新市鎮面臨著一個嚴重的問題，即今天的人口幾乎達到了計劃的上限。

• 元朗、粉嶺-上水對經濟的貢獻優於其他新市鎮。

• 新市鎮對經濟增長的貢獻急劇下降，從 1970 年代的兩位數下降到 1990 年代的個位數。

• 新市鎮的規模對經濟增長沒有顯著影響。

• 新市鎮同步發展的經濟增長遠好於階段性發展。

對於目標 3，我們發現:

• 新市鎮的不平等在過去四年中有所下降，這是建立在低收入家庭流出和中高收入家庭流入基礎上的。

• 新市鎮的發展導致新市鎮與新界其他地區的發展不平衡。

就目標 4 而言，我們發現新市鎮沒有房價泡沫（即資本收益不會遠遠超過經濟收益），但在新市鎮區以外的新界發現一些房價泡沫。

雖然本研究得出了大量的統計結果，但結果可以概括為兩個特定方面，即 1）我們從過去的新市鎮開發中獲得的成功經驗； 2）我們可以為未來的新市鎮發展做出的潛在改進。

以往新市鎮發展的成功經驗

本研究發現，第一個十年是提升新市鎮經濟產出（通過大規模建設和基礎設施）的關鍵時間窗口。此外，新市鎮有效地容納了不斷增長的人口，並在不產生泡沫的情況下保持房價適度增長。值得注意的是，公共服務的成功發展，如軌道交通(MTR)，已經在新市鎮中引起了高檔化，並吸引了中/高收入人口流入。過去幾十年新市鎮發展的成功經驗，為北部都會區的發展提供了良好的方向。

未來新市鎮發展的潛在改善

儘管過去的新市鎮取得了成功，但有幾個教訓值得關注。首先，新市鎮的產業只能在前十年推動發展勢頭，這使得它們對經濟增長的貢獻在隨後的時期不可持續。其次，新市鎮帶來了整個新界的區域發展不平衡（區域內和區域間）。新市鎮的多階段發展戰略加劇了區域內部和區域之間的這種不平衡。第三，新市鎮大規模基礎設施建設導致低收入人群外流，新市鎮內部存在一些不平均問題。

政策影響概述及相關政策建議

加快新市鎮發展

許多新市鎮都面臨著人口到今天幾乎達到規劃上限的問題。根據現有人口與規劃人口的比例，新市鎮可分為三類：幾乎飽和、接近飽和、嚴重和中性。至於“幾乎飽和”的群體，荃灣（人口 823,386）、沙田（人口 665,606）、天水圍（人口 286,232）接近 97%、90%、和 93%的計劃人口。在“接近飽和”的人群中，將軍澳和粉嶺上水均達到規劃人口水平的 89%。大埔、屯門屬於“嚴重”組，分別達到計划水平的 75%和 78%。現有新市鎮中的東涌，屬於“中性”組，僅佔規劃人口的 39%。政府應視乎洪水橋、古洞北、粉嶺北等規劃新市鎮的規模，加快北部都會區發展。

新市鎮的經濟表現

首先，元朗和粉嶺上水這兩個新市鎮開始運作的表現優於其他新市鎮。元朗和粉嶺上水遠離市中心，但對經濟的貢獻最大。政府可考慮加快北部都會區發展，把握潛在的城市群和規模經濟的機遇，協同新市鎮發展，為香港提供新的增長動力。

其次，對於潛在的新市鎮/新開發區，我們的回歸模型建議政府應擴大財政支出以增加就業機會，促進經濟結構更加平衡的發展。

第三，香港政府不應該簡單地複制以前的新市鎮發展模式，舊模式對經濟增長的動力急劇下降，從 1970 年代的兩位數下降到 1990 年代的個位數。新界多個新市鎮（北部都會區）同時大規模發展，可能會帶來更顯著和持續的增長機會。

第四，對於現有的新市鎮，由於新市鎮的產業較少，其規模對經濟的貢獻並不大。考慮到新市鎮規劃和北部都會區發展規劃旨在迎接新的經濟機遇和挑戰，關注發達城區規模與經濟增長之間關係的回歸模型提供了一些建議：香港的經濟增長與香港島和九龍的市區規模呈負相關，表明經濟發展對傳統中央商務區和市區的權重太大。我們的研究結果支持香港政府應在新界尋找足夠大的新發展區，以支持規劃中的新市鎮和可持續的經濟增長。此外，新市鎮的同步發展比分階段發展的經濟效益要好得多。

新市鎮發展與不平均

不平均是香港長期存在的問題。通過使用泰爾指數，也可以識別新市鎮和新界（不包括新市鎮）的不平均。這兩個領域的泰爾指數顯示出不同的模式。泰爾的新市鎮指數表明，在過去的四年裡，它們接近於零（即趨向平等）。另一方面，新界（不包括新市鎮）的指數走勢不同。然而，兩個地區的泰爾指數表明發展不平衡。我们進行了一項後續研究，以討論大型基礎設施發展（例如地鐵）如何在新市鎮中造成這種不平均。我們的研究結果表明，香港政府不應該簡單地複制以前的發展模式，即先開發新市鎮，然後進行大型基礎設施建設。這樣對區內現有的低收入家庭弊大於利，因他们無法享受港鐵等大型基建帶來的便利。政府或考慮與港鐵公司協商，在港鐵站附近提供部分公屋，以安置受影響的低收入人士。

新市鎮的房屋開發與管理

儘管房價飛漲，但我們並沒有在新市鎮發現房地產泡沫的跡象。我們的研究結果表明，政府應該密切關注洪水橋、粉嶺北、古洞北和新界北等有潛力發展為新市鎮地區的樓市。目前新市鎮房屋開發和管理的經驗教訓將有助於提高香港緊湊高密度環境中的宜居性。

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Chapter 1. Introduction

Hong Kong initiated new town development in 1973, and has completed nine new towns in three decades: Tsuen Wan, Shatin and Tuen Mun in the early 1970s; Tai Po, Fanling/Sheung Shui and Yuen Long in the late 1970s; and Tseung Kwan O, Tin Shui Wai and Tung Chung in the 1980s and 1990s. The nine new towns accommodate around 3.47 million people in Hong Kong (CEDD, 2017). Meanwhile, Hong Kong recorded a high speed in economic development in the 1960s and 1970s, and real GDP has more than quadrupled in 20 years. From an economy lacking natural resources, it has become one of the Asian four dragon economies. Until recent years, even in the face of external economic turmoil, Hong Kong's economic growth has remained robust among developed economies across the world.

However, the situation has become more complicated lately. Various new development areas (NDAs) in the New Territories, i.e. Kwu Tung North, Fanling North, Ping Che/Ta Kwu Ling (NENT NDAs) and Hung Shui Kiu (HSK NDA), or urban development areas such as Central and Wan Chai Reclamation, Kai Tak Development and West Kowloon Cultural District, have been put forward for a feasibility study or are under construction. Despite this, it was difficult to achieve substantial progress in these projects over the last couple of years. It is essential to comprehensively evaluate the impacts of past new town development on the society, so as to have a better understanding of the feasible pathways for new development areas in the future, as well as to learn from past lessons which are not Pareto-optimal to avoid pitfalls, so as to gain wider public and legislative support for megaprojects affecting the urban districts.

Such retrospective research also facilitate comparison between different measures to increase land supply in the coming decades, which is conducive to sharpening the insights into applicable and publicly-acceptable ways to solve the long-standing housing crisis due to the land supply shortage problem in Hong Kong. The Task Force on Land Supply (2018) has submitted a report regarding increasing land supply through short-to-medium (brownfield development, private agricultural land development, alternative use of recreational land, etc.) and medium-to-long term (near-shore reclamation outside Victoria Harbor, East Lantau Metropolis development, more NDAs in the NT, pilot development areas near country park, etc.) options. One of the major challenges for the Task Force's report on land supply is a public perception concerning the inequality problems arising from prior land supply practices, i.e. spatial inequality from the urban renewal process. To make the land supply options more

inclusive, it is essential to review the past successful experiences of new town development in Hong Kong, and to make reference to comparable policy frameworks of international organisations for updated and upgraded practice guidance.

According to the World Bank's (2014) guideline, inclusiveness refers to the provision of equal opportunity to all people so that they can benefit from the development process. As mentioned in the World Bank's (2014) *Urbanization Finance Model*, there are two fiscal strategies for urban development: (a) efficiency-driven (i.e. increasing the value of goods and services), and (b) inclusiveness-driven (i.e. improving the quality of living standards). Inclusive urbanisation is different from efficient urbanisation or sustainable urbanisation. Efficient urbanisation refers to maximising the utility of productive resources (land use, working population and capital accumulation) to increase productive efficiency and hence the welfare of urban residents. Sustainable urbanization refers to providing quality of urban life that is supported by the environment (land, water, air) and natural resources. In comparison, inclusive urbanisation pertains to providing all people equal opportunity to access public infrastructure and urban services, including housing security; education; medical and health care; urban and rural community; environmental protection; social safety net and employment; transportation; exploration, power and information. Inclusive development is an underpinning factor of social stability, and housing is an important dimension for inclusive development. The framework lays out a foundation for evaluating the comprehensive impacts of new town development on Hong Kong.

Moreover, the change in the United Nations (UN) agenda calls for research on the issue of inequality so that policy implications can be drawn to assist economies in formulating inequality alleviation policies. Given that the Millennium Development Goals (MDGs) era has concluded, the UN (2016) has adopted a new policy document entitled "Transforming our world: the 2030 Agenda for Sustainable Development" as the global development agenda. According to the Sustainable Development Goals (SDG) of the UN (2016), there are 17 goals that are expected to stimulate global action over the next 15 years in areas of critical importance for humanity and the planet, all of which have 4 clear inter-related dimensions: Economic sustainability (no poverty; zero hunger; decent work and economic growth; industry; innovation and infrastructure; and responsible consumption and production); Social/spatial sustainability (good health and well-being; quality education; gender equity; reduced inequality; and sustainable cities and communities); Environmental sustainability

(clean water and sanitation; affordable and clean energy; climate action; life below water; and life on land); Institutional sustainability (peace, justice and strong institutions; and partnerships for the goals). Although equality is one of the core values of the MDGs, these goals only touched upon gender equality and did not place enough emphasis on other forms of inequality. The SDGs have integrated the issue of inequality into the 10th SDG, namely, *reduce inequality*. It is well known that inequality can exert various adverse impacts on the progress of poverty reduction, economic growth, and even social and political stability. Meanwhile, development can not only solve the problem of inequality, but is also capable of providing solutions to other SDGs such as 1st SDG *no poverty*; 4th SDG *quality education*; 8th SDG *decent work and economic growth*; 9th SDG *industry;* and *innovation and infrastructure*. These five SDGs underpin the establishment of our conceptual framework in this research.

In view of these questions and enquiries, the **research objectives** of this study are as follows:

1. To evaluate the impacts of new town development on different sectors of the economy using computable general equilibrium modelling.
2. To compare the economic outputs of regions completing new town development using regression analysis.
3. To measure the income inequality of regions completing new town development using decomposition measurements and indicators.
4. To project the evolutionary trend of the gaps between capital gains and economic gains of regions undertaking new town development using the transitional dynamics approach.

Based on the framework of Thomas Piketty on the evolving dynamics between capital gain and economic gain, we aim to achieve four research objectives using different methods. For **Objective 1**, we evaluate the impacts of new town development on different sectors of Hong Kong's economy using computable general equilibrium modelling. For **Objective 2**, we compare the economic outcomes of different regions completing new town development using regression analysis. For **Objective 3**, we measure the income inequality of different regions completing new town development adopting decomposition measurements and indicators. For **Objective 4**, we project the evolutionary trend of the gaps between capital gains and economic gains of regions undertaking new town development using the transitional dynamics approach.

Chapter 2. Literature Review

2.1 Recent Trend in Inequality Studies

Thomas Piketty's (2013) *Capital in the Twenty-First Century* has revolutionised our understanding of income and wealth disparity, in an era when the growth of capital gain (r) exceeds the growth of economic gain (g) in developed economies. Sitting within the more general concern about the global trend of increasing capital-to-income ratios, Piketty (2013) suggested that the gap between the rate of return on capital (r) and the economic growth rate (g) is an important factor explaining the magnitude and variation in wealth inequality over the long run, despite that in the past institutional changes played a major role in inequality and development. It is noted that although a higher r–g gap does not have as much effect on labour earning inequality as access to skills and education, the gap tends to greatly amplify the inequality of wealth distribution (Piketty, 2013). Piketty and Zucman (2014) compiled the wealth-to-income ratio for eight developed economies and found that, in every country, the ratio has gradually risen in recent decades, from around 200-300% in 1970 to around 400-600% in 2010. Nevertheless, r > g itself is not a problem; it is the enlarging r - g gap that matters, with higher wealth inequality (Piketty, 2015). Piketty and Saez (2014) found that, since the 1970s, labour income inequality has been more saliently enlarged in the US compared to in Europe. A significant contribution from Piketty is to realign housing with inequality, a focused area of political economy before the industrial revolution when land substantially constituted a proportion of family wealth. Although robots may substitute labour-intensive sectors in the future, at least for now more traditional sectors, such as real estate and energy, remain capital intensive (Piketty, 2015).

Structural change is the foundation of sustained and inclusive growth and the condition for achieving the SDGs (Lin et al., 2019). Understanding the structural change and industrial upgrading of Hong Kong during its economic taken-off period is indicative of achieving its sustainable and inclusive growth goals in the future. According to the New Structural Economics, an economy's structure of factor endowments evolves along the continuum rather than a dichotomy of two economic development levels (Lin, 2012). At each given level of development, effective market mechanisms plus active government in facilitating industrial upgrading and infrastructure improvement are pivotal to effective resource allocation (Lin, 2012). Lin et al. (2019) put forth an index of Inclusive Sustainable Transformation to assess

an economy's levels of modern industry or service development as well as its protection of the environment and inclusiveness of gender, indicating that the best strategy for an economy's sustainable and inclusive development is to align its desired characteristics with its development status.

2.2 Nexus among Land, Housing and Inequality

As for Hong Kong, the nexus among land, housing and inequality have been studied in public policy research (Li, 2013; Leung, 2014; Lai, 2014; Yau, 2015; Forrest, 2015; Hui, 2016) or by local think tanks (OHKF, 2015; 2016; 2017; 2018). As for public policy research, Li (2013) reviewed the roller-coaster movement in residential prices and housing completions, in the context of phenomenal upheavals within and beyond Hong Kong. It is recommended to conduct a comprehensive and updated review of current land use and planning processes, particularly in the Northeast New Territories, as the existing framework was institutionalised in a different socio-political environment. Leung (2014) maintained that affordability, flexibility and accessibility have made industrial buildings ideal workspaces for the selected sectors and possibly more. Further to this, additional and affordable land is needed for logistics, manufacturing, innovation and creativity sectors. Lai (2014) studied the pattern of repeated planning applications for projects on sites zoned as "Comprehensive Development Area", and found some evidence of lease modification as a cause of the lengthy development process, which on average lasted for five years, with the new lease having to replace the old ones. Yau (2015) suggested that heavier sanctions against non-conformers, facilitation of in-flat inspection and more frequent patrols are the most accepted policy options for tackling the illegal subdivided unit problems. A scientific and reliable protocol has also been formulated to facilitate the process of soliciting and evaluating the inputs of different stakeholders. Forrest (2015) provided a comprehensive account of assisted homeownership schemes in Hong Kong, and confirmed the roles of HOS and TPS in providing an important stepping stone into the homeownership market. Hui (2016) analysed the planning control decisions of TPB on applications for residential development, and found that during C.Y. Leung's administration period, the success rate of application approval for residential development in the CDA zone was highest. Besides this, the TPB is more likely to approve applications with higher proposed GFA.

Regarding local think tanks, Our Hong Kong Foundation (OHKF) has published widely on

the topics of land, housing, and economic development. On its homepage (OHKF, 2019), it is stated that “Hong Kong is currently confronted with a severe shortage of land, resulting in higher costs of living, medical care, and even running a business”. Therefore, OHKF focuses its land research on “the socioeconomic impacts of a shortage of land supply, the reasons behind the shortage, and the feasibility of different approaches to increasing land supply”, through conducting research such as “in-depth studies on the situation regarding housing supply, the structure of Hong Kong’s land and housing market, development in Lantau Island, the effectiveness of approval and developmental processes, etc.”. It further reveals that “(g)iven the factors of economic globalization, China’s economic reform and rapid growth, and severe land shortage, as an international financial center, it is almost inevitable that Hong Kong suffers from high property prices”. Consequently, a property prices increase will make wealth inequality more acute, dividing citizens into homeowners and non-homeowners, thus resulting in “more fractures in society, (and) governance may be jeopardized”. Hence, OHKF aims its housing research at “reviewing the effectiveness of Hong Kong’s housing policies over the years, and the social problems associated with the rise in property prices (e.g. youth social mobility, poverty, aging population and retirement, etc.)”.

Land and housing issues are also associated with economic development. Located in the heart of Asia, the most vibrant region in terms of economic growth opportunities in the 21st century, Hong Kong as an international city is saliently affected by the global trend of homeownership financialization. While there is rich evidence about the positive effect of robust economic growth on housing price increase, the impact of housing price on economic development is more subtle for Hong Kong: on the one hand, the last round of the property cycle coincided with the Asian Financial Crisis and the outbreak of SARS; as such, measures to promote homeownership in the form of housing subsidies, unfortunately, ended up as a driving force of housing price collapse and economic recession; on the other hand, recent government intervention in the housing market was due to prudential consideration of the global business cycle and reflection on the previous property cycle. Letting the market determine all became a doctrine again for the private housing sector after 2003, which was certainly subject to various comments and forms of criticism. Being aware of said situation, OHKF (2019) has explored the positioning and opportunities of Hong Kong’s economic development in the future. In addition to advocating policies to consolidate its status as an international financial centre, it is also necessary to keep Hong Kong abreast of the global economic direction and develop other advantageous industries, among which high-tech

industries and innovative and creative industries are particularly important. As an international city, Hong Kong must also strengthen cooperation with surrounding areas, especially with the goal of being the economic centre of gravity of Asia, as well as better cope with the new normal of economic development in Mainland China; in addition, the city must complement the advantages of the Greater Bay Area, and actively position itself on the national Belt and Road Initiative.

Specifically, OHKF (2015) advocated a subsidised homeownership scheme for public housing residents. While the idea of subsidised housing is not new, and can be traced back to the "85,000 Plan", it is believed that the key objective of the scheme is to satisfy the people's need for accommodation and property ownership, so that more needy families can become property owners. OHKF (2018) pointed out that among all the options under consideration today (which are detailed in the 18 options from the consultation paper by the Task Force on Land Supply), only the option of large-scale reclamation can create the foundations to bring a new vision to Hong Kong's development. This option proposed a 2,200-hectare reclamation in the Central Waters between Lantau Island and Hong Kong Island. This man-made island can be connected to Mainland China and the rest of Hong Kong through three major road links, including one connecting to Kennedy Town, another to Lantau Link and a third to Mui Wo and then to Tuen Mun and the Hong Kong-Zhuhai-Macao Bridge; added to this are three new railway lines connecting to Kennedy Town, Mei Foo and Tuen Mun South. By doubling the size of the reclamation and creating an area half the size of Kowloon, it is possible to create a land bank for Hong Kong's development for the next two decades. It is estimated that the proposal has the potential to create a new city that can accommodate a population of up to 0.7-1.1 million people, while also housing new industries and recreational facilities. With a preliminary proposal of 28-32% of the land being reserved for residential purposes, at least 70% of which is dedicated to public housing, this reclamation can help reduce Hong Kong's population density and increase per capita living space, bringing about five "re-imaginations" for Hong Kong: affordable housing; urban design and quality of living; redevelopment of old Hong Kong; industry development; and transportation and connectivity. While the proposal looks promising, admittedly any large-scale development in Hong Kong is complex and requires significant time and societal consensus. Needless to say, the proposal should be financially, technically and environmentally feasible.

2.3 Institutional Settings in Land and Housing Markets

Various institutions play a role in land development and urban planning, such as public-private-partnership, zoning and participatory planning, land readjustment and developers' obligations, development rights transfer, Coasean bargaining, and informal institutions (Chau et al., 2018). These settings and institutional innovations may lead to imbalanced allocation of resources, i.e. land and housing, to different groups of people. In the context of Hong Kong, institutional changes have played an important role in transforming the nexus among land, housing, inequality and their social sustainability implications. Lai et al. (2012) used Olson's group theory to explain the rise and fall of cooperative housing of civil servants in Hong Kong during its transition from a British colony to a Chinese special administrative region: it was found that the number of members of the ownership body was positively related to the formation and dissolution of the cooperative body; other influential factors on the opportunity cost of maintaining status quo were the value of land and the real option value of redevelopment. Chan et al. (2002) argued that Hong Kong's floor area control policy has a significant and negative effect on the development potential of private housing and thus exerts an adverse impact on the quality of living space. Tang (2017) further demonstrated that open space is inequitably distributed across residential and commercial housing development projects, due to the government's urban planning strategy to expand the network of new open space and to encourage public-private-partnership in place promotion and urban marketing.

The public housing sector accommodates around half of Hong Kong's population (in public rental housing or subsidized housing), thus having a redistributive effect on Hong Kong's income disparity. However, the availability of public housing depends on government commitment and priority in solving the housing problems (Chiu, 2007). Delang and Lung (2010) used aggregated census tract-level data to study if the poverty concentration mechanism of public housing exists in Hong Kong; regression analysis suggests that public housing is not essentially related to poverty concentration. Meanwhile, empirical results suggest that while public housing helps alleviate the income inequality problem in Hong Kong, the public expenditure on housing is not as efficient as on other uses to improve the Gini coefficient or other inequality measurements (Lui, 2007). It is also found that public housing tenants are disadvantaged in many ways when compared to private housing residents, due to their lower socioeconomic status, smaller dwellings, and lower rates of car ownership (Wang and Li, 2016).

The other half of Hong Kong's population lives in the private housing sector. It is noted that housing wealth is more significant than other equities for most Hong Kong citizens, which may lead to a possibly stable finance-led growth model where expenditures based on the capital gains from sufficient housing stocks can compensate for the diminishing wage-based demand (Smart and Lee, 2003). Due to this homeownership financialization trend, a large drop of homeowners was found among young people in the recent two decades (Forrest and Xian, 2018), in particular for recent migrants from the mainland who also suffered from lacking public housing opportunities (Li and Du, 2020). The difference in housing pathways between non-local and local young people thus lies in their diverse expectations of financial support from parents, which are more profound for non-local mainland students (Castro Campus et al., 2016). It is also argued that the redevelopment projects conducted by the Urban Renewal Authority lead to unintended gentrification in the urban areas of Hong Kong (La Grange and Pretorius, 2016).

To summarise, there is a lack of empirical research about whether new town development is the solution to different problems of the society, i.e. simultaneously increasing land supply, improving housing conditions, and lowering income inequality. Needless to say, Hong Kong is spatially highly integrated and concentrated (18 districts notwithstanding). Still, indicators like GDP (outputs or income), capital stock, infrastructure investment, or fiscal expenditure differ across its three regions: Hong Kong Island, Kowloon and New Territories. The impacts of new town development on Hong Kong's regional income growth and inequality have not been revealed in detail. In particular, new town development in Hong Kong is public housing-led, while unaffordable housing price is one unresolved problem of public policy planning. The construction of new towns should be complemented by appropriate social management measures to achieve the policy objectives of maximizing net development benefit to the entire community and minimizing inequality of its distribution. Quantitative studies of the cause or effects of inequality relative to new town construction are useful reference materials for social and construction policy planning. This project aims to fill this research gap by examining past experience, so as to provide information to policymakers and confidence to the public about future pathways to inclusive growth opportunities brought about by successful new town development projects, which aim to enhance the overall social welfare.

Chapter 3. Methodology and Data

3.1 Conceptual Model

A revised framework from Piketty has been established for evaluating the impact of new town development between the 1970s and 1990s, and the impact after the completion of these new towns. Specifically, Piketty (2015) found that large upward or downward movements of real estate prices significantly affected the evolution of aggregate capital values. Based on the work of Piketty and Zucman (2014), it is expected that the capital-to-income (wealth-to-income) ratio $\beta t = Kt/Yt$ will converge to $\beta = s/g$, where s is the long-run annual saving rate and g is the long-run annual total growth rate. The growth rate g is the sum of productivity growth and population growth. The share of capital income to overall income is defined as $\alpha = rK/Y = r\beta$, where r is the average annual real rate of return on wealth.

Regional wealth can be decomposed into inter- (NFA^i_t) and intra-region (K^i_t) capital:

$$W^i_{rt} = NFA^i_t + K^i_t$$

Intra-region capital (K^i_t) can be broken down into land (L^i_t), housing (H^i_t), and other capital (K^i_{ct}), including the market value of corporations and the value of nonfinancial equity:

$$K^i_t = L^i_t + H^i_t + K^i_{ct}$$

In the context of Hong Kong, the development of new towns has accompanied the economic take-off while preceding the property market boom. Because of metro development, it is increasingly convenient for people to live and work in different regions, given the rise of new towns. Therefore, we first decomposed economic growth into intra-region (K^i_t) and inter-region (NFA^i_t) factors to better understand the sources of wealth accumulation in region *i*. Region income (Y^i_{rt}) is basically the sum of intra-region output (Y^i_t) and inter-region income ($r_tNFA^i_t$):

$$Y^i_{rt} = Y^i_t + r_tNFA^i_t$$

While intra-region output Y^i_t mainly determines households' income, regional income Y^i_{rt} is deterministic of housing prices. If inter-region capital NFA^i_t becomes higher, or the growth rate of capital income r_t becomes higher, then non-homeowners should have to spend more on housing rents. Failure to self-contain new towns may lead to long travel distances to employment for new town residents, which may lower the overall economic efficiency. While Hong Kong has successful experiences with new towns for establishing a spatial bond, there are also cases of spatial mismatch. For instance, in the Tin Shui Wai new town, there is a serious jobs-housing imbalance which increases travel time and fare costs of its residents, leading to high unemployment rates and weakened social network (Lau, 2010). Hence it is meaningful to assess inter-region contribution NFA^i_t (mainly from new towns in New Territories) to Hong Kong Island and Kowloon. Our analysis helped further clarify the effects of spatial bonds or mismatch on income inequality in Hong Kong.

We then traced the evolution trend of GDP growth to household income growth. It is expected that regions with higher housing price growth (and thus higher capital income growth r_t) or higher contribution of inter-region (NFA^i_t) capital to local housing markets also has more explosive increases in GDP growth. In other words, the dichotomy between homeowners and non-homeowners tends to be intensified in these regions. As the housing wealth to household income ratio is $\beta^i_{ht} = H^i_t/Y^i_{rt,}$ we further explored the distribution dynamics of β^i_{ht} to reveal whether capital gain (*r*) has exceeded economic gain (*g*) more disproportionally in region *i* after the completion of new town development. A projection of the future evolution trend of β^i_{ht} was also carried out, so that the patterns of income inequality among different regions were evaluated.

Regarding the nexus between capital gain r (i.e. housing price) and economic gain g (i.e. GDP), r>g indicates that in the long run, wealth inequality tends to be amplified (Piketty and Saez, 2014). Meanwhile, new town development can create more job opportunities so that the gaps between capital gain and economic gain may be narrowed, if new towns are properly targeted and planned. We studied past successful experiences of new towns to see if they have achieved *Pareto Improvement* instead of *Piketty Inequality*, by comparing the periods of economic booms and property booms (thus the study period dates back to the 1970s). The results hence shed light on understanding the inclusive development goals of future NDAs, e.g. Northern Metropolis.

3.2 Empirical Model

Based on the above framework, we have achieved four research objectives using different methods.

3.2.1 Computable General Equilibrium (CGE)

The CGE model is deemed to be the most appropriate tool for policy analysis, as it can not only analyse the economy-wide impacts of a policy on an economy, but can also be used in examining the linkage effects among different economic sectors and with foreign countries. All the major parts of the economy are incorporated into the CGE model; therefore, it is a powerful tool for policy analysis, and has gained widespread use in the economics profession, particularly in the government sector and various research institutions across the world. CGE models can not only give a simulation of Hong Kong's economy as a whole; indeed, the modelling exercise can also be conducted at a very detailed level so that the impacts can be evaluated for each industrial and commercial sector. Moreover, the models are not only capable of providing an evaluation of the immediate effects of any socioeconomic policy, but can also be used to prepare a forecast for several decades in the future. This can reveal the long-term socioeconomic impacts on Hong Kong, and the analytical results may prove valuable for the private sectors, as the firms can employ the findings in making decisions for future planning in investment and recruitment.

We compared the impacts of new town development on the local economy, focusing on the key industries of Hong Kong: financial services; tourism; trading and logistics; professional services and other producer services. Over the past decades, Hong Kong has faced various challenges in maintaining its competitive advantages but successfully kept its momentum. To this end, we intend to develop a CGE model to explore the impacts of new town development policy on the local economy. Specifically, CGE can offer detailed information on the impacts of new town development on the region's economy by providing the following information:

1. The change of region's GDP
2. The percentage change in output in each of the four key sectors
3. The impact on employment for the skilled and unskilled labour
4. The change in wage and thus the impact on consumption
5. The change in demand for other goods and services

3.2.2 Regression analysis

The economic outputs data dates back to the 1970s. We include this study period not only because of data availability, but also to isolate the specific effects of any time-related events from the findings. We can identify whether the factor of with/without new town development has a significant impact on the economic performance over time. The system generalized method of moments (SGMM) estimator was used. The SGMM estimator, developed by Arellano and Bover (1995), was employed in this project to tackle the issue of endogeneity. The two-step SGMM was used to tackle the thorny issue of heteroskedasticity. To handle the issue of instrument proliferation, the technique of collapsing the blocks in the instrument matrix was used (Roodman, 2009). Moreover, the number of lags was limited to two for the explanatory variable when preparing the instruments for the transformed equations, and only the present value was used as the instrument for the time dummies. All the explanatory variables were treated as endogenous, as there is no prior knowledge about the exogeneity of the independent variables. The Hansen test, the Sargan test and the serial correlation test were employed to evaluate the over-identifying restrictions, according to Arellano and Bover (1995) and Roodman (2009). The regression model is as follows:

$$gdp_{it} = \alpha + \beta_1 govspd_{i,t-1} + \beta_2 urban_{i,t} + \beta_3 den_{it} + \beta_4 work_{it} + \beta_5 fis_{it} + \beta_6 NTD_{it} + \lambda I_{it} + \mu_i + \varepsilon_{it}$$

where i represents the region; t represents the year; gdp_{it} is GDP growth; $urban_{it}$ is urbanisation rate, defined as the ratio of non-agricultural population to the region's aggregate population; den_{it} is urban density, defined as urban population divided by urban area; $work_{it}$ is working for age population, defined as the proportion of working population (aged 18 to 65) to total population; fis_{it} is fiscal decentralisation ratio, defined as region's fiscal expenditure divided by city's fiscal expenditure; and NTD_{it} is a dummy variable, which equals 1 after the start of new town development and equals 0 otherwise. When there is more than one new town in the region, the number of NTD_{it} is summed up. I_{it} represents the interaction terms between variables; μ_i denotes the unobservable individual-specific effect; and ε_{it} denotes the disturbance item which is independent and identically distributed. The sign and significance of the NTD_{it} coefficient shed important light on understanding the impact of new town development on the overall social welfare.

3.2.3 Inequality Decomposition Indicators

The most commonly used inequality measurements are the Gini coefficient, as well as the

Theil-T and Theil-L indices. These indicators satisfy two important criteria of inequality measurement: 1) the property of income-zero-homogeneity, which means that the value of the inequality measurement should remain the same when there is a scale change of the whole income distribution; and 2) the Pigou-Dalton principle, which suggests that a transfer of income from a poor person to a rich person should result in an increase of the inequality indicator (Bourguignon, 1979).

Specifically, the Theil-T and Theil-L indices can be decomposed completely into the components of the sub-groups (Bourguignon, 1979), while the Gini coefficient cannot satisfy the property of additive decomposability. Thus the Gini coefficient cannot be decomposed completely into the components of the sub-groups, but can be decomposed according to the income sources. Thus, the inequality measurement results based on the Theil index were employed in the decomposition by sub-groups in analysing the relationship between inequality and region groupings.

According to Cheong and Wu (2012), the formula of the population-weighted Theil-T is:

$$Theil - T = \sum_i \frac{Y_i}{Y} ln \frac{\frac{Y_i}{Y}}{\frac{n_i}{N}}$$

The formula of the population-weighted Theil-L is:

$$Theil - L = \sum_i \frac{n_i}{N} ln \frac{\frac{n_i}{N}}{\frac{Y_i}{Y}}$$

where Y is the total gross domestic product (GDP) of all regions, Y_i is the GDP in region i, N is the total population of Hong Kong, and n_i is the population in region i.

The formulae of the unweighted Theil-T and Theil-L respectively are:

$$Theil - T = \sum_i \frac{Y_i}{Y} ln \frac{\frac{Y_i}{Y}}{\frac{1}{R}}$$

$$Theil - L = \sum_i \frac{1}{R} ln \frac{\frac{1}{R}}{\frac{Y_i}{Y}}$$

where R is the total number of regions.

The formula of the population-weighted Gini coefficient is:

$$\sum_i \sum_j \frac{|y_i - y_j|}{2\mu} \frac{n_i}{N} \frac{n_j}{N}$$

where N is total population of Hong Kong, n_i and n_j are population in region i and region j respectively, y_i and y_j are GDP per capita in region i and region j respectively, and:

$$\mu = \sum_i \frac{y_i n_i}{N}$$

The formula of the unweighted Gini coefficient is:

$$\sum_i \sum_j \frac{|Y_i - Y_j|}{2\mu R^2}$$

where R is total number of regions, Y_i and Y_j are GDP in region i and region j respectively, and $\mu = \sum_i \frac{Y_i}{R}$.

According to Theil (1972), decomposition of inequality into sub-groups can be employed to determine the contributions of the sub-groups to overall inequality, which is broken down into the inequality existing between region sub-groups, i.e. the inter-sub-group component and the weighted sum of the inequalities existing within the region sub-groups, i.e. the intra-sub-group component (Bourguignon, 1979). To this end, we have explored the impact of new town development on income inequality. Overall inequality can be decomposed into intra-sub-group component and inter-sub-group component:

$$I = \sum w_j I_{intra,j} + I_{inter}$$

where W_j is the weight for the j^{th} region sub-group, $I_{intra,j}$ is the intra-sub-group inequality within region grouping j, and I_{inter} is the inter-sub-group component.

It is noteworthy that income weight should be used in Theil-T, whereas population weight should be used in Theil-L (Gustafsson and Li, 2002).

The weight of Theil-T for regional grouping is $Wj = \frac{Y_j}{Y}$

The weight of Theil-L for regional grouping is $Wj = \frac{n_j}{N}$

where Y is Hong Kong's GDP, Y_j is the region's GDP in sub-group j, N is Hong Kong's population, and n_i is the population in sub-group j. So W_j , the weight for the j^{th} sub-group, is $\frac{Y_j}{Y}$ for Theil-T and $\frac{n_j}{N}$ for Theil-L, where Y_j is the region GDP in sub-group j and n_j is the population.

Moreover, a region's GDP is made up of the value added generated by the three economic sectors. The Gini coefficient can be decomposed into these income sources so as to calculate the contribution of each sector to overall international inequality.

$$G = \sum_{s=1}^{S} W_s C_s$$

where G is international income inequality as measured by the Gini coefficient, C_s is the concentration coefficients of sector s, and W_s is the income share of sector s of total income.

So, G is the weighted sum of concentration coefficients which can be computed by:

$$C_s = 1 - \sum_{j=1}^{m} P_j(2Q_{sj} - W_{sj})$$

where $Q_{sj} = \sum_{l=1}^{j} W_{sl}$, W_{sj} is the share of income for region j of total source income s, and P_j is the population share of total population for region j. Both P_j and w_{sj} should be sorted in ascending order of total income per capita in the calculation of C_s. The contribution of each sector can be calculated as:

Contribution of sector $s = \frac{W_s C_s}{G}$

3.2.4 Transitional Dynamics Analysis

According to the conceptual framework, we tested whether new town development affects the ratio of housing price growth to GDP growth, which is $\beta^i_{ht} = H^i_t/Y^i_{rt}$. Distribution dynamics analysis can reveal crucial information on the underlying income distribution and the transitional dynamics. It was first developed by Quah (1993), and can be further divided into the Markov transition matrix analysis and the stochastic kernel approach. The latter approach has the merit of circumventing the issue of demarcation, and thus was used first to evaluate the effect of new town development on the gap between capital gain and economic gain.

Specifically, the bivariate kernel estimator is defined as:

$$\hat{f}(x,y) = \frac{1}{nh_1h_2}\sum_{i=1}^{n} K\left(\frac{x-X_{i,t}}{h_1}, \frac{y-X_{i,t+1}}{h_2}\right)$$

where n is the number of observations, h_1 and h_2 are the bandwidths which are calculated based on the approach proposed by Silverman (1986); K is the Epanechnikov kernel function, x is a variable representing the housing price or GDP growth of a region at time t, y is a variable representing the housing price or GDP growth of that region at time t +1, $X_{i,t}$ is an observed value of housing price or GDP growth at time t, and $X_{i,t+1}$ is the observed value of housing price or GDP growth at time t +1.

An adaptive kernel with flexible bandwidth is used to increase the accuracy of the model. Assuming that the evolution is time invariant and first order, and the distribution at time $t + \tau$ depends on t only and not on any previous housing price or GDP growth distribution, then the relationship between the housing price or GDP growth distributions at time t and time $t + \tau$ is:

$$f_{t+\tau}(z) = \int_0^{\infty} g_\tau(z|x) f_t(x) dx$$

where $f_{t+\tau}(z)$ is the τ-period-ahead density function of z conditional on x, $g_\tau(z|x)$ is the transition probability kernel that maps the distribution from time t to $t + \tau$ and $f_t(x)$ is the kernel density function of the distribution of the housing price or GDP growth at time t.

The ergodic density function can be computed by:

$f_{\infty}(z) = \int_0^{\infty} g_{\tau}(z|x) f_{\infty}(x) dx$

where $f_{\infty}(z)$ is the ergodic density function if τ is infinite.

We further validated whether the period of new town construction has a significant effect on enlarging or reducing the gap between capital growth and economic growth. A right-tailed unit root (RADF) test (Yiu et al., 2013) was used to test whether the ratio of housing price growth to GDP growth has changed dramatically. Based on the present value model, rational bubble assumption and non-linear explosive characteristics, Yiu et al. (2013) devised a method to explore the potential bubble existence in asset prices of sub-samples under flexible initial observation and window size. The RADF method assumes a random walk process:

$y_t = dT^{-\eta} + \theta y_{t-1} + \varepsilon_t \quad \varepsilon_t \text{ (iid)} \sim N(0, \sigma^2), \theta = 1$

where d is constant, η is a localising coefficient of the sample size T which approaches infinity, and ε is the error term.

The testing strategy of RADF is based on the following equation:

$y_t = \mu + \rho y_{t-1} + \sum_1^p \varphi i \Delta y(t-i) + \varepsilon_t$

where y is the variable for the question, μ is an intercept, p is the maximum number of lags, and ε is the error term. The RADF test examines the null hypothesis of a unit root and the alternative hypothesis of an explosive autoregressive coefficient:

Null Hypothesis $H_0 : \rho = 1$

Alternative Hypothesis $H_1 : \rho > 1$

We compared the transitional distribution patterns of housing price growth and GDP growth with the RADF test results to find out whether there are periods of explosive patterns (which equate to enlarging gaps between capital gain and economic gain) that coincide with the periods of new town development.

3.3 Data and Variable

3.3.1 Data

Five sets of data are required in this study. The first set is the semi-decennial census statistics between 1976 and 2016 from the website of the Census and Statistical Department in Hong Kong. The census statistics are at the tertiary planning unit level (TPU). The census in 1976 is the earliest record that can be found in Hong Kong at the TPU level. The census in 2016 is the latest statistics available from the Hong Kong government. The TPU is a geographic reference system adopted by the Hong Kong Planning Department (HKPD) for the territory of Hong Kong. A TPU is very similar to the census tract in North America. According to the HKPD, the whole city of Hong Kong is divided into 291 TPUs. Each TPU incorporates boundary information and sociodemographic information. The total number and reported number of TPUs are reported in Table 3.1. The difference between the total number and the reported number is because the population of TPUs (if it is less than 1000) was incorporated in the proximate TPU in order to protect the privacy of the residents (Yip et al., 2021). The total numbers shown in Table 3.1 are different due to some TPUs being uninhabited at the time of the census. The number of the TPUs keep increasing from 1976 to 2016 may ascribe to the new town development from the 1970s and 1990s such that a large number of Hong Kongers reside in the new towns.

Table 3.1 Description of New Towns in Hong Kong

Sort	Time of Census Statistics	Number of TPUs	Reported TPUs
1	1976	243	189
2	1981	270	217
3	1986	271	217
4	1991	272	196
5	1996	276	195
6	2001	282	197
7	2006	287	204
8	2011	287	209
9	2016	291	214

Data Source: Census statistics Department in Hong Kong

The second set of data is the geographical information of New Towns and urban areas in Hong Kong, which is collected from the planning department of Hong Kong (Figure 3.1). By incorporating the demographic information into the New Towns areas, the basic information of New Towns in Hong Kong is displayed in Table 3.2. In Table 3.2, only the existing new towns are reported and planned new towns (i.e., Fanling North, Kwu Tung North, and Hung

Shui Kiu) are not shown in the table. As of the statistics in 2016, the population of Tsuen Wan, Sha Tin, Fanling-Sheung Shui, Tseung Kwan O, and Tin Shui Wai almost reaches the maximum planned level.

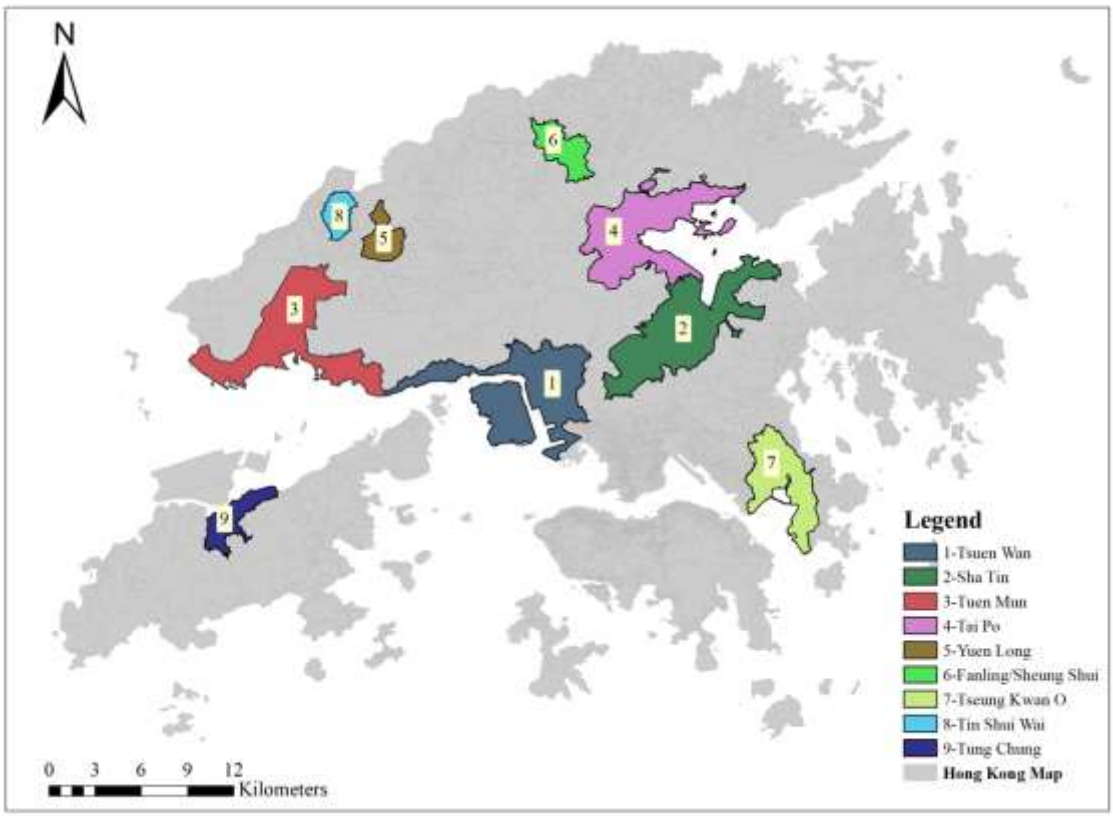


Figure 3.1 Distribution of New Towns in Hong Kong

Data Source: Planning Department of Hong Kong

Table 3.2 Description of New Towns in Hong Kong

#	New Towns	Time of development	Population (in 2016)	Planned Population	Size (Km^2)	Number of TPUs
1	Tsuen Wan	1973	823,386	845,000	24.00	13
2	Sha Tin	1973	665,606	735,000	35.87	7
3	Tuen Mun	1973	487,407	649,000	19.00	10
4	Tai Po	1976	270,728	347,000	12.70	8
5	Yuen Long	1977	160,010	196,000	11.70	4
6	Fanling-Sheung Shui	1978	259,942	291,000	7.80	5
7	Tseung Kwan O	1982	398,479	450,000	10.05	6
8	Tin Shui Wai	1987	286,232	306,000	4.30	1
9	Tung Chung	1996	86,392	220,000	8.30	6

Data Source: Census statistics Department in Hong Kong

The third data set is the GDP index in Hong Kong from 1980 to 2020, which is obtained from

the census and statistical department of Hong Kong. The GDP is at the integrated level. The fourth set is the domestic housing price index, which is from the rating and valuation department of Hong Kong. It covers the period between 1980 and 2020.

The fifth set of data is collected from the 5% population census in 2001 and 2006, which are on the household level.

3.3.2 Variables

To achieve the research objectives, the variables in the present study relied on the census statistics. The reason is ascribed to the GDP index for different sub-regions in Hong Kong is not available. In Hong Kong, only the integrated GDP (i.e., city-level) is recorded. In other words, Hong Kong does not record the sub-region's GDP. Thus the abovementioned variables were replaced by some proxies. The details are shown in the following context.

Housing Starts

As explained in the last paragraph, due to the unavailability of the sub-region's GDP in Hong Kong, the increment of living quarters replaced the variable gdp_{it}. It was used as a proxy to measure the economic growth as the housing development generally reflects the contribution to the economic development within a certain area. The increment of living quarters is also called housing starts in the literature (Strauss & Haasl, 2018), which can be well measured by the number of newly built housing units between any two-census year. According to the Bureau of the Census of the U.S. Department of Commerce (NYU, 2021), housing starts is a leading indicator.

Government spending

Similar to the economic growth, the figures of government spending on the sub-regions in Hong Kong are not available. Thus we employ the proxy of the total population in the sub-region to indicate the level of government's spending (i.e., $govspd_{i,t-1}$). As suggested by Ladd (1994), greater population growth is associated with higher current government spending. As such, we use the total population at time t-1 of region i to indicate government spending.

Urban (Non-Agriculture)

The variable Urban is to measure the percentage of the non-agriculture population over the total population in the region i at time t. We can simply calculate this variable via the census

statistics in Hong Kong.

Density/Size

The term density in this study refers to population density. As the total population has been taken into consideration as the proxy of governments' spending, the density therefore may simply be replaced by the size/areas of TPU. It could be well served as the control variable for the regression analysis.

Working Population

The working population is termed as the number of the labour force. In the present study, this variable is served as the control variable.

Fiscal Expenditure (ΔJobs)

In this study, we adopted the increment of jobs as the proxy to measure the impact of fiscal expenditure on economic growth. According to the Federal Reserve Bank (Cavallo, 2005; FRBSF, 2022), job growth is the gross number of wage-paying positions created through government expenditure. Job growth is often used as a measure of economic expansion. Using job-growth (*ΔJobs*) can reflect the stimulus effect of fiscal expenditure on economic growth.

New Town Development (NTD)

The variable NTD is of particular interest in this study. It is a dummy variable, where it is denoted as 1 if the region belongs to the new town, otherwise, it is 0. The consideration of this variable enables us to compare the difference in economic growth inside and outside the new town areas.

Interaction terms

The interaction terms include four variables, namely New Town×$Pop_{i,s}$, New Town× $NonAgr_{it}$, New Town×Size, and New Town×ΔJobs. They are used for considering how the government spending and fiscal expenditure in New Towns impact economic growth.

Region

The location variables are used for identifying where the TPU is located. In this study, three

regions, namely Hong Kong Island, Kowloon, and New Territories are considered.

3.3.3 Descriptive statistics

3.3.3.1 Impact of Development of New Towns on Economic Growth

The descriptive statistics are summarized in Table 3.3. It is worth mentioning that the sample size in the descriptive table is not simply the combination of the census statistics from 1976 to 2016. The number is based on the reproduction of the census statistics on the basis of four different base years, that is 1976, 1981, 1986, 1996. The selection of these four base years is because the Hong Kong government paid substantial efforts to develop/initiate new towns during these periods. The base year is set as the point of departure in which the economic growth statistics can be generated through pairing up the statistics in the later years. For example, by setting 1976 as the base year, we generate eight cross-year census statistics: 1976-1981 (147 TPUs), 1976-1986 (148 TPUs), 1976-1991 (128 TPUs), 1976-1996 (121 TPUs), 1976-2001 (118 TPUs), 1976-2006 (129 TPUs), 1976-2011 (129 TPUs), and 1976-2016 (131 TPUs). Similarly, we can generate the cross-year census statistics for the rest of the base years (i.e., 1981, 1986, 1996). On combining all the cross-year census statistics at the TPU level, the total sample size is 2913.

Table 3.3 Summary of variables and descriptive statistics

Variables	Description	Unit	Mean	Standard Deviation	N
Dependent Variables					
ΔLQ	Increment of living quarters of the i-th TPU from the time s to t (**Proxy of GDP growth from s to t, s<t**)	Ratio	2.5018	10.1263	2913
Independent Variables					
Pop/Spending	Number of populations of the i-th TPU at time s (**Proxy of government spending at time s, s < t**)	Number	30645	40571	2913
$NonAgr_{it}$	The ratio of non-agriculture population over total population in the i-th TPU at time t	Ratio	0.5261	1.3217	2913
Size (C)	The size of the i-th TPU	Km^2	5.5623	11.6826	2913
Working (C)	The percentage of the working population of the i-th TPU at time t	Percentage	0.5252	1.3763	2913
ΔJobs/Fiscal Expenditure	Increment of jobs/employments of the i-th TPU from the time s to t (**Proxy of fiscal expenditure increment from the time s to t, s < t**)	Ratio	2.4324	12.2520	2913
New Town	Whether the TPU at time t belongs to New Town (1 = Yes, 0 = No)	Dummy	0.2163	0.4118	2913
New Town×Pop	Population of the New Town at time s	Number	8449	29088	2913

New Town× NonAgr	The ratio of non-agriculture population in the New Town at time t	Percentage	0.1058	0.2453	2913
New Town×Size	The size of New Town	Km^2	1.7774	8.1515	2913
New Town×ΔJobs	Increment of jobs of the New Town from the time s to t	Ratio	1.2545	11.0124	2913
HK#	Whether the TPU is located in Hong Kong Island (1 = Yes, 0 = No)	Dummy	0.2543	0.4355	2913
KL	Whether the TPU is located in Kowloon (1 = Yes, 0 = No)	Dummy	0.2838	0.4509	2913
NT	Whether the TPU is located in New Territories (1= Yes, 0 = No)	Dummy	0.4617	0.4986	2913

Note: TPU is short for Tertiary Planning Unit. #Hong Kong Island is served as the reference in the present study. C here is short for the control variable.

The descriptive statistics in Table 3.3 could not well present the difference between the non-New Town areas and New Town areas. In this regard, two panels of descriptive statistics are performed, which are displayed in Table 3.4 and Table 3.5 respectively. Table 3.4 targets the comparison between the urban areas (excluding the new town areas) and new towns, while Table 3.5 only concentrates on comparing the new territories (excluding the new towns) and the new towns. It is easy to observe that nearly all the mean values of the selected variables of new towns are greater than that of other regions in Table 3.4 and Table 3.5, indicating that the fast development of the new town may contribute significantly to the economic growth in the past few decades.

Table 3.4 Descriptive statistics – Comparison between Urban Areas and New Towns

Urban Areas (excluding New Towns)					**New Towns**		
Variables	**Unit**	**Mean**	**Standard Deviation**	**N**	**Mean**	**Standard Deviation**	**N**
ΔLQ	Ratio	1.5188	5.4064	2283	6.0639	18.7742	630
Working	Percentage	0.5321	1.5371	2283	0.5003	0.4443	630
Pop	Number	28320.53	36414.97	2283	39069.67	52144.91	630
NonAgr	Ratio	0.5130	1.0459	2283	0.4893	0.3012	630
Size	Km^2	4.8293	10.07575	2283	8.2188	15.9562	630
ΔJobs	Ratio	1.5029	6.3311	2283	5.8006	23.1308	630

Table 3.5 Descriptive statistics – Comparison between New Territories and New Towns

New Territories (excluding New Towns)					**New Towns**		
Variables	**Unit**	**Mean**	**Standard Deviation**	**N**	**Mean**	**Standard Deviation**	**N**
ΔLQ	Ratio	0.6997	2.6492	715	6.0639	18.7742	630
Working	Percentage	0.4495	0.09113	715	0.5003	0.4443	630
Pop	Number	6109.03	4700.21	715	39069.67	52144.91	630
NonAgr	Ratio	0.4924	1.8678	715	0.4893	0.3012	630
Size	Km^2	12.3365	15.2311	715	8.2188	15.9562	630
ΔJobs	Ratio	1.4842	2.8419	715	5.8006	23.1308	630

3.3.3.2 Inequality Analysis-impact of MTR development on New Towns

The descriptive statistics are presented in Table 3.6. We only consider the information of the MTR served areas and non-MTR served areas in New Territories as the study objects (i.e., Ma On Shan Line, Tseung Kwan O Line, and West Rail Line) are mainly located in New Territories, which includes 72 TPUs in 2001 and 76 TPUs in 2006. By referring to the previous studies of transit-induced gentrification (Dong, 2017; Bardaka et al., 2018), we select various variables as the indicators for measuring the changes in social status, including average monthly housing rent (Rent, Table 3.6), percentage of the population that is 25 years old with at least a bachelor's degree or above (Education, Table 3.6), percentage of the employed population in the managerial position (Managerial, Table 3.6) and percentage of the employed population in the professional occupation (Professional, Table 3.6).

In addition, we also need to identify the low-income households at the TPU level. By referring to the *Hong Kong Poverty Situation report 2019*, the low-income households are defined based on the households' size (CSD, 2020). The thresholds are set as HK$ 4,500 (1 person), HK$ 10,000 (2-person), HK$ 16,600 (3-person), HK$ 21,400 (4-person), HK$ 22,100 (5-person) and HK$ 23,000 (6-person or above) (CSD, 2020). The distributions of the low-income households in 2001 and 2006 are shown in Figure 3.2 and Figure 3.3. Apart from the selection of social status, middle-class and low-income household, we select the median age of the population in the TPU (Age), the population in the TPU (Population), median household size in the TPU (HSize) and percentage of the population over 16 years old in the labour force (Labor) as control variables. The descriptive statistics are reported in Table 3.6.

Table 3.6 Summary of variables and descriptive statistics in TPU

Variables	Description	Unit	Mean	Standard Deviation	N‡
Dependent Variables					
Rent	Average monthly rental payment of households (adjusted to Nov 2020 Price)	HKD	5459.72	4102.87	148
Education	Percentage of the population that is 25 years old held at least a bachelor's degree or above	Percentage	0.1053	0.0689	148
Managerial	Percentage of the employed population in the managerial occupation	Percentage	0.0544	0.0408	148
Professional	Percentage of the employed population in the professional occupation	Percentage	0.0236	0.0177	148
Low-income	Percentage of low-income households	Percentage	0.1243	0.0952	148
Independent Variables					
Age	The median age of the population in the TPU	Number	36.4797	3.4532	148

Population	Number of people in the TPU	Number	34156.98	50302.08	148
HSize	Median household size in the TPU	Number	3.0344	0.3442	148
Labor	Percentage of population over 16 years old is in the labour force	Percentage	0.5971	0.1152	148
Time	If the data is from the statistical year 2006	1 or 0	0.5	0.5017	148
Treatment	If the TPU is located in the MTR served areas.	Percentage	0.3243	0.4697	148

Note: The number of TPU stands for the ones located in New Territories only, including both 2001 and 2006, which consist of 72 TPUs in 2001 and 76 TPUs in 2006.

As explained in the above section, the 5% population census in 2001 and 2006 on the household level is required for the analysis. The descriptive statistics are shown in Table 4.7. It includes 105,390 and 116,759 households' demographical data in 2001 and 2006. Similar to the data set at the TPU level (Table 3.6), two groups of internal migration information are shortlisted for the following empirical analysis. The first group is related to the internal migration information of the social status. It includes the flows of professionals (i.e., inflows, outflows or stay), flows of managerial, and flows of well-educated people (i.e., people who obtained at least a bachelor's degree). The number of households that meet the above criteria is 15,277 (Education attainment in both 2001 and 2006), 10,997 (Managerial), and 13,666 (Professional) respectively. The second group of information is to select the internal migration information of low-income households. By following the definition of low-income households above, the number of low-income households is 36,938. Except for the key indicators, we include household size (HSize), number of household members who obtained bachelor's degree or above (NDegree), number of household members who are aged over 65 (Over65), number of household members who are aged under 15 (Under15) as controlling variables.

Table 3.7 Summary of variables and descriptive statistics of flows of households

Variables	Description	Unit	Mean	Standard Deviation	N
Education					
Migration	Internal migration of the household where at least one member obtained bachelor's degree (2= move out from the MTR served area, 1= move in from the MTR served area, 0 = stay the same place)	0, 1, or 2	0.7319	0.7447	15,277
Treatment	Whether household lives in the MTR served areas (1= Yes, 0 = No)	1 or 0	0.4402	0.7370	15,277
Time2006	Whether the data is from the census statistics in 2006 (1 = Yes, 0 = No)	1 or 0	0.5461	0.4979	15,277
HSize	Household size	Number	4.3007	3.1928	15,277
NDegree	Number of household members who obtained bachelor's degree or above	Number	1.5331	0.8878	15,277
Over65	Number of household members aged over 65	Count	0.2444	2.2311	15,277

Under15	Number of household members aged under 15	Count	1.4292	0.7384	15,277
Managerial					
Managerial	Internal migration of the household where at least one member is in the managerial occupation (2= move out from the MTR served area, 1= move in from the MTR served area, 0 = stay the same place)	0, 1, or 2	0.7537	0.7251	10,997
Treatment	Whether household lives in the MTR served areas (1= Yes, 0 = No)	1 or 0	0.4108	0.7849	10,997
Time2006	Whether the data is from the census statistics in 2006 (1 = Yes, 0 = No)	1 or 0	0.5314	0.4990	10,997
HSize	Household size	Number	4.2379	1.5601	10,997
NDegree	Number of household members who obtained bachelor's degree or above	Number	0.8665	0.8759	10,997
Over65	Number of household members aged over 65	Count	0.1672	0.4556	10,997
Under15	Number of household members aged under 15	Count	1.5364	0.8090	10,997
Professional					
Professional	Internal migration of the household where at least one member is in the professional occupation (2= move out from the MTR served area, 1= move in from the MTR served area, 0 = stay the same place)	0, 1, or 2	0.4983	0.5001	13,666
Treatment	Whether household lives in the MTR served areas (1= Yes, 0 = No)	1 or 0	0.4008	0.7988	13,666
Time2006	Whether the data is from the census statistics in 2006 (1 = Yes, 0 = No)	1 or 0	0.5517	0.4973	13,666
HSize	Household size	Number	4.2451	1.5531	13,666
NDegree	Number of household members who obtained bachelor's degree or above	Number	0.8503	0.8708	13,666
Over65	Number of household members aged over 65	Count	0.2636	0.5727	13,666
Under15	Number of household members aged under 15	Count	1.5202	0.7997	13,666
Low-Income					
Low-Income	Internal migration of the low-income household (2= move out from the MTR served area, 1= move in from the MTR served area, 0 = stay the same place)	0, 1, or 2	0.5290	0.6971	36,938
Treatment	Whether household lives in the MTR served areas (1= Yes, 0 = No)	1 or 0	0.4796	0.4996	36,938
Time2006	Whether the data is from the census statistics in 2006 (1 = Yes, 0 = No)	1 or 0	0.4538	0.5336	36,938
HSize	Household size	Number	4.6329	1.9862	36,938
NDegree	Number of household members who obtained bachelor's degree or above	Number	0.4233	0.4288	36,938
Over65	Number of household members who aged over 65	Count	0.2352	0.7005	36,938
Under15	Number of household members who aged under 15	Count	0.3483	0.7943	36,938

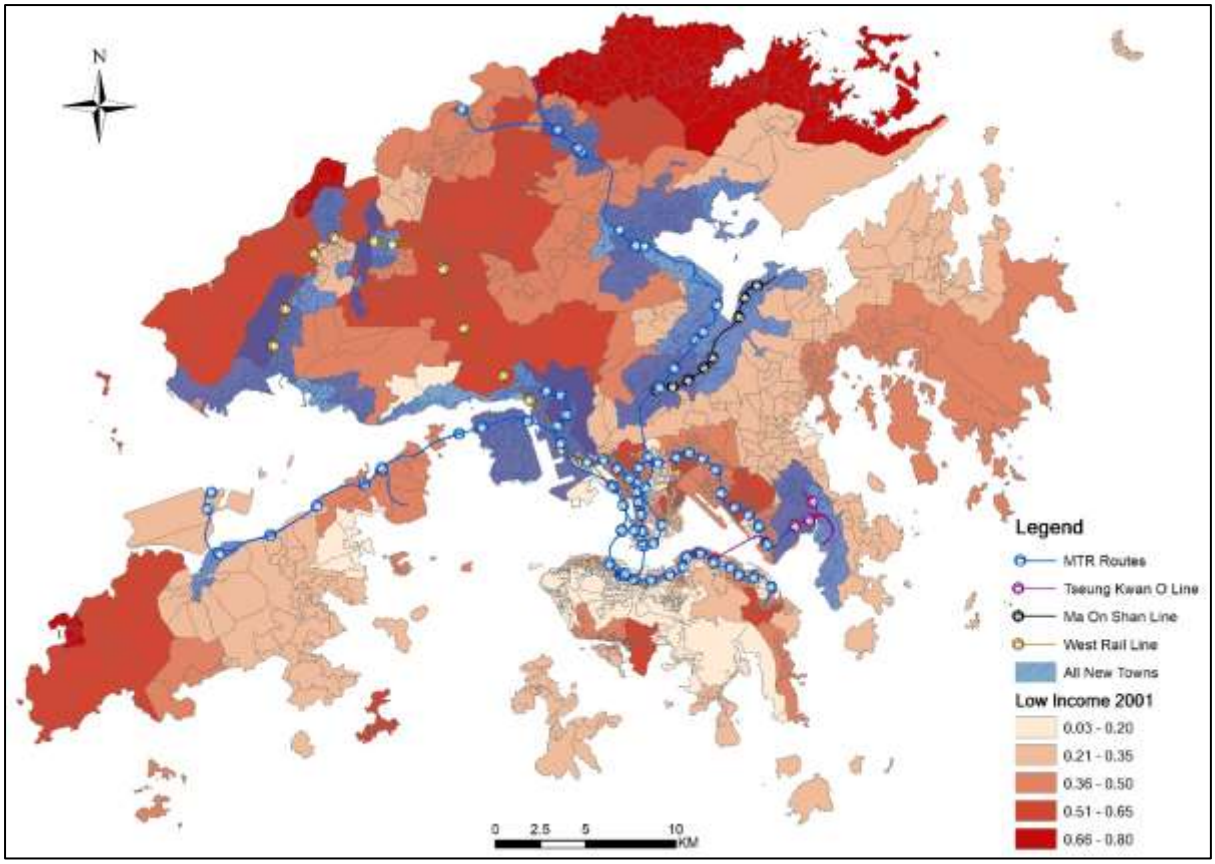


Figure 3.2 Distribution of low-income households in 2001 in Hong Kong

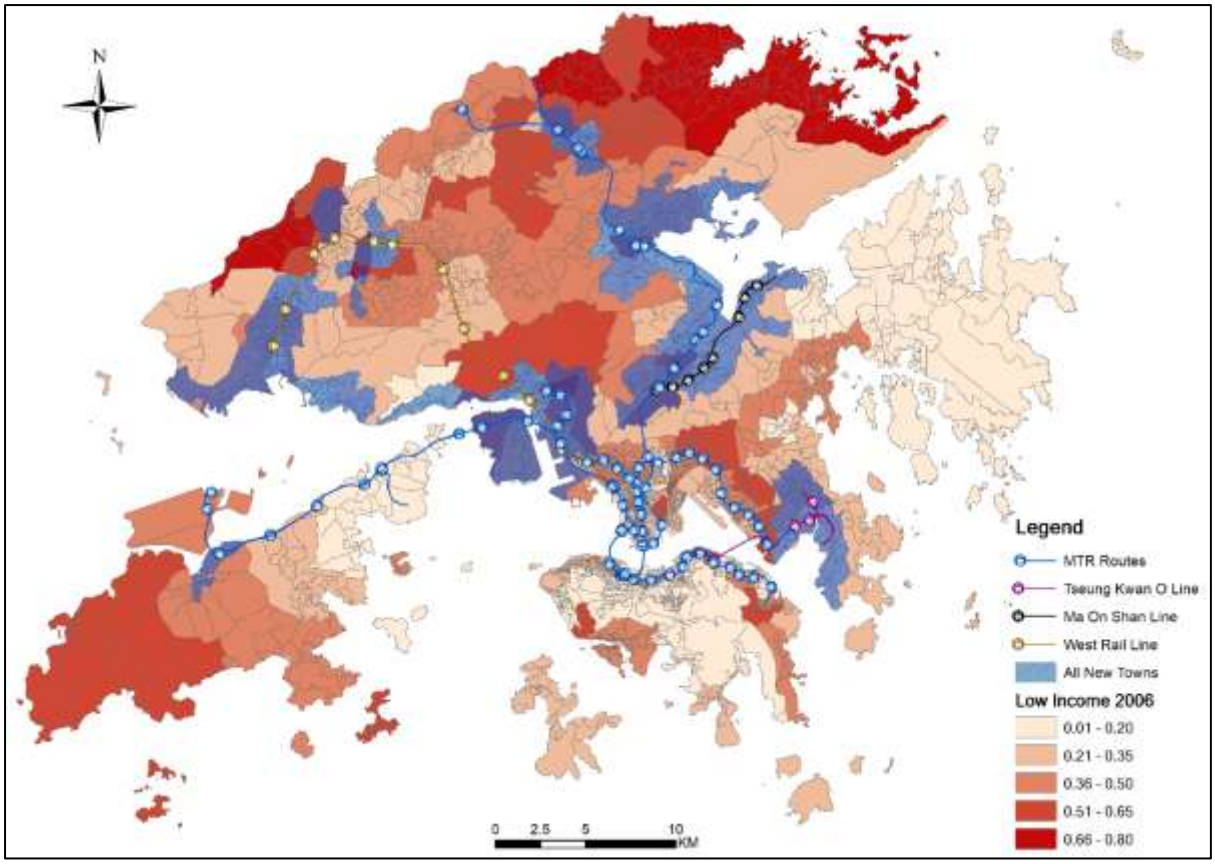


Figure 3.3 Distribution of low-income households in 2006 in Hong Kong

Chapter 4. Results and Findings

In this chapter, we first run regressions to analyze the impact of past new town development on local economic indicators (Objective 2). Then, we perform decomposition analysis (Objective 3) and distribution dynamics analysis (Objective 4). Finally, we explore the potential impacts of Northern Metropolis Development on the local economic sectors in the future using CGE modelling (Objective 1). The reason we performed CGE modelling at last is that the Hong Kong SAR Government announced the *Northern Metropolis Development Strategy* on 6 October 2021. To keep our report as much updated as possible with regard to the government's latest policy initiative, our team decided to arrange our tasks by assessing the impacts of past new town development first, followed by projection of economic impacts brought by the future new development area.

4.1 Regression Analysis

The statistical results are shown in Tables 4.1 ~ 4.6. Tables 4.1 ~ 4.4 delineate the impact of the new town development on economic growth by setting 1976, 1981, 1986, and 1996 as the base year, respectively. Tables 4.5 ~ 4.6 focus on how new towns' development impacts economic growth by incorporating all the different base years.

4.1.1 Impact of New Town development on Economic Growth (the base year 1976)

4.1.1.1 General findings of Hong Kong

The statistical results reported in Table 4.1 mainly center on the relationship between the economic growth and development of the new town with the starting year 1976. Four new towns, namely Tsuen Wan, Sha Tin, Tuen Mun, Tai Po are considered in this part. There are eight columns in Table 4.1, where each exhibits the analysis with a different time span. The variable *Pop* is the proxy of government's spending, it can be observed that the coefficients are significant with a positive sign in columns (3) ~ (7) in Table 4.1. It indicates that government spending may not instantly impact economic growth, while the effects can be spotted after 10 years. *NonAgr* is the variable to measure the influence of the non-agricultural industry on the economy. Results show that the coefficients of columns (4), (5), (6), and (8) are statistically significant with the positive magnitudes, where the magnitudes in columns (4) ~ (6) are monotonically increasing. It indicates that Hong Kong shifts its focus on putting more effort and resources into the non-agricultural industry. *Working* in the present study is utilized for measuring the association of the labour force on economic growth. The more the

labour force, the fast growth of the economy in Hong Kong should be detected. Setting the starting year as 1976, we can see that working in columns (3) ~ (7) is significant. *ΔJobs* are found to be significant with positive coefficients in columns (1) and (2). It demonstrates that the fiscal expenditure on the whole city of Hong Kong significantly impacts the economic growth in the first 10 years. *Size* here is employed for measuring the impact of TPU on economic growth. It is easy to see those three columns, that is (5), (6), and (7) are shown as significant with a negative coefficient. A possible explanation of the negative coefficient is that the well-developed areas that are equipped with business/industry are located in Hong Kong Island and Kowloon but with a limited size of urban areas. On the contrary, the size of most areas of New Territories is larger than that of Hong Kong Island and Kowloon.

4.1.1.2 Findings of New Town

The results of the New Town and interaction terms (i.e., *New Town×Pop, New Town×NonAgr, New Town×Size, and New Town×ΔJobs*) in Table 4.1 are of special importance in this study. It reveals the relationship between the new town development on the economy in Hong Kong. The variable - *New Town* are statistically significant with the positive sign in columns (1) (0.3536) and (2) (0.3224). It shows that the regions of new towns in Hong Kong experience a ten-year fast development period. On seeing the results of *New Town×Pop*, columns (4) ~ (8) are detected to be statistically and economically significant with positive magnitudes, which are very similar to the generated cases (Pop, columns (3) ~ (7)). It implies that government spending on the New Town is similar to the other areas in Hong Kong, which shows some lagging effects. It also indicates that the significance of the New Town development (i.e., The significance of New Town in columns (1) and (2)) on the economic growth may not come from the government spending. As for the *New Town×NonAgr*, only columns (4) and (5) are significant. It delineates that New Towns between 1996 and 2001, in comparison to the previous two decades, significantly contributes to the economy. Such significance may witness Hong Kong's allocating more resources to developing the tertiary industry, resulting in the agricultural production and activities shrinkage. *New Town×Size* in columns (1) ~ (8) are insignificant, indicating that the size of the new towns does not significantly impact the economic growth in Hong Kong. The variable *New Town×ΔJobs* in columns (1) ~ (8) are all statistically significant with positive coefficients. It well reflects that the fiscal expenditure of New Town significantly contributes to the economic growth. It may also imply that the significance of the dummy variable (New Town) mainly results from the

fiscal expenditure of New Town.

4.1.2 Impact of New Town development on Economic Growth (the base year 1981)

From this section onwards in section 4.1, we only focus on the *New Town*-related variables as they are of particular interest/major focus in the present study. In this section, the new towns refer to Tsuen Wan, Sha Tin, Tuen Mun, Tai Po, Yuen Long, and Fanling-Sheung Shui. In comparison to the new towns in section 4.1.1, Yuen Long and Fanling-Sheung Shui are the two new areas arising from 1976 to 1981.

The variable *New Town* is spotted to be significant in columns (1) (0.2014, Table 4.2) and (2) (0.2865, Table 4.2), reflecting that the development of the new town from 1981 to 1991 significantly show some contribution (i.e., more than 28%) on economic growth in Hong Kong. After that, the contributions of new towns seem not to be different among the other areas in Hong Kong. The results of the interaction term, *New Town×Pop* are found to be significant in columns (1) ~ (3) in Table 4.2. The coefficients are all positive. The results are somewhat different from those in Table 4.1. It means that the government spending on the new town from 1981 to 1996 has a significant and positive impact on the local economy. The difference may be ascribed to two new towns (Yuen Long and Fanling-Sheung Shui) which provided a substantial contribution to the GDP in Hong Kong in the 1980s. The variables, *New Town×NonAgr*, *New Town×Size* are insignificant in Table 4.2. The results of *New Town× ΔJobs* is the only interaction term in Table 4.3, which are statistically significant from columns (1) ~ (7). The results are very similar to Table 4.1, indicating that fiscal expenditure on new towns would significantly impact economic growth.

Table 4.1 Impact of New Town development on Economic Growth (the base year 1976)

	(1) 1976-1981	(2) 1976-1986	(3) 1976-1991	(4) 1976-1996	(5) 1976-2001	(6) 1976-2006	(7) 1976-2011	(8) 1976-2016
Pop^{old}	0.0593	0.2954	0.6537*	0.7579**	1.1124***	1.0655***	0.7585**	0.3102
	(0.0773)	(0.1556)	(0.2425)	(0.2131)	(0.2045)	(0.1740)	(0.2221)	(0.2832)
NonAgr	-0.0032	0.1329	1.0253	1.6337*	2.4985***	2.8931***	0.8828	0.0510**
	(0.0052)	(0.2793)	(0.6103)	(0.5030)	(0.4999)	(0.4684)	(0.5658)	(0.0185)
Working	0.0312	0.2767	0.6413*	0.7707**	1.1644***	1.1106***	0.8216***	-0.1668
	(0.0735)	(0.1564)	(0.2421)	(0.2090)	(0.2013)	(0.1719)	(0.2158)	(0.2752)
ΔJobs	0.4315***	0.4292**	0.0068	0.0122	-0.3075	-0.2190	0.0131	0.4269
	(0.0832)	(0.1583)	(0.2476)	(0.2129)	(0.2023)	(0.1719)	(0.2196)	(0.3026)
Size	0.0085	0.0214	-0.0096	-0.0121	-0.0678*	-0.0792**	-0.0815*	0.0235
	(0.0219)	(0.0248)	(0.0335)	(0.0302)	(0.0274)	(0.0257)	(0.0326)	(0.0798)
New Town	0.3536***	0.3224***	0.4598	0.2698	0.0761	0.0964	0.1216	0.1767
	(0.0727)	(0.0894)	(0.1181)	(0.1137)	(0.1026)	(0.0911)	(0.1173)	(0.2613)
New Town×Pop	0.0074	-0.0465	-0.0636	0.1691*	0.1738**	0.1406*	0.0773*	0.0802*
	(0.0506)	(0.0598)	(0.0913)	(0.0759)	(0.0651)	(0.0606)	(0.0892)	(0.1788)
New Town× NonAgr	0.1258	0.4472	-1.3263	3.1199**	3.7801*	-1.4802	-1.7301	-0.0513
	(0.0399)	(0.6829)	(1.6278)	(1.0371)	(2.1632)	(1.6875)	(2.0931)	(0.1328)
New Town×Size	-0.0259	-0.0910	0.0219	0.0515	0.0002	0.1196	0.0885	-0.2555
	(0.0661)	(0.0825)	(0.0917)	(0.0951)	(0.1023)	(0.0799)	(0.0983)	(0.2611)
New Town×ΔJobs	0.3530***	0.3966***	0.1847*	0.1269**	0.1726***	0.1499**	0.1437**	0.1532**
	(0.0816)	(0.0871)	(0.0844)	(0.0704)	(0.0663)	(0.0605)	(0.0773)	(0.0345)
Location FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.6654	0.8088	0.8189	0.8987	0.9163	0.9283	0.8951	0.3780
N	147	148	128	121	118	129	129	131

Note: *p < 0.05, **p < 0.01, ***p < 0.001. Robust standard errors clustered at the TPU level are reported in the brackets.

Table 4.2 Impact of New Town development on Economic Growth (the base year 1981)

	(1) 1981-1986	(2) 1981-1991	(3) 1981-1996	(4) 1981-2001	(5) 1981-2006	(6) 1981-2011	(7) 1981-2016
Pop^{old}	0.2116***	0.0578	0.6956**	1.1197***	0.0604	0.4163**	1.0007***
	(0.0352)	(0.2037)	(0.2098)	(0.1726)	(0.1739)	(0.1347)	(0.1887)
NonAgr	0.0863	0.5909	0.5705	1.6013***	0.3280	0.9733**	1.5723**
	(0.1748)	(0.4052)	(0.3755)	(0.3318)	(0.3592)	(0.2835)	(0.5051)
Working	0.2078***	0.0496	0.6127**	1.1366***	0.0366	0.4965***	1.0315***
	(0.0365)	(0.2093)	(0.2126)	(0.1725)	(0.1778)	(0.1385)	(0.1869)
ΔJobs	0.5586***	0.6341**	1.2335***	-0.2951	0.7564***	0.3739**	-0.2149
	(0.0459)	(0.2059)	(0.2152)	(0.1688)	(0.1763)	(0.1346)	(0.1840)
Size	0.0098	0.0065	-0.0537	-0.0534**	-0.0587*	-0.0650**	-0.0574**
	(0.0144)	(0.0274)	(0.0288)	(0.0174)	(0.0231)	(0.0186)	(0.0203)
New Town	0.2014***	0.2865**	0.2703	0.0084	0.0824	0.0109	0.0176
	(0.2691)	(0.5053)	(0.4320)	(0.5083)	(0.7248)	(0.7249)	(0.8768)
New Town×Pop	0.1399***	0.1652**	0.2164***	-0.0617	-0.1774	-0.1154	-0.0241
	(0.0238)	(0.0578)	(0.0384)	(0.0839)	(0.0943)	(0.0963)	(0.0389)
New Town× NonAgr	-0.2811	-0.6967	-0.4671	-0.1669	-1.9978	-2.7669	-2.2680
	(0.3738)	(1.1463)	(0.6771)	(0.9428)	(1.2070)	(1.0168)	(1.4674)
New Town×Size	-0.0068	0.0430	-0.0445	0.0494	0.0448	0.0490	0.0256
	(0.0323)	(0.0662)	(0.0444)	(0.0381)	(0.0504)	(0.0386)	(0.0423)
New Town×ΔJobs	0.1248*	0.1124*	0.4618***	0.1995***	0.1920**	0.2386***	0.3167***
	(0.0491)	(0.0550)	(0.0548)	(0.0424)	(0.0578)	(0.0446)	(0.0451)
Location FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.8734	0.8626	0.8976	0.9416	0.8879	0.9332	0.9212
N	189	158	152	147	152	154	157

Note: *p < 0.05, **p < 0.01, ***p < 0.001. Robust standard errors clustered at the TPU level are reported in the brackets.

4.1.3 Impact of New Town development on Economic Growth (the base year 1986)

The new towns in this section incorporate seven areas, Tsuen Wan, Sha Tin, Tuen Mun, Tai Po, Yuen Long, Fanling-Sheung Shui, and Tseung Kwan O. Tseung Kwan O is the newly developed areas from 1981 to 1986. On seeing the results of variable *New Town*, columns (1) and (2) are found to be statistically significant with a positive coefficient (0.1711, column (1), 0.1498 in column (2)) in Table 4.3. It suggests that the large scale development of new towns since the 1970s still significantly contribute to economic growth. The variable *New Town×Pop* is shown to be statistically significant in columns (2) ~ (4) in Table 4.3, indicating that Tseung Kwan O significantly provides new momentum for economic growth in the late 1990s and mid-2000s. *New Town×NonAgr* is shown to be significant in column (1) in Table 4.3 (1.3901). It demonstrates that the development of Tseung Kwan O would simply lead to an influx of residents from other areas in Hong Kong. These new residents/immigrants specialized in non-agricultural activities, which largely changes the industrial structure in the new town. The variable *New Town×Size* is insignificant. Similar to the above analysis, the variable *New Town×ΔJobs* are detected to be statistically significantly associated with positive magnitude. A majority of the magnitude of *New Town×ΔJobs* in Table 4.3 is greater than that in Table 4.2, indicating that the economy in Hong Kong largely benefits from injecting the fiscal expenditure on the new area – Tseung Kwan O.

Table 4.3. Impact of New Town development on Economic Growth (the base year 1986)

	(1) 1986-1991	(2) 1986-1996	(3) 1986-2001	(4) 1986-2006	(5) 1986-2011	(6) 1986-2016
Pop^{old}	0.0757	0.2681***	0.1933*	0.0922	0.3400***	0.2211*
	(0.0607)	(0.0648)	(0.0791)	(0.0708)	(0.0300)	(0.0910)
NonAgr	0.5351*	0.7465**	0.9556**	1.6777***	1.1521***	0.4343
	(0.2499)	(0.2285)	(0.3361)	(0.3163)	(0.2926)	(0.4612)
Working	0.1031	0.2396***	0.1853*	0.0839	0.3608***	0.2360*
	(0.0601)	(0.0628)	(0.0792)	(0.0676)	(0.0254)	(0.0916)
ΔJobs	0.5163***	0.3303***	0.4928***	0.5888***	0.3660***	0.4456***
	(0.0713)	(0.0648)	(0.0818)	(0.0725)	(0.0257)	(0.0928)
Size	-0.0188	0.0044	-0.0339*	-0.0378*	-0.0414*	-0.0555**
	(0.0127)	(0.0165)	(0.0169)	(0.0176)	(0.0161)	(0.0194)
New Town	0.1711***	0.1498*	0.0592	0.1545	0.0595	0.0624
	(0.0470)	(0.0578)	(0.0631)	(0.0691)	(0.0610)	(0.0735)
New Town×Pop	0.0355	0.1136***	0.0724*	0.0708*	-0.0152	-0.0013
	(0.0211)	(0.0314)	(0.0327)	(0.0311)	(0.0325)	(0.0369)
New Town× NonAgr	1.3901***	0.1067	0.0787	-1.1018	-1.0494	0.3424
	(0.4846)	(0.5485)	(0.9752)	(0.8325)	(0.9818)	(1.3798)
New Town×Size	0.0032	-0.0313	0.0207	0.0276	0.0544	0.0654
	(0.0263)	(0.0394)	(0.0348)	(0.0332)	(0.0316)	(0.0379)
New Town×ΔJobs	0.3931***	0.1799***	0.2360***	0.3256***	0.2951***	0.3086***
	(0.0464)	(0.0494)	(0.0492)	(0.0493)	(0.0433)	(0.0494)

Location FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.6851	0.7950	0.8820	0.8723	0.8962	0.9101
N	166	157	145	150	156	158

Note: *p < 0.05, **p < 0.01, ***p < 0.001. Robust standard errors clustered at the TPU level are reported in the brackets.

4.1.4 Impact of New Town development on Economic Growth (the base year 1996)

In this section, we focus on how the development of all the existing new towns on the local economy with the starting/base year 1996. The results are reported in Table 4.4. The new areas in this section include Tin Shui Wai and Tung Chung/North Lantau. *New Town*, the dummy variable is shown to be significant in columns (1) and (2), which are in line with the analysis in the previous sections. It displays that the newly developing areas in Hong Kong (i.e., Tin Shui Wai and Tung Chung) significantly impact the economic growth in the first 10 years. The effects of government spending in new towns can be seen in 10 years, the variable *New Town×Pop* is found to be significant in column (2) (0.0524 in Table 4.4). By cumulating the experience of the new town development in the 1970s and 1980s, its positioning has shifted its focus on the tertiary industry rather than agriculture, the variable *New Town× NonAgr* is found to be insignificant in all columns of Table 4.4. The variable *New Town×ΔJobs* are found to be significant in all four columns in Table 4.4, indicating that the fiscal expenditure on new town fuels the power for economic growth in Hong Kong.

Table 4.4. Impact of New Town development on Economic Growth (the base year 1996)

	(1) 1996-2001	(2) 1996-2006	(3) 1996-2011	(4) 1996-2016
Pop^{old}	1.0371***	0.1930	0.4958***	0.8493***
	(0.0958)	(0.1184)	(0.0210)	(0.0883)
NonAgr	1.9614***	1.9949***	1.9763***	2.1931***
	(0.2204)	(0.3705)	(0.2489)	(0.3345)
Working	1.0381***	0.1565	0.5050***	0.8597***
	(0.0974)	(0.1156)	(0.0197)	(0.0883)
ΔJobs	-0.0303	0.6605	0.4699***	0.0843
	(0.0957)	(0.1260)	(0.0216)	(0.0889)
Size	0.0049	0.0105	-0.0113	-0.0262*
	(0.0076)	(0.0156)	(0.0103)	(0.0109)
New Town	0.0305*	0.1259*	0.0189	0.0052
	(0.0303)	(0.0617)	(0.0399)	(0.0429)
New Town×Pop	0.0214	0.0524*	0.0286	0.0419
	(0.0144)	(0.0229)	(0.0193)	(0.0207)
New Town× NonAgr	0.1004	-0.5446	-0.2622	-0.2719
	(0.3732)	(0.5384)	(0.5667)	(0.6754)
New Town×Size	0.0148	0.0159	0.0411	0.0166
	(0.0137)	(0.0234)	(0.0195)	(0.0201)
New Town×ΔJobs	0.4343***	0.6582***	0.3177***	0.3522***
	(0.0600)	(0.0529)	(0.0473)	(0.0471)
Location FE	Yes	Yes	Yes	Yes

R^2	0.9010	0.9138	0.9350	0.9305
N	159	165	166	169

Note: *p < 0.05, **p < 0.01, ***p < 0.001. Robust standard errors clustered at the TPU level are reported in the brackets.

4.1.5 Impact of New Town development on Economic Growth with the different base years

The analysis above (section 4.1.1~4.1.4) shows the dynamic relationship between the new town development and economic growth in Hong Kong. The analysis also discloses how the newly developed areas in new towns contribute to the GDP in Hong Kong. Yet the new towns appeared in Hong Kong in different time periods. In this regard, it is necessary to incorporate all the time frames (i.e., consider different starting/base years) of the new town development to capture how it contributes to the economy. For this purpose, a two-way fixed effects model is employed in this section. The model simply extends the error term ε_{it} in section 3 as $v_t + \epsilon_{it}$, where v_t is the starting/base year fixed effects, and ϵ_{it} is the error term in the two-way fixed effects. The results shown in Table 4.5 consists of five columns. Each column documents the analytical results by incorporating all the new town development with different time frames. In other words, the new towns with different starting/base years (i.e., the 1970s, 1980s, and 1990s) are all considered in one model. Specificifically, Table 4.5 is comprised of five columns. Each column shows the performance of all new towns in the different time spans. For example, column (1) presents the results of how new town development influenced the economy in the 5-year time window since it started to operate. Following a similar logic, results of columns (2), (3), (4), and (5) report the impacts of new town development on the local economy in 10 years, 15 years, 20 years, 20+ years respectively.

The presentation in this section followed the same strategy of sections 4.1.2 ~ 4.1.4, on which only the New Town-related variables were concentrated. Generally speaking, the variable *New Town* shows a significant coefficient with a positive sign in columns (1) and (2). It indicates that the development of the new town, compared to the other urban areas, significantly contributed 19% and 22% to the economic development in 5 years and 10 years time window respectively in Hong Kong. As for the government spending, the coefficients of the variable *New Town×Pop* are all significant with positive magnitude. The explanation is that the analysis combines all-new towns in a different time period without overlooking some new areas that appeared in the later years. It may also imply that the government spending in the new town at all stages significantly enhance the economic performance in New Town

development. The variable *New Town×NonAgr* is found to be significant in column (1) in Table 4.5 (0.1344). Similar to the above analysis, the significance in the 5 years since it started to operate means that new town development may attract more newcomers/immigrants who specialized in non-agriculture activities from other urban areas. The development of a new town may also need to change the land use pattern for transferring parts of farmland for urban areas, giving rise to limited room for agriculture development. *New Town×Size* is not found to be significant, indicating that the size of the new town areas does not affect the economic enhancement. The coefficients of *New Town×ΔJobs* in Table 4.5 are very similar to the results of section 4.2. They are all significant. The fiscal expenditure on the new town, regardless of when it started to operate, accelerates the fast development of the economy in Hong Kong.

Table 4.5. Impact of New Town development on Economic Growth with the different base year

	(1) 5-year	(2) 10-year	(3) 15-year	(4) 20-year	(5) 20 plus
Pop^{old}	0.1293***	0.1907**	0.2792***	0.3615***	0.1611
	(0.0279)	(0.0556)	(0.0292)	(0.0595)	(0.1223)
NonAgr	0.0071	0.7915***	0.4941*	2.0645***	0.0602***
	(0.0045)	(0.1620)	(0.2067)	(0.1958)	(0.0118)
Working	0.0892**	0.1592**	0.2962***	0.3566***	-0.1340
	(0.0276)	(0.0554)	(0.0282)	(0.0585)	(0.1203)
ΔJobs	0.4914***	0.5133***	0.3851***	0.4461***	0.7601***
	(0.0333)	(0.0556)	(0.0292)	(0.0589)	(0.1235)
Size	0.0083	0.0043	-0.0152	-0.0422***	-0.0444
	(0.0328)	(0.0113)	(0.0127)	(0.0101)	(0.0278)
New Town	0.1913***	0.2212***	0.1666	0.1259	0.4194
	(0.0294)	(0.0392)	(0.1478)	(0.1398)	(0.1994)
New Town×Pop	0.0543***	0.1089***	0.1086***	0.0591**	0.0790*
	(0.0145)	(0.0219)	(0.0223)	(0.0208)	(0.0591)
New Town× NonAgr	0.1344***	0.6694	0.1686	0.6762	0.1165
	(0.0283)	(0.3876)	(0.4518)	(0.4695)	(0.0795)
New Town×Size	0.0032	0.0298	0.0151	0.0410	0.0381
	(0.0182)	(0.0261)	(0.0254)	(0.0224)	(0.0688)
New Town×ΔJobs	0.3172***	0.1548***	0.3476***	0.1823***	0.1575*
	(0.0318)	(0.0307)	(0.0323)	(0.0291)	(0.0792)
Base Year FE	Yes	Yes	Yes	Yes	Yes
Location FE	Yes	Yes	Yes	Yes	Yes
R^2	0.7766	0.8173	0.8456	0.9055	0.5588
N	661	628	591	587	446

Note: *p < 0.05, **p < 0.01, ***p < 0.001. Robust standard errors clustered at the TPU level are reported in the brackets.

Except for the analysis covering the whole city of Hong Kong in Table 4.5, the analysis only focuses on the New Territories is considered. The analysis shed light on the difference between the development of New Town and outside the new town areas in New Territories.

The analytical method is identical to that of Table 4.5, the difference is the regional focus on New Territories. The results are presented in Table 4.6. The variable of *New Town* is significantly associated with positive coefficient in columns (1) and (2). Comparing the magnitude in Table 4.5, the ones in Table 4.6 are much larger. It may simply outline that the contribution of new towns to the economic development in the first 10 years substantially outperforms the other areas in the new territories. After 10 years, the difference between the new towns and other areas narrow down. It may be due to the infrastructure such as transportation development, housing development, and public facilities being available for all residents living in New Territories such that the economic activities can be made and supported through accessing these facilities and infrastructure. The interaction term *New Town×Pop* is observed to be significant in columns (2) ~ (3). It may indicate that the effects of government spending on the new town areas (compared to other areas in New Territories) could appear in the next 10 ~ 15 years. The variable *New Town×NonAgr* like the analysis in Table 4.5 shows the significant result in the 5 years. Interestingly, the interaction term *New Town×Size* is insignificant in Table 4.6. It addresses that the size of New Town areas is not highly relevant to its contribution to the economy. The fiscal expenditure in Table 4.6 shows the similar patterns of Table 4.5 with all the results being significant. It shows that the fiscal expenditure on the new town development, compared to the other areas in New Territories, substantially improves the economic development in Hong Kong.

Table 4.6. Impact of New Town development on Economic Growth (New Territories only) with the different base year

	(1) 5-year	(2) 10-year	(3) 15-year	(4) 20-year	(5) 20 plus
Pop^{old}	-0.1663***	-0.2599**	-0.2937***	-0.3447***	0.2624
	(0.0392)	(0.0801)	(0.0389)	(0.0818)	(0.2153)
NonAgr	-0.0071	-0.8810**	-0.4108	-1.6471***	0.0606***
	(0.0055)	(0.2778)	(0.3195)	(0.3058)	(0.0138)
Working	0.0974*	0.1985*	0.2931***	0.2853***	-0.3077
	(0.0385)	(0.0809)	(0.0379)	(0.0805)	(0.2087)
ΔJobs	0.4759***	0.4727***	0.3868***	0.4925***	0.8987***
	(0.0471)	(0.0806)	(0.0381)	(0.0804)	(0.2142)
Size	-0.0003	0.0055	-0.0089	-0.0209	-0.0815
	(0.0135)	(0.0196)	(0.0217)	(0.0163)	(0.0465)
New Town	0.2312***	0.2648***	0.1892	0.2092	0.5107
	(0.0399)	(0.0539)	(0.0664)	(0.0521)	(0.1306)
New Town×Pop	0.0211	0.1318**	0.1526***	0.0041	0.0304
	(0.0228)	(0.0397)	(0.0384)	(0.0383)	(0.1031)
New Town× NonAgr	0.1317***	0.4054	0.2399	0.2803	0.1094
	(0.0331)	(0.5408)	(0.5094)	(0.5627)	(0.0927)
New Town×Size	0.0258	0.0430	0.0180	0.0235	0.0246
	(0.0241)	(0.0376)	(0.0309)	(0.0287)	(0.0925)
New Town×ΔJobs	0.3915***	0.1701***	0.2593***	0.3462***	0.2859**

	(0.0427)	(0.0452)	(0.0389)	(0.0432)	(0.1102)
Base Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.8109	0.8256	0.8931	0.9018	0.6056
N	318	295	272	264	196

Note: *p < 0.05, **p < 0.01, ***p < 0.001. Robust standard errors clustered at the TPU level are reported in the brackets.

4.2 Inequality Analysis

In this section, the impact of the new town development on the distribution of the GDP/ economic growth in Hong Kong is considered. Gini Index and Theil indices are employed to tackle this issue. As for the Gini index, it is the most well-known toolbox for measuring inequality, where it centres on the degree to which the distribution of the GDP deviates from the ideal equal distribution. The Theil indices are used to measure economic inequality. A key feature of Theil indices is that they can be fully decomposable into two groups: within-group indices and between-group indices. Such a feature is not applicable to the Gini index. According to Jenkins & Van Kerm (2008) and Afonso et al. (2015), Theil's T is more sensitive to changes in the upper-GDP/economic growth while Theil's L is more sensitive to the changes in the lower-GDP/economic growth.

4.2.1 Gini Index

The study in this section mainly relies on the census statistical data, which has been used for analytical work in section 4.1. The advantage of employing this set of data allows us to decompose the Theil indices for different areas in Hong Kong. More specifically, the chances of living quarters in any two consecutive census statistics are used as indicators to measure the GDP or economic growth. Considering that there are only nine records of census statistics (1976 ~ 2016), the production process then only generated eight indicators. We first use the indicators to calculate the Gini index from 1981 to 2016. The results are displayed in Table 4.7. By comparing to the official records of the Gini index from the Labour and Welfare Bureau in Hong Kong, the results in the present study ranged from 0.47 ~0.48, which is not far away from the official number.

Table 4.7 Gini index of Hong Kong from 1981 to 2016

Year	Present study	Government[§]
1981	0.466	0.451

1986	0.475	0.453
1991	0.477	0.476
1996	0.479	0.518
2001	0.490	0.525
2006	0.482	0.533
2011	0.483	0.537
2016	0.484	0.539

Note: [§]The Gini coefficients are from the Hong Kong government (LEGCO, 2004; Labour and Welfare Bureau, 2021)

4.2.2 Theil Indices

As explained in the former section, the Gini index is not capable of decomposing the inequality index. As such, Theil Indices are considered in this section. Based on Cheong (2012), Theil's T and Theil's L are calculated. The results are reported in Table 4.8. In addition, the Theil's T within-group and Theil's T between groups as well as Theil's L within-group and Theil's L between groups are also produced by following Cheong (2012). The results of within-group and between the groups for both Theil's T and Theil's L are very trivial. On looking at the trivial number, it does not interpret any information for the inequality. As suggested by the recent research from the University of Texas Austin (TUTA, 2019), comparing the Theil statistics over a series of years can depict a clear idea of how inequality is changing.

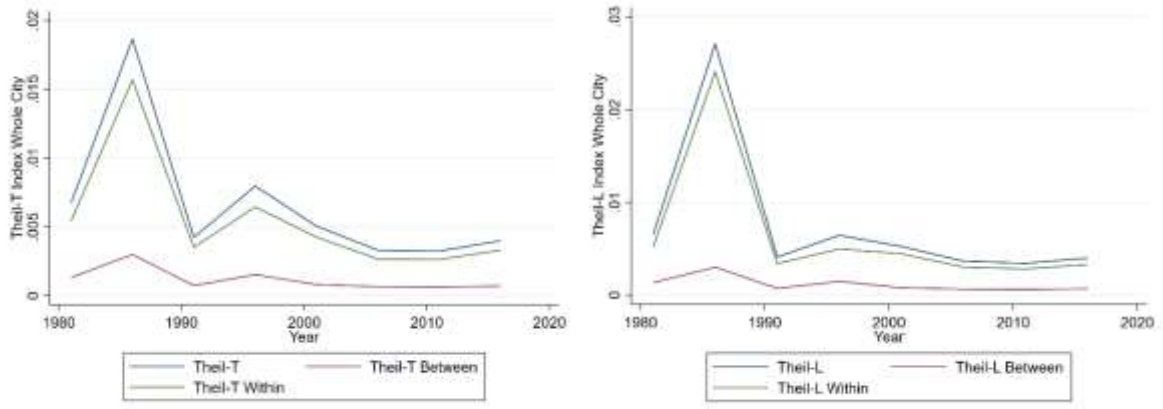
Table 4.8 Inequality index of Hong Kong from 1981 to 2016

Year	**Whole City**		**Hong Kong Island**		**Kowloon**		**New Territories**		**New Town**	
	Theil-T	Theil-L	Theil-T	Theil-L	Theil-T	Theil-L	Theil-T	Theil-L	Theil-T	Theil-L
1981	0.0067	0.0065	0.0060	-0.0028	-0.0027	0.0088	0.0059	-0.0040	-0.0025	0.0046
1986	0.0186	0.0271	0.0121	-0.0081	-0.0002	0.0054	0.0102	-0.0065	-0.0034	0.0362
1991	0.0044	0.0041	0.0070	-0.0051	-0.0010	0.0037	0.0059	-0.0041	-0.0078	0.0095
1996	0.0079	0.0064	0.0172	-0.0076	-0.0022	0.0037	0.0036	-0.0019	-0.0106	0.0122
2001	0.0050	0.0052	0.0058	-0.0033	0.0026	0.0024	0.0043	-0.0028	-0.0077	0.0089
2006	0.0033	0.0036	0.0027	-0.0009	0.0096	-0.0007	0.0016	-0.0001	-0.0108	0.0121
2011	0.0032	0.0034	0.0008	0.0014	0.0097	-0.0074	0.0004	0.0006	-0.0077	0.0089

2016	0.0039	0.0039	0.0001	0.0024	0.0112	-0.0079	0.0007	-0.0001	-0.0081	0.0097

4.2.3 Theil Indices of the whole city of Hong Kong

The Theil's indices of the whole city of Hong Kong are shown in Figures 4.1 (a) and (b) respectively, where the former one presents Theil's T statistics and the latter one displays Theil's L statistics. Two figures show a similar pattern. It first rockets from 1981 to 1986, then sharply declines in the period between 1986 and 1991. Since then the Theil indices remain steady.

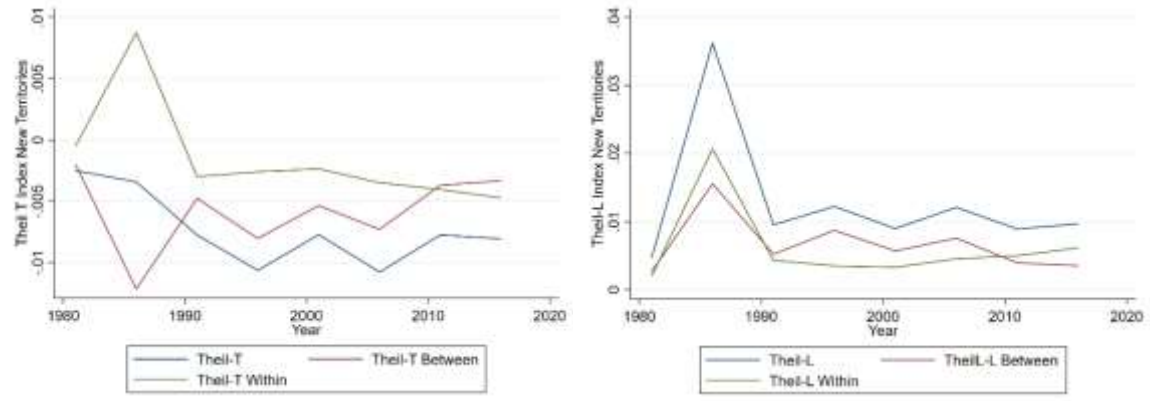


(a) Theil's T (b) Theil's L

Figure 4.1: Theil's indices of the whole city of Hong Kong from 1981 to 2016

4.2.4 Theil indices of New Territories

The Theil indices, including Theil's T and Theil's L in New Territories (excluding New Towns), are shown in Figures 4.2 (a) and (b) respectively. In Figure 4.2 (a), the starting value of overall Theil's T is -0.0025, it then declines in the upcoming year between 1981 and 1996. In the late 1990s, it displays slight ups and downs. But the trend of the overall Theil's T is downwards and far away from zero, meaning that the inequality of upper-GDP areas in new territories may rise. On seeing the patterns of Theil-T between and Theil-T within in Figure 4.2 (a), a large proportion of overall Theil's T is from the Theil-T between district councils. In Figure 4.2 (b), the trends of Theil's L are consistent. The majority of Theil's L comes from the Theil's L between district councils. The trend of Theil's L indicates that the inequality of lower GDP areas in non-New Town does not have many changes from 1986 to 2016.

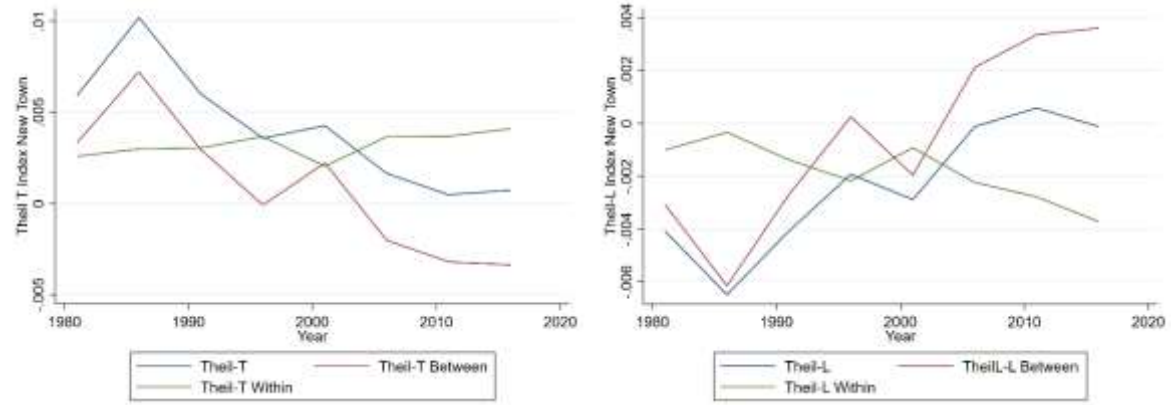


(a) Theil's T (b) Theil's L

Figure 4.2 Theil's indices of New Territories (exclude New Towns) from 1981 to 2016

4.2.5 Theil indices of New Towns

The Theil's T and Theil's L are exhibited in Figures 4.3 (a) and (b). It is obvious to see that both the trend of the Theil's T (blue curve) and Theil's L (blue curve) converge to zero, showing that the development of new towns in the past four decades enables the inequality in the new town areas to decline generally. Theil's T Between (red curve) and Theil's T Within (green curve) go in two opposite directions while gradually deviating from zero. The Theil's L Between (red curve) and Theil's L Within (green curve) have a similar pattern. It indicates that the holistic equality of new town development is achieved through the mitigation of imbalance within each new town TPUs and the imbalance between them.



(a) Theil's T (b) Theil's L

Figure 4.3 Theil's indices of New Town from 1981 to 2016

4.2.5 Impact of MTR development on New Towns

The different patterns of Theil's indices of New Towns and New Territories may be caused by the exogenous shocks such as building large scale infrastructure. It is worth noting that three MTR routes provide service for the new territories and new towns from 2002 and 2004. In this section, a follow-up study is to examine the impact of MTR development on new towns.

The results are documented in Tables 4.9 ~4.10. We first consider how the MTR development impacts the demographic changes of social status at the TPU level, then we further examined whether the demographic changes come from internal migration.

Table 4.9. Results of demographical changes in New Towns (TPU level)

Variables	(1) Rent	(2) Education	(3) Managerial	(4) Professional	(5) Low-income
Treatment	0.0925	0.0027	0.0035	0.0011*	-0.0285†
	(0.1624)	(0.0133)	(0.0053)	(0.0033)	(0.0304)
Time2006	0.0191	0.0315**	0.0039*	0.0034**	0.0157*
	(0.1433)	(0.0117)	(0.0047)	(0.0029)	(0.0269)
DID	0.1255	0.0310†	0.0150	0.0063†	-0.0514†
	(0.2091)	(0.0169)	(0.0068)	(0.0042)	(0.0390)
Control	Yes	Yes	Yes	Yes	Yes
R-Squared	0.4860	0.5076	0.4894	0.4803	0.4950
N	89	89	89	89	89

Note: 1. †p < 0.10 *p < 0.05, **p < 0.01, ***p < 0.001

2. The number in parentheses is the standard error of the estimated result.

3. DID is the interaction term of Treatment and Time2006, which is equivalent to Treatment ×Time2006

4. The control represents the control variables, including median age of the TPU (Age), Population, median household size (Hsize), and percentage of labor force (Labor)

Table 4.9 summarized the results of how MTR development affects the demographic changes in new towns. We spot that the coefficients of DID of columns (2), (4), and (5) are statistically significant at 10% with high magnitude. The significant coefficients of columns (2) and (4) are of positive sign and the results in column (5) stand the opposite with negative sign. The significant results demonstrate that the MTR development would increase the proportion of well-educated people and professionals. In the meantime, the development of the three MTR routes would decrease the percentage of low-income households in the new towns.

The significant results in Table 4.9 provide little evidence of whether the demographic changes are from the movement of citizens in other areas. In this regard, we conduct the

multinomial logistic regression analysis, and the results are shown in Table 4.10. It is straightforward to observe that the coefficients of DID of columns (1) and (3) in Panel A are significant with a positive scale, meaning that the new opening of three MTR lines was more likely to attract well-educated people and professionals to move in. The DID of column (4) in Panel B is found to be significant with a positive coefficient, implying that developing three MTR lines would give rise to more low-income households moving out.

Table 4.10. Statistical results of internal migration models in New Towns (household level)

Variables	(1) Education	(2) Managerial	(3) Professional	(4) Low-income
Move in (Panel A)				
Treatment	0.0210	0.1457	0.0605	0.1962***
	(0.0856)	(0.0955)	(0.1483)	(0.0556)
Time2006	0.3614***	0.4911***	0.4981**	0.0376*
	(0.1002)	(0.1149)	(0.0181)	(0.0785)
DID	0.5026***	0.5119	0.5605**	0.2215
	(0.0117)	(0.1312)	(0.0120)	(0.0845)
Controls	Yes	Yes	Yes	Yes
Move out (Panel B)				
Treatment	0.3462***	0.1507	-0.3118*	0.1491*
	(0.0969)	(0.1104)	(0.1358)	(0.0584)
Time2006	0.3879**	-0.2819*	-0.0475	0.2784***
	(0.1120)	(0.1307)	(0.1758)	(0.0752)
DID	0.1553	0.5065	0.3789	0.5110***
	(0.1262)	(0.1491)	(0.1977)	(0.0837)
Controls	Yes	Yes	Yes	Yes
Log likelihood	-12323.38	-7758.25	-4118.56	-26530.43
N	12,366	7,608	4,216	27,791

Note: 1. *p < 0.05, **p < 0.01, ***p < 0.001
2. The number in parentheses is the standard error of the estimated result.
3. DID is the interaction term of Treatment and Time2006, which is equivalent to Treatment ×Time2006

4.3 Transitional Dynamic Analysis

This section focuses on how new town development impacts the ratio of housing price to GDP. As suggested by AGRE (2022), GDP and housing price boasts with high correlation. Nonetheless, property cycles are not always in line with the business cycle. The reason may be that the property cycle is not entirely driven by economic growth, but also affected by other factors such as urbanization and demographic changes. Still, the housing price to GDP ratio can show how much housing price movement is following/deviating from economic fundamentals, thus reflecting the difference between capital gain and economic gain.

4.3.1 Ergodic Distribution for the Ratio of Housing Price to GDP

The plot of housing price to GDP is shown in Figure 4.4. The ratio is constructed by collecting the housing price index from the Rating and Valuation Department, and the GDP index is from the Census and Statistical Department. The time period for the ratio covers forty years, that is from 1980 to 2020. The patterns of the plot in Figure 4.4 coincides with the economic performance in Hong Kong. For example, the ratio reached its local maxima around 1997 (Asia Financial Crisis), then comes with a sharp decline until 2003 (SARS). Since 2003, the ratio gains momentum to rise. Even in 2009 (Bankruptcy of Lehman Brothers, Global Financial Tsunami), the ratio kept growing with a steady trend.

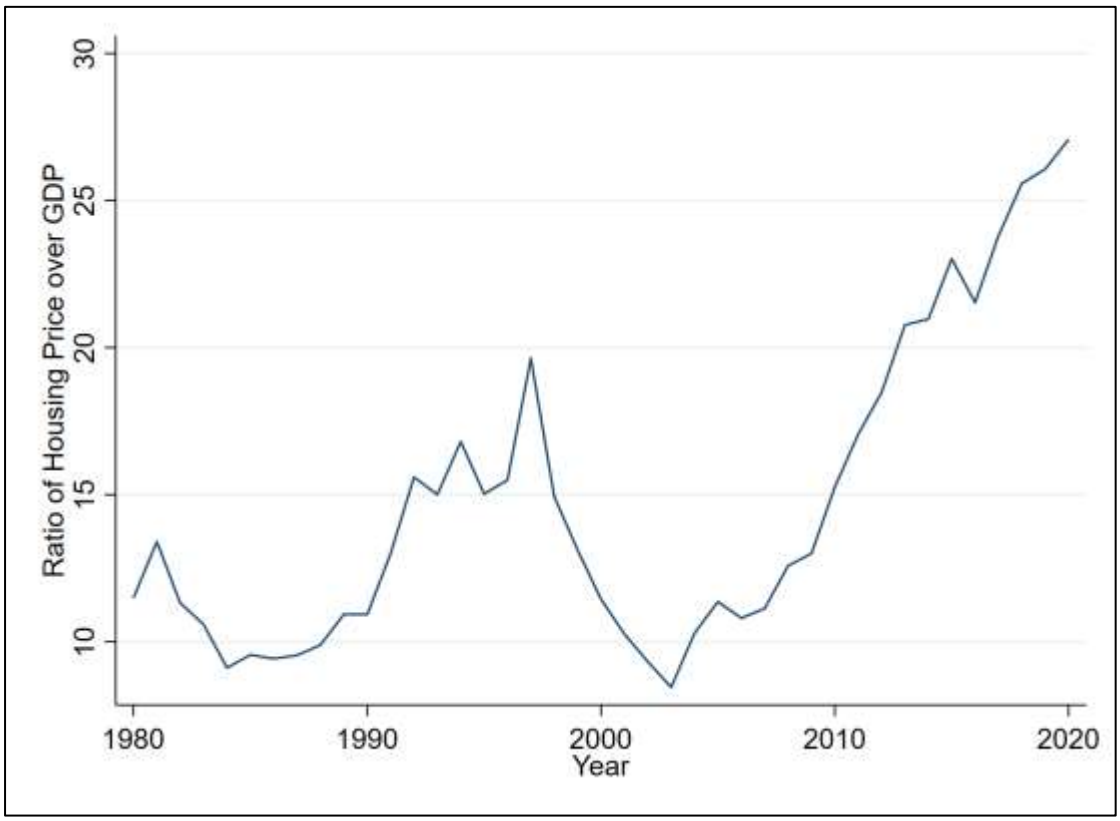


Figure 4.4 integrated Time series plot of the ratio of housing price over GDP in the city of Hong Kong from 1980 to 2020

The overall housing price to GDP ratio may not directly enable us to identify the pattern of wealth redistribution caused by new town development. For such a purpose, we construct the regional housing price to GDP ratio by using the census statistics. The newly constructed ratio covers four regions: Hong Kong Island, Kowloon, New Territories (excluding New Towns), and New Towns. GDP in the newly constructed ratio is proxied by the increment of living quarters. The regional ratios of housing price to GDP are displayed in Figure 4.5. On

seeing the tendencies among these four regions, the ratio of Hong Kong Island is observed to rise after 1996. The ratios of Kowloon and New Territories follow a synchronal trend. The one of New Towns seems to be the most stable one among the four regions.

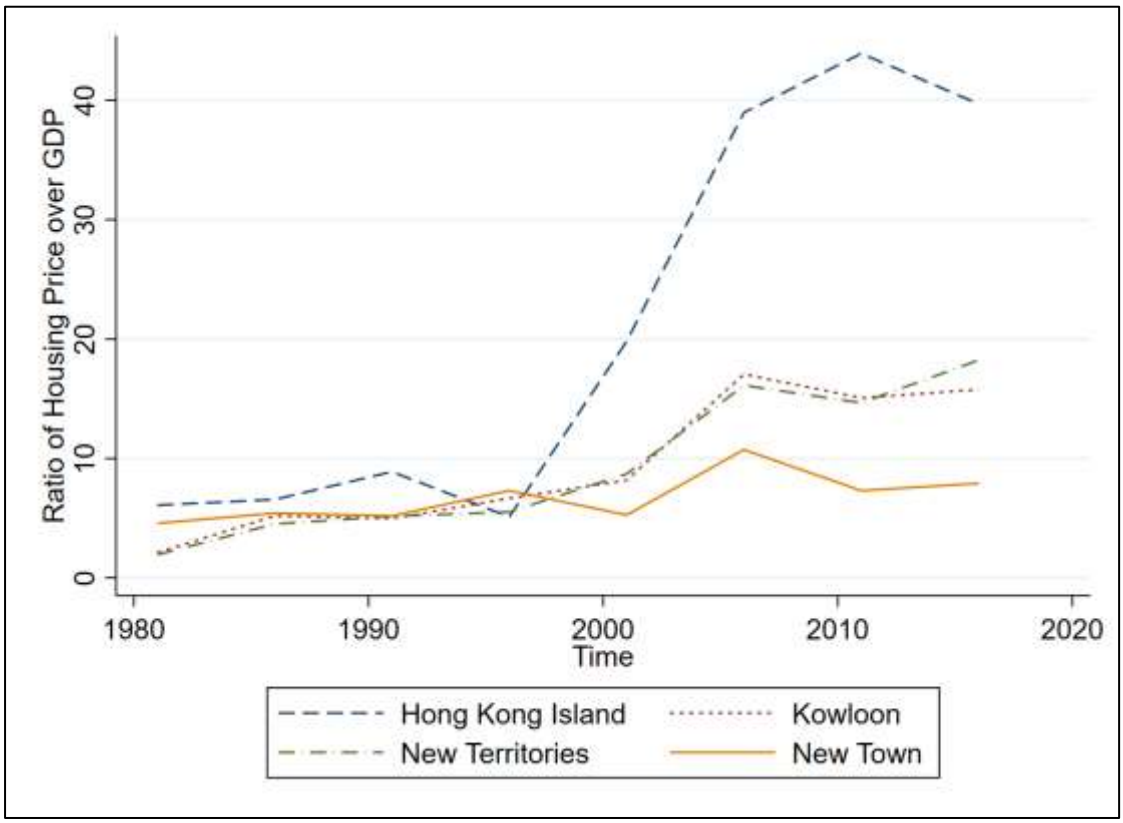


Figure 4.5 Time series plot of the ratio of housing price over GDP from 1981 to 2016 (covering four specific areas)

Based on the trends of ratio, the ergodic distribution of these four regions is shown in Figure 4.6. The purpose of exhibiting the ergodic distribution is to capture whether all these four markets follow one distribution. In other words, using ergodic distribution enables us to compare the movement of standardized housing prices following similar patterns. On seeing the graphical patterns of all these five sub-figures in Figure 4.6, housing prices among all these five areas may follow a different pattern. We performed the right-tail augmented Dickey-Fuller (RADF) test to analyze whether the housing price in these four areas had an explosive growth trend. The employment of RADF is specialized for capturing the explosive patterns, the results of New Towns are of special interest in this study. The test results are detailed in the following section.

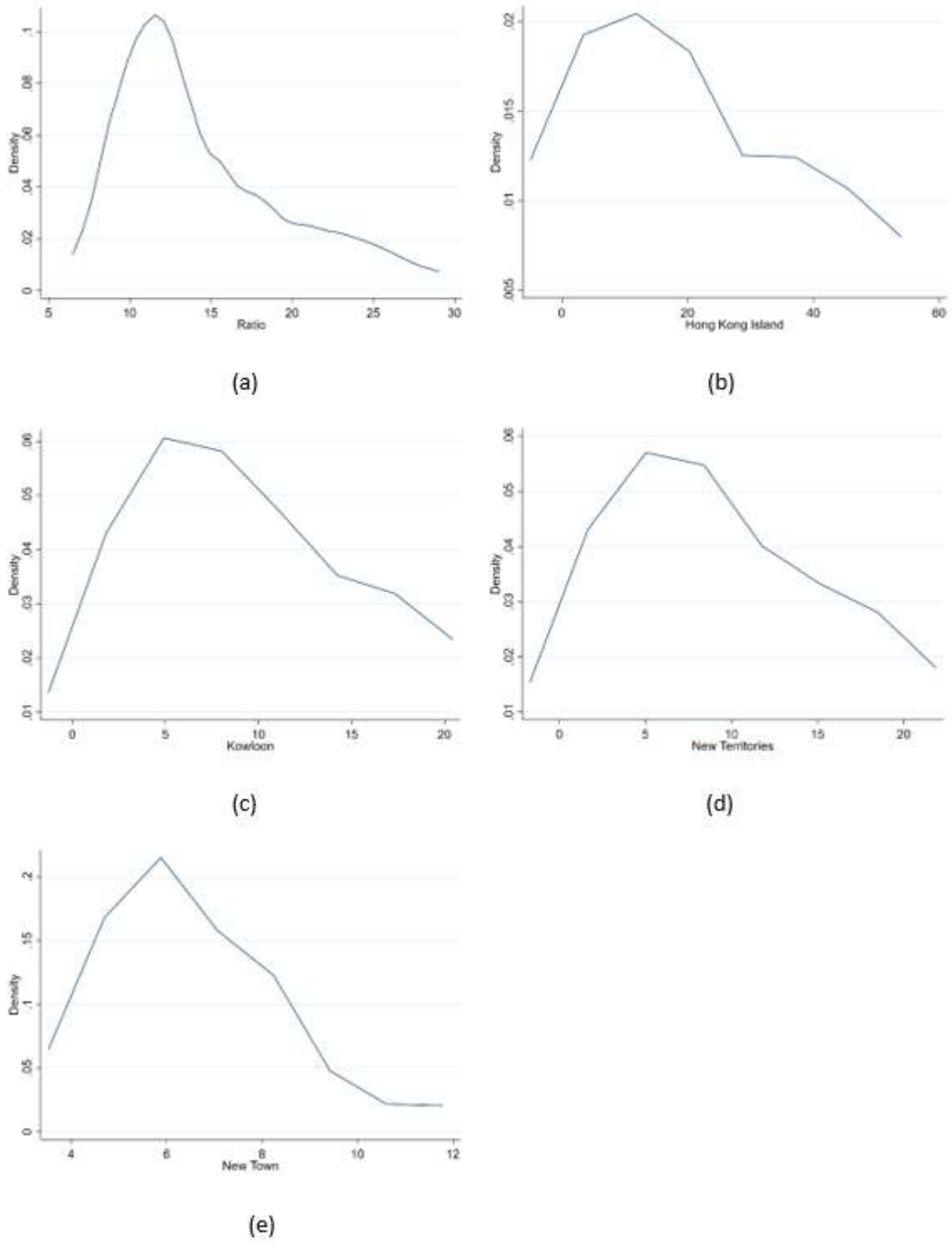


Figure 4.6 Ergodic Distribution of Ratio of housing price over GDP in Hong Kong

(a) The whole city of Hong Kong from 1980 to 2020 (b) Hong Kong Island from 1981 to 2016 (c) Kowloon from 1981 to 2016 (d) New Territories from 1981 to 2016 (e) New Towns from 1981 to 2016

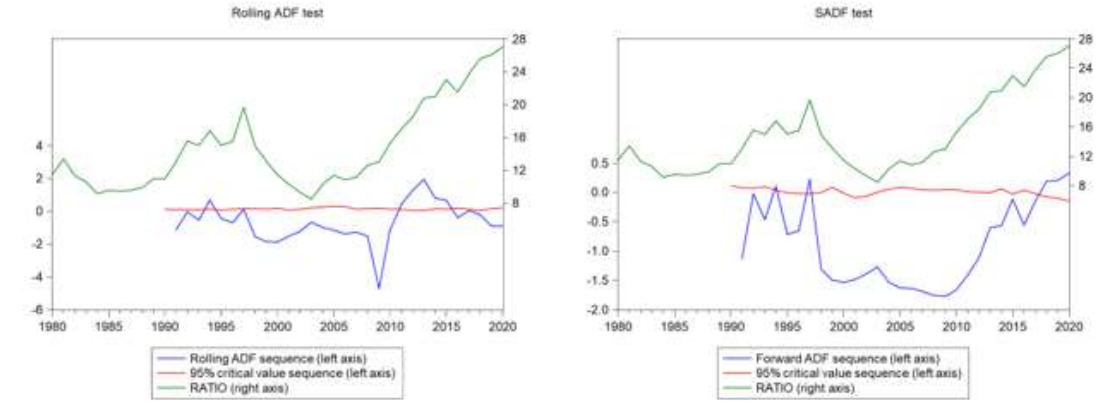
4.3.2 Right-tail Augmented Dickey-Fuller Test

The test statistics of the right-tail augmented Dickey-Fuller test is shown in Tables 4.10 and 4.11. The results in Table 4.10 covers the whole city of Hong Kong, while Table 4.11 details the explosive behaviour for four regions. Each table contains three test results. They are the rolling window Augmented Dickey-Fuller (ADF) test, supremum ADF (SADF), and generalized supremum ADF (GSADF).

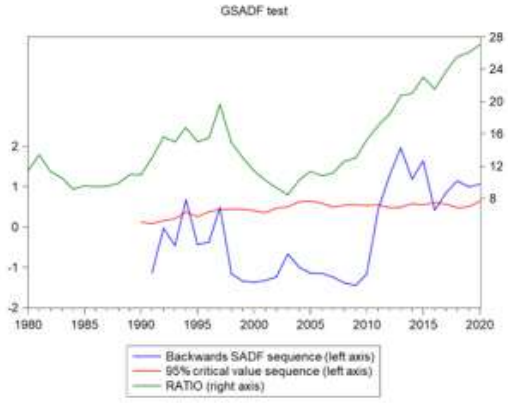
Table 4.10. Test results of Right-tail augmented Dickey-Fuller for Hong Kong

	t-statistic	p-value	Tab90	Tab95	Tab99
Hong Kong					
RADF	1.9611*	0.0350	-0.2721	0.1164	0.8590
SADF	0.3330	0.2490	0.9025	1.1879	1.8981
GSADF	1.9612*	0.0480	1.4988	1.8908	2.7469

Note: Note: *p < 0.05, **p < 0.01, ***p < 0.001Tab90, Tab95 and Tab99 are short for right-tail tabulated critical values for 90, 95, 99 confidence levels (Vasilopoulos, Pavlidis, Spavound and Martínez-García, 2020).



(a) RADF test of the Whole City of Hong Kong (b) SADF test of the Whole City of Hong Kong



(c) GSADF test of the Whole City of Hong Kong

Figure 4.7 Right Tail Augmented Dickey-Fuller Test of the ratio of housing price over GDP from 1980 to 2020 (The whole city of Hong Kong)

In Table 4.10, RADF and GSADF are statistically significant at 5%, which means explosive behaviour exists in Hong Kong. Figure 4.7 provides more specifically at what time the explosive behaviour can be spotted. Both figures of RADF and GSADF show us the explosive behaviour that appears from 2011 to 2014.

Table 4.11. Test results of Right-tail augmented Dickey-Fuller for four areas

	Test statistics	p-value	Tab90	Tab95	Tab99
New Town					
ADFQ	-1.2255	0.9260	0.1508	0.6699	2.2509
SADF	-1.2255	0.7780	0.9993	1.7351	5.4874
GSADF	-1.2255	0.9340	1.4981	2.2105	7.5089
Hong Kong Island					
ADFQ	1.1787	0.1260	0.1508	0.6699	2.2509
SADF	1.1787†	0.0870	0.9993	1.7351	5.4874
GSADF	1.1787	0.1410	1.4981	2.2105	7.5089

Kowloon					
ADFQ	0.9772	0.1560	0.1508	0.6699	2.2508
SADF	0.9772	0.1030	0.9993	1.7352	5.4874
GSADF	0.9772	0.1740	1.4982	2.2105	7.5089
New Territories					
ADFQ	1.5926†	0.0800	0.1508	0.6699	2.2508
SADF	1.5926†	0.0560	0.9993	1.7352	5.4874
GSADF	1.5926†	0.0890	1.4982	2.2105	7.5089

Note: Note: 1. †p < 0.10 *p < 0.05, **p < 0.01, ***p < 0.001 New Territories do not include New Towns. Tab90, Tab95 and Tab99 are short for right-tail tabulated critical values for 90, 95, 99 confidence levels (Vasilopoulos, Pavlidis, Spavound and Martínez-García, 2020).

In addition, to consider the whole city of Hong Kong, we also examined the explosive behaviour for four different regions, Hong Kong Island, Kowloon, New Territories (excluding New Towns), and New Towns. The RADF results are summarized in Table 4.11, where the details can also be seen in Figure 4.8. It is straightforward to see that no explosive housing behaviour is found in the New Town. It is interesting to see that the test statistics of New Territories (excluding New Towns) are significant at 10%. It may imply that some areas of New Territories (excluding New Town) may be used for developing the new towns in the near future.

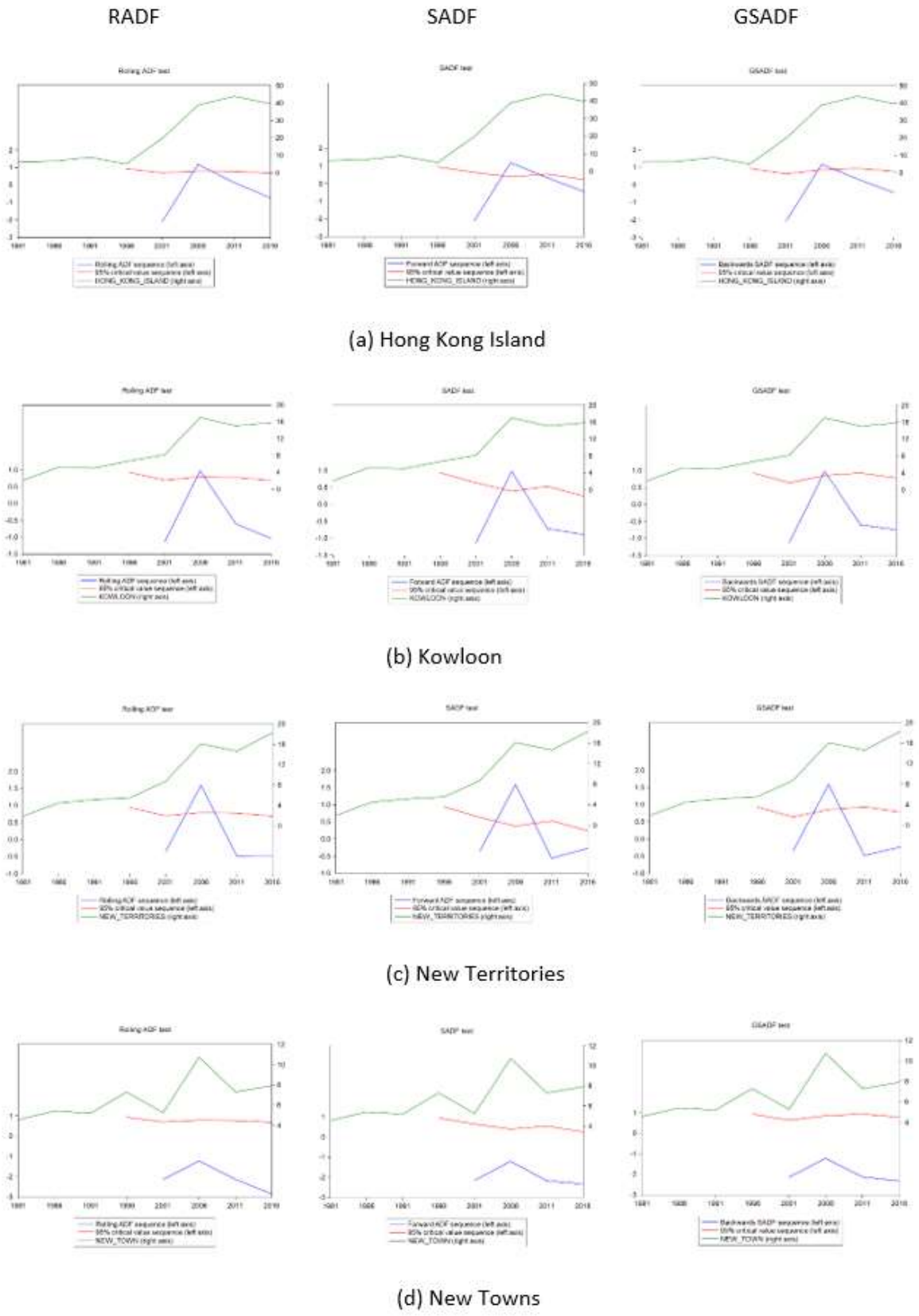


Figure 4.8 Right tail of Augmented Dickey-Fuller test of ratio of housing price over GDP from 1981 to 2016

4.4 Computable General Equilibrium (CGE)

In this section, we study the impacts of new town development on the local economy in Hong Kong, focusing on its four key industries: financial services; tourism; trade and logistics; professional services and other producer services. To this end, the result of the CGE model has explored the impacts of housing stock changes caused by new town development on (1) the change of Hong Kong's GDP; (2) the percentage change in output in each of the four key sectors; (3) the impact on employment for the skilled and unskilled labour: (4) the change in wage and thus the impact on consumption; and (5) the change in demand for other goods and services.

We studied the potential impact of the Northern Metropolis plan on housing stock change, which would influence Hong Kong's economic sectors in the long run. According to the Long Term Housing Strategy (2014), Hong Kong planned an average supply of 43,000 residential housing units in the year 2014, which is the base year for CGE modelling. According to the Northern Metropolis Development Strategy (2021), Northern Metropolis plans to increase residential housing supply of around 911,600 units (i.e. an average of 45,580 units in the next 20 years), or a 6% annual increase in residential housing units compared to the target of the Long Term Housing Strategy. The 6% increase in housing supply is incorporated in the CGE modelling under the "Construction" sector, resulting in a 3.63% GDP growth, a 3.29% welfare gain and an 8.24% increase in employment compared with the base year of 2014.

Specifically, Table 4.12 presents the output change in each sector. Regarding the economic outputs in the key industries, professional services would be increased by 3.72%, followed by financial services (3.61%), tourism (3.34%), trade and logistics (2.96%).

Table 4.12. Output change in each sector (%)

Sector	% Change
Tourism	3.34
Trade and logistics	2.96
Financial services	3.61
Professional services	3.72
Manufacturing	5.48
Real estate	2.93
Capital investment	6.24
Others	3.93

Moreover, Table 4.13 presents the consumption change in each sector. Regarding private

consumption in the key industries, financial services would be increased by 4.46%, followed by tourism (4.19%), professional services (4.14%), trade and logistics (4.09%).

Table 4.13. Private consumption change in each sector (%)

Sector	% Change
Tourism	4.19
Trade and logistics	4.09
Financial services	4.46
Professional services	4.14
Manufacturing	3.83
Real estate	3.38
Others	3.85

Interestingly, the CGE result shows a 3.74% decline in wages caused by the increase in housing supply under Northern Metropolis development. To further explain the potential wage decrease, we present the market price change in each sector. As is shown in Table 4.14, except for the real estate sector, the market price in other sectors would decline by 0.36% to 0.88%. Such decline may indicate the potential population inflows from other Greater Bay Area cities into the Northern Metropolis in the long run.

Table 4.14. Market price change in each sector (%)

Sector	% Change
Tourism	-0.46
Trade and logistics	-0.36
Financial services	-0.77
Professional services	-0.88
Manufacturing	-0.63
Real estate	0.48
Capital investment	-0.40
Others	-0.43

Chapter 5. Policy Implications and Recommendations

Based on research findings in Chapter 4, policy implications and suggestions are proffered in this chapter. The major focus covers the following areas: (1) Gear up new town development; (2) Economic performance of new towns; (3) New town development and inequality; (4) Housing development and management in new towns.

5.1 Gear Up New Town Development

New towns refer to developing parts of rural areas as commuter/satellite towns in the New Territories in order to meet the requirement for a booming population in the late 1950s and 1960s. For the existing new towns, they are not new anymore.

According to our finding in Chapter 4, many new towns confront a serious problem in which the population as of today almost reaches the planned limit. Based on the ratio of current population to planned population, the new towns can be categorized into three groups: close to saturation, nearly saturation, severe and neutral.

As for the group of “close to saturation”, Tsuen Wan (with a population of 823,386), Sha Tin (with a population of 665,606), and Tin Shui Wai (with a population of 286,232), approaching 97%, 90%, and 93% of the planned population. For the group of “nearly to saturation”, both Tseung Kwan O and Fanling Sheung Shui reach 89% of the planned population level. Tuen Mun, Tai Po is in the group of “serve”, arriving at 75% and 78% of the planned level. Tung Chung among the existing new towns, lies in the group of “neutral”, where it only reaches 39% of the planned population.

Hong Kong has long been suffering from the problem of insufficient urban land and a shortage of housing supply. Despite that the Hong Kong government proposed some new plans for tackling these problems (e.g., Lantau Tomorrow Vision), they are long-term projects which may not immediately support the rigid housing demand and economic growth of Hong Kong. Developing new towns among most of the choices are the most feasible and plausible options. One reason is that Hong Kong accumulated rich experience in developing rural areas of New Territories as new towns. Subject to the size and scale of the planning new towns such as Hung Shui Kiu, Kwu Tung North, and Fanling North, the government should speed

up the Northern Metropolis Development.

5.2 Economic performance of new towns

The results of regressions in Chapter 4 provide useful suggestions and policy implications in the following manifolds:

First, Yuen Long and Fanling-Sheung Shui, at which these two new towns start to operate, outperform the other new towns. Yuen Long and Fanling-Sheung Shui are located far away from the city centre but contribute the most to the economy. The government may consider speeding up the Northern Metropolis development to grasp the opportunity of potential urban agglomeration and economy of scale in synergized new town development, thus providing a new growth engine for Hong Kong.

Second, for the potential new towns/new development areas, our regression model suggests that government should enlarge the fiscal expenditure to promote more job opportunities and to foster the development of more balanced economic structures.

Third, the Hong Kong government should not simply replicate the previous new town development model, as the momentum of the old models to the economic growth declined sharply, from the double digits in the 1970s to single-digit in the 1990s. Large-scale development of multiple new towns in the New Territories simultaneously (Northern Metropolis) is likely to bring about more significant and sustained growth opportunities.

Fourth, as for the existing new towns, size does not significantly contribute to the economy because there are few industries in new towns. Considering that the plan for new towns and the Northern Metropolis Development Plan target at embracing new economic opportunities and challenges, the regression model which focuses on the association between size (of the developed urban areas) and economic growth provides some suggestions: Hong Kong's economic growth is negatively associated with the size of the urban areas in Hong Kong Island and Kowloon, indicating that economic development weights too much on the traditional CBD and urban areas. The limited size of urban areas is subject to the scale of economic growth. Our findings support that the Hong Kong government should seek a sufficiently large new development area in the New Territories for the planned new towns and

sustainable economic growth. Besides, simultaneous development of new towns has much better economic outcomes than staged/periodic development.

5.3 New town development and inequality

Inequality is a long-standing problem in Hong Kong. By employing Theil's indices, the inequality of New Towns and New Territories (excluding New Towns) can also be identified. Theil's indices for these two areas show different patterns. Theil's indices of New Town show that they approach zero (i.e., towards equality) in the last four decades. On the other hand, the indices of New Territories (excluding New Towns) follow a different pattern. However, Theil's indices in both districts indicate an imbalanced development. A follow-up study is conducted to discuss how large infrastructure development (e.g., MTR) drives such inequality in the new towns. Our findings suggest the Hong Kong government do not need to simply replicate the previous development model which is to develop new towns first and then carry out large infrastructure. It brings more harm than good to the existing low-income households in the area, as they cannot enjoy the convenience from the large-scale infrastructure like MTR. The government may consider negotiating with the MTR Corporation to provide some public housing nearby MTR stations to accommodate the affected low-income people.

5.4 Housing development and management in new towns

Housing is an indispensable part of new town development. Despite the ever-rising housing prices already reaching the skyrocketing level, our findings in Chapter 4 that there is no explosive behaviour (housing bubbles) in new towns. However, the explosive behaviour is found to appear in the New Territories that are outside the new town areas. The explosive housing behaviour discovered in New Territories outside new towns may warm up the housing market, preparing for heated or overheated status when new towns are ready to use. Our findings suggest that the government may keep an eye on the housing market in the potential areas that would be developed as new towns. As Hung Shui Kiu, Fanling North, Kwu Tung North and New Territories North are planned for future new towns, the current lessons and experiences of housing development and management in the new towns enable enhancing liveability in the compact high-density environment in Hong Kong, e.g. increasing housing provision in the New Territories may be a feasible solution to alleviate the existing housing problems (Li et al., 2021).

5.5 Limitations and weaknesses of the study

In this report, we have mainly used census data to achieve four research objectives. Due to the importance of the research topic and the uniqueness of Hong Kong as the study area, the underlying forces and factors influencing urban, spatial, economic and social developments have not been fully examined. We admit that this is a limitation of our research, and aim to explore future opportunities to conduct in-depth research in these directions.

Due to data unavailability, we have used several proxies for important missing variables. One limitation is to use housing starts as a proxy for GDP, as land supply is also influencing new housing construction in Hong Kong. We have calculated the correlation among two couples of variables using annual data from 1995 to 2020: GDP and land supply, GDP and housing starts, respectively. The correlation coefficient between GDP and land supply is 0.11, while the correlation coefficient between GDP and housing starts is 0.14. For comparison, the correlation coefficient between land supply and housing starts is -0.25, while the correlation coefficient between land supply at time t and housing starts at time t+1 is 0.34. The results indicate that land supply could be an important factor influencing new housing construction in the next period in Hong Kong. However, it may be difficult to use land supply as a proxy for GDP as the lags of land development vary substantially.

As Hong Kong is a high-rise city, another limitation is to use the size of new towns rather than development intensity. We have searched the literature and found a paper by Tang and Yiu (2010) which discussed the nexus between housing price and development intensity. They have used the number of housing units to indicate development intensity. We also searched the databases of TPU and large scale street block groups (LSBG), but did not find any information of plot ratios or building areas. Thus the possible measure of development intensity remains the number of housing units. However, our regression analysis has used housing starts as a proxy for GDP, which has a strong correlation with the number of housing units. Besides, calculating the exact development intensity is quite difficult as that involves different zones' exact plot ratios and sizes. Within one piece of land, there might be different plot ratios. If we look at districts like Sai Kung, it will be even more complicated as most have illegal building structures, substantially more than the actual development intensity. As the data of development intensity is not available, size has been used as a proxy in this study.

Last but not least, regression analyses establish associations between two variables, but not necessarily causal relationship. We are aware of this as a limitation of our research, and have tried to test if there is any co-integration relationship among the variables of GDP, housing starts and land supply using the annual data from 1995 to 2020. However, we did not find any co-integration relationship among them, thus we cannot further perform Granger Causality Test. We admit that our regression results should be treated with caution by policy makers.

Chapter 6. Conclusion

The present study is the pioneering research to explore how the development of new towns impacts the development of Hong Kong. By employing the census statistics from 1976 to 2016 from the Census and Statistical Department of Hong Kong, the housing price index from 1980 to 2020 from the Rating and Valuation Department of Hong Kong, the study fulfils four objectives.

The first objective evaluated the impacts of new town development on different sectors of the economy using computable general equilibrium modelling. It is estimated that the Northern Metropolis plans would generate a 6% annual increase in residential housing units compared to the target of the Long Term Housing Strategy, resulting in a 3.63% GDP growth, a 3.29% welfare gain and an 8.24% increase in employment compared with the base year.

The second objective compared the economic outputs of regions completing new town development using regression analysis. The major findings are:

- Many new towns confront a serious problem in which the population as of today almost reaches the planned limit. Among the nine existing new towns, three (Tsuen Wan, Sha Tin, and Tin Shui Wai) are over 90% of the planned population level, two (Tseung Kwan O and Fanling Sheung Shui) are approaching 90%, two (Tuen Mun, and Tai Po) are around 75%, only one (Tung Chung) is below 40%.

- The contributions of Yuen Long, Fanling-Sheung Shui to the economy outperform the other new towns.

- The contribution of the new towns to the economic growth declines sharply, from the double digits in the 1970s to single-digit in the 1990s.

- The size of new towns did not significantly impact economic growth.

- The economic growth of the simultaneous development of new towns was far better than that of the periodic development.

The third objective measured the income inequality of regions completing new town

development using decomposition measurements and indicators. We find that:

- The inequality of new towns decline in the past four decades, which is built upon the outflows of low-income families and the inflows of middle- or high-income families.
- The development of the new towns has led to an imbalanced development between the new town and the other areas in the New Territories.

The fourth objective projected the evolutionary trend of the gaps between capital gains and economic gains of regions that undertake new town development using the transitional dynamics approach, results of which indicate that: there is no explosive behaviour of housing prices (housing bubbles) in New Towns, although some explosive behaviours of housing prices are found to appear in the New Territories that are outside the new town areas.

Accordingly, the policy implications for the Hong Kong government are:

- The development of the Northern Metropolis should be speeded up as it is a solution to existing land, housing and growth challenges.

- To enlarge the fiscal expenditure through creating/providing more job opportunities and to develop multi-industry, the first five to ten years for the planned new towns may be the crucial time window to develop/expand the innovative and technology industry.

- As for the performance of previous new town development, the momentum of the old models to the economic growth declined sharply, from the double digits in the 1970s to single-digit in the 1990s.

- Simultaneously develop the potential planned new towns / new areas in New Territories.

- Should not simply replicate previous development model: New Towns first then carry out the large infrastructure.

- Leave more time and room to discuss with MTR Corporation in order to provide some

room for developing the public housing to accommodate low-income people.

- Keep an eye on the housing market in the potential areas that would be developed as new towns.

- Build up the datasets to document the different economic statistics across different areas/sub-market in Hong Kong.

Chapter 7. Public Dissemination

7.1 Research Papers

Based on the research findings in this project, two research papers have been compiled. One research paper titled “Does rail transit development gentrify neighbourhoods? Evidence from Hong Kong” is based on the result of Objective 3, and is published on Transportation Research Part A: Policy and Practice, 155, 354-372. The other paper is based on Objective 4 and is in preparation for submission to a peer-reviewed journal.

7.2 Public Seminar

A public seminar titled “New Town Development and Gentrification in Hong Kong” is held on 10 March 2022, in which the research team reported the project’s preliminary findings to approximately 30 members in the Department of Geography and Resource Management and the Institute of Future Cities.

7.3 Conference Presentation

A conference presentation titled “Housing development under the new town development scheme in Hong Kong” was made at the 26th International Symposium on Advancement of Construction Management and Real Estate on November 20-21, 2021, in which the research team reported the project’s preliminary findings to approximately 30 conference participants from related fields.

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