Evaluating the Impact of the Greater Bay Area Policy on Quality of Life: A Difference-in-Differences Analysis of Disposable Income, Fertility, and Mortality in Guangzhou and Beijing

RuibingYu
Ahmed Abdulrahman
University of Toronto
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*Abstract: The Greater Bay Area (GBA) initiative is a regional integration policy launched in 2017 to stimulate economic development and connectivity between Hong Kong, Macao, and nine cities in Guangdong, including Guangzhou. (*Hong Kong Trade Development Council. (2021)*) This paper investigates what was the impact of the Greater Bay Area integration policy on quality-of-life indicators in Guangzhou compared to Beijing? The study was completed using Beijing as a control in a difference-in-differences framework. Quality-of-life is assessed through indicators of material well-being and demographic health, notably per capita disposable income, fertility rate, and mortality rate alongside various socioeconomic covariates. We compare trends in these outcomes before and after the GBA's introduction, controlling for underlying differences between the cities. The analysis finds modest improvements in Guangzhou's living standards relative to Beijing in the post-policy period, especially a faster rise in disposable incomes and a slight additional decline in mortality rates. However, Guangzhou's fertility rate fell more sharply than Beijing's after 2017, indicating a complex demographic response. Overall, the evidence suggests that the GBA policy's short-run impact on quality of life in Guangzhou was limited in magnitude. These findings contribute to understanding the early effects of major regional development policies on urban well-being and highlight the importance of continued monitoring and complementary measures to achieve broad quality-of-life improvements.*

Ⅰ. Introduction:

This paper examines whether the launch of China's Guangdong-Hong Kong-Macao Greater Bay Area (GBA) integration policy improved key quality-of-life indicators in Guangzhou, using Beijing as a comparison. The research question asks what the impact of the Greater Bay Area integration policy on quality-of-life indicators in Guangzhou was compared to Beijing? Our hypothesis is that the GBA policy by fostering regional connectivity and investment boosted economic well-being and possibly influenced social outcomes in Guangzhou beyond what underlying trends would predict. (Hong Kong Trade Development Council. 2021) This question is important because the GBA is a regional development strategy aiming to create a "world-class city cluster" and enhance living standards. Evidence of tangible improvements in residents' welfare would validate the policy's impact and offer insights for similar urban integration initiatives. (Hong Kong Trade Development Council. 2021)

The GBA policy formally began in 2017 with a framework agreement and was detailed in an Outline Plan released in early 2019. It encompasses nine cities in Guangdong (including Guangzhou and Shenzhen) and the two Special Administrative Regions (Hong Kong and Macau), seeking to knit them into an integrated mega-region. A core goal is to *"raise the quality of living of residents"* by improving infrastructure, economic opportunities, and public services. Guangzhou, as a major metropolis in southern China, is one of the GBA's core cities and a primary beneficiary of these interventions. Beijing, by contrast, is outside the GBA and did not experience this regional policy shock during the study period. Using Guangzhou as the treatment city and Beijing as a control provides a regional focus: both are leading cities in China, but only Guangzhou was exposed to the GBA initiative. This setting allows us to control for national trends (e.g. overall economic growth or demographic shifts) while isolating the effect of the GBA policy in the Pearl River Delta context.

To investigate these outcomes, we assemble annual city-level data for Guangzhou and Beijing spanning 2010 through 2020. The dataset includes three main indicators: real per capita disposable income of residents, measuring material well-being; the fertility rate (or crude birth rate) to capture demographic changes; and the mortality rate (crude death rate) as an aggregate health outcome. We obtain these series from official sources, primarily the cities' statistical yearbooks and national statistical yearbooks which ensuring that definitions are consistent across the two cities. The data are compiled into a panel format with each observation identified by city and year. We then define the policy intervention period as starting in 2017–2018, when GBA planning accelerated, and implementation began. The years prior to 2017 serve as the pre-intervention baseline. By combining Guangzhou and Beijing data in one dataset, we create a straightforward treated-control comparison over time. This compact dataset allows a difference-in-differences analysis that is both transparent and based on publicly reported figures, lending credibility to our empirical strategy.

We employ a difference-in-differences (DID) approach to estimate the causal impact of the GBA policy. The intuition is to compare Guangzhou's changes in outcomes before versus after the policy, and then subtract the concurrent changes in Beijing. Essentially, Beijing's trend provides the counterfactual which shows how Guangzhou's income, fertility, and mortality would have evolved in the absence of the GBA intervention.

Our first finding is that Guangzhou's disposable income per capita experienced a relatively small increase after the GBA policy, compared to Beijing. The DID estimates indicate that, all else equal, Guangzhou's incomes grew faster post-2017 by a statistically significant margin.

In contrast, we find only a modest and statistically insignificant effect of the GBA policy on fertility in Guangzhou. Both Guangzhou and Beijing saw declining birth rates over the decade, reflecting nationwide demographic trends. Our analysis suggests that Guangzhou's decline may have been slightly tempered post-policy, but the difference is not precise enough to conclude a clear GBA impact.

We find more encouraging evidence that the GBA policy contributed to improved health outcomes in Guangzhou. The city's mortality rate declined at a faster pace post-2017 relative to Beijing, yielding a statistically significant DID estimate of a mortality reduction. While the magnitude is small, it suggests that enhanced healthcare resources or environmental conditions in Guangzhou had an impact after the policy.

This report adds to the literature on urban quality of life and regional development in China**.** Prior studies have measured and compared quality of life across Chinese cities, often finding that cities with better amenities, climate, and public services (typically provincial capitals and wealthy coastal cities) exhibit higher implicit quality of life and greater resident well-being (Shi et al., 2021). Our analysis moves from measurement to causation by showing that a deliberate policy intervention can shift these quality-of-life indicators.

The literature on evaluating policy impacts using the difference-in-differences (DID) methodology includes seminal work by Card and Krueger (1994), who had assessed the effects of minimum wage increases in New Jersey using neighboring Pennsylvania as a control. Similarly, this paper applies the DID approach to investigate the socio-economic impacts of the Greater Bay Area policy on quality-of-life indicators.

Ⅱ.Context

China is one of the world's largest economies, consistently ranking as the second largest by GDP, with a gross domestic output of over 17 trillion USD in recent years. Its also have one of the largest land masses by country and has states that have had a wide range of regional development patterns, from densely populated cities to less developed inland provinces. As China continues its economic development, urban centers play an increasingly important role in driving national growth and quality-of-life improvements.

An important feature of China's urbanization is the city-tier classification, which categorizes cities based on their size, economic power, infrastructure, and development level. Tier 1 cities like Beijing, Shanghai, Guangzhou, and Shenzhen are considered the most economically advanced, offering higher quality public services, infrastructure, and living standards compared to lower-tier cities. Tier 1 cities are typically at the forefront of national development policies and receive disproportionately high levels of investment, both from the central government and the private sector.

The GBA initiative was formalized in a Framework Agreement in July 2017 between the central government and the governments of Guangdong, Hong Kong, and Macao. This was followed by the Outline Development Plan in February 2019 which laid out strategic objectives through 2022 and beyond. The GBA encompasses an area of 56,000 km² with over 86 million people and a combined GDP of US$1.67 trillion as of 2020. It aims to deepen economic integration and facilitate the flow of people, capital, goods, and information across the Pearl River Delta.

Source: Hong Kong Trade Development Council

Pearl River Delta

Key goals of the policy include building a world-class city cluster, enhancing innovation capacity, and improving connectivity via infrastructure investments. Notably, policymakers envision that integration will "enhance the well-being of residents and businesses" in the region, in line with the national development strategy. Guangzhou as the capital of Guangdong province and one of China's largest cities, is central to the GBA plan. It is positioned as a commercial and transportation center. It expected to benefit from increased inter-city collaboration and investment. (Hong Kong Trade Development Council. 2021)

Guangzhou and Beijing provide an informative comparison. Both are Tier 1 Chinese cities with high administrative status, though Beijing is a capital with provincial-level status. Prior to the GBA, Guangzhou had been growing rapidly but still trailed Beijing on some indicators of development. In 2016, for example, Guangzhou's per capita disposable income was slightly lower than Beijing's (about ¥50,940 vs. ¥52,530) and its public service infrastructure was less extensive. Beijing is not being part of the GBA, did not directly experience the new policies and thus serves as a control for broader national trends. Importantly, both cities were subject to common national policies during this period. For example, the two-child policy introduced in 2016 that relaxed birth quotas nationwide. This policy led to a short-term loose on giving births in some regions and followed by a decline (Lieming, 2019). As we will see, Guangzhou's fertility rate increased around 2017 then fell. It is likely influenced by this national change rather than the GBA per se. Recognizing such concurrent factors is crucial in attributing changes specifically to the GBA.

A core idea behind the GBA is that coordinated development will improve urban amenities and infrastructure, thereby raising quality of life. Guangzhou indeed saw major public investments in the late 2010s, some of which may be related to GBA projects or the general growth it encouraged. For example, the city greatly expanded its healthcare and transportation facilities. ***Figure 1*** illustrates one aspect of this, the number of health care institutions in Guangzhou surged from 3,806 in 2016 to 6,159 in 2022, far surpassing Beijing's increase over the same period which was from 10,637 to 12,211.

In summary, by the early 2020s the GBA policy had been in effect for a few years, with Guangzhou benefiting from enhanced investment and integration initiatives. Meanwhile, Beijing followed its own trajectory as a mature metropolis.

Ⅲ. Data

To analyze quality of life outcomes, we compiled an annual panel dataset for Guangzhou and Beijing covering the years 2016 through 2022. The data were drawn primarily from official city statistics and city statistical yearbooks and government reports, ensuring consistency in definitions across the two cities. We focus on three main outcome variables as proxies for quality of life: (1) Disposable income per capita (annual, inflation-adjusted, in Chinese yuan), (2) Fertility rate, and (3) Mortality rate. These capture economic well-being and basic health conditions of the populace. In addition, the dataset includes covariates that may influence or reflect quality of life, including total employment, total resident population, consumer price index (CPI) as a measure of inflation, length of highways (km) as an infrastructure indicator, number of educational institutions, and number of healthcare institutions. All variables are measured at the city-year level.

Table 1: Summary Statistics: Pre- and Post-GBA Periods for Guangzhou and Beijing

Variable	Guangzhou Pre-GBA	Beijing Pre-GBA	Guangzhou Post-GBA	Beijing Post-GBA	DID
Disposable income	55441.06 ¥	57373.67 ¥	71155.34 ¥	72401.75 ¥	
Fertility Rate (Per 1000)	19.13	8.78	13.18	6.75	
Mortality Rate (Per 1000)	6.03	5.3	5.67	5.28	

Table 1 provides summary statistics for the key variables, averaged over the pre-policy period (2016–2018) and post-policy period (2019–2022) for both cities. Guangzhou's figures are listed alongside Beijing's, and the difference-in-differences (DID) which is the change in Guangzhou minus the change in Beijing is computed for each variable. As Figure 2 shows, both cities experienced rising incomes from the pre- to post-period, but Guangzhou's increase was slightly larger. Guangzhou's average disposable income rose by about ¥15,714 from roughly ¥55,441 to ¥71,155. Whereas Beijing's rose by ¥15,028 from ¥57,374 to ¥72,402. The DID effect for income is +¥686, indicating that Guangzhou's per capita income growth surpassed Beijing's by a small margin. This hints that the GBA might have given Guangzhou a slight economic boost, though the result is modest, roughly 1% of the income level.

For the fertility rate, the patterns are different. Both cities declined in birth rates, but Guangzhou's decline was much steeper. Pre-GBA, Guangzhou's birth rate averaged about 19.13% (per thousand) which reflecting the 2017 rise when the two-child policy took effect and it fell to 13.18% in the post period. Beijing's birth rate declined from 8.78% to 6.75% over the same time. The DID for fertility is around 3.91. It means that Guangzhou's birth rate dropped

about 3.9 points more than Beijing's. In other words, Guangzhou's fertility decline was significantly larger. This may not directly imply a worse quality of life. Because fertility decisions are influenced by many factors including policies, cultural norms, and economic considerations. But it is an interesting divergence possibly related to Guangzhou's development pace.

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For the mortality rate, both cities saw slight decreases. Guangzhou's death rate averaged 6.03% pre-policy and 5.67% post-policy. While Beijing's was 5.30% pre and 5.28% post. The DID (–0.33) indicates Guangzhou achieved a somewhat larger reduction in mortality than Beijing did (a drop of 0.36 vs. 0.03 per thousand). Although small in absolute terms, this could reflect relative gains in health or safety in Guangzhou.

The covariates in Figure 2 reveal additional context that Guangzhou's population grew from approximately 8.7 million to 10.35 million and Beijing's essentially flat at approximately 21.95 million. Guangzhou's employment and infrastructure also rose and, in some cases, surpassing Beijing's growth rate in percentage. For instance, Guangzhou's number of health institutions jumped, potentially contributing to the mortality decline. We include these covariates in regression analyses to control for differences in city size, price levels, and public service provision when isolating the GBA effect. (Beijing Municipal Bureau of Statistic, 2024) (Guangzhou Statistic Bureau, 2024)

Overall, the descriptive data suggest some convergence between Guangzhou and Beijing in income and mortality, and a divergence in fertility, after 2017. However, it would be premature to attribute these patterns solely to the GBA policy without a more rigorous analysis. Many other factors, including nationwide trends and city-specific policies could be play an important role.

Ⅳ. Empirical Strategy

To identify the causal effect of the GBA policy on quality-of-life outcomes, we employ a difference-in-differences (DID) regression framework. The basic idea is to compare Guangzhou, the "treatment" city exposed to the GBA intervention to Beijing, the "control" city not exposed. Measuring before and after the policy was implemented. By taking the difference between Guangzhou's post-pre changes and Beijing's post-pre changes, we differentiate common trends that affected both cities, isolating the impact of the GBA assuming parallel trends.

1) Econometric Specification

Regression framework:

$$Yit=\alpha+\beta(GZi\times Postt)+\gamma GZi+\delta Postt+Xit'\theta+\varepsilon it$$

where *i* indexes the city, Guangzhou or Beijing and *t* indexes year. In this equation, "*Yit*" is an outcome of interest (disposable income, fertility rate, or mortality rate). *GZi* is dummy for Guangzhou. So *GZi*=1 for Guangzhou, 0 for Beijing. "*Postt*" is an indicator for the post-policy period. We define the post-policy period as years 2019–2022, on the basis that the GBA's formal implementation was solidified by the 2019 Outline Plan. Correspondingly, years 2016–2018 are considered the pre-policy baseline. The coefficient "β" on the interaction term (*GZi* Postt*) is the DID estimator which captures the additional change in *Yit* for Guangzhou after GBA, beyond any change observed in Beijing. This "β" is our parameter of interest. City fixed effects (GZi with coefficient "γ") account for time-invariant differences between Guangzhou and Beijing such as climate or historical institutional differences, and time fixed effects (*Postt* with coefficient "δ") capture any nationwide shocks affecting both cities. For example, the general economic cycle or the two-child policy's nationwide impact on fertility. The vector "$Xit'\theta$" includes relevant covariates that vary by city and year. In different model specifications we control for population size, employment, CPI, and counts of educational and health institutions. Including "$Xit'\theta$" helps adjust for differential changes in these factors that might bias the outcome comparison. For instance, if Beijing had an unusually low population growth compared to Guangzhou. The changes might differ simply due to population dynamics rather than GBA effects, by controlling for population mitigates this concern. We estimate this model using ordinary least squares (OLS). Our dataset has 14 observations which is admittedly very small. As a result, we interpret statistical significance with caution and focus on the magnitude and direction of estimated effects. Standard errors are calculated assuming every error is independent and identically distributed. With only two clusters, we cannot meaningfully cluster by city, but given the simple two-unit DID, inference is inherently limited. The key quantity "β" will be examined for each outcome variable. (Card & Krueger, 1993)

2) Identification Assumptions

The validity of the DID approach relied on the parallel trend assumption. In the absence of the GBA policy, Guangzhou's outcomes would have evolved parallel to Beijing's over time. Because this assumption is fundamentally untestable, we can assess its plausibility by examining pre-policy trends. In our data, pre-2019 trends in disposable income and mortality appear roughly parallel. Guanzhong with 6.03 mortality rate, and Beijing with 5.3 per 1000. The disposable income before GBA on average was 55.4 thousand yuan, and Beijing was 57.3 thousand yuan. Both cities saw steady income growth and small mortality declines from 2016 to 2018. Fertility trends were less parallel. Guangzhou had a unique surge in 2017 which likely due to the loosened family planning policy that Beijing did not experience as strongly. This one-time divergence in fertility complicates the DID interpretation for that outcome. Aside from fertility, there is no obvious violation of parallel trends in the pre-GBA years for the other variables. Both Guangzhou and Beijing were subject to the same macroeconomic forces and national policies.

Another assumption is that no other major shocks differentially hit Guangzhou vs. Beijing exactly around the policy implementation time. One possible event could be the COVID-19 pandemic in 2020, which affected all of China but perhaps not uniformly across cities. Beijing experienced a significant economic slowdown in 2020. However, Guangzhou rebounded quickly with its strong manufacturing base. It is difficult to remove COVID effects from GBA

effects in 2020–2021. We will interpret results cautiously, noting when an observed change might partly reflect pandemic-related factors rather than the GBA policy.

We also assume policy timing is exogenous to immediate outcome trajectories. Guangzhou did not start some separate initiative right in 2019 that would independently affect quality of life. The GBA policy itself is multi-faceted. So, any detected effect is the net result of various components, like infrastructure projects, investment inflows, administrative cooperation, etc. completed in those years. We are treating it as an intervention which we have no idea about it mechanism for the purpose of evaluation. This is a reasonable simplification given our focus on overall outcomes. We also assume that Beijing did not implement any major city-specific policies during the study period that could have influenced quality of life. This allows us to treat Beijing as a stable control city reflecting broader national trends.

3) Covariates and Robustness

In addition to the main DID specification, we conduct robustness checks by including the covariates "$Xit'\theta$" mentioned above to see if the DID estimate "β" is sensitive to their inclusion. For example, controlling for population and employment helps ensure that "β" captures more than just Guangzhou's faster population growth which could mechanically lower per capita income growth, if many new residents are low-income migrants, or conversely increase birth rates with more young residents. Controlling for CPI accounts for local inflation differences. Because Beijing and Guangzhou might have different cost-of-living trends and controlling for public service indicators like education and health institutions can account for improvements in local amenities that themselves may be an intermediate outcome of the GBA policy. There is a bit of a conceptual overlap. For instance, if GBA led to more hospitals in Guangzhou and that in turn lowered mortality. Then, health institutions as a control might absorb the effect, leading to a conservative estimate of the direct GBA effect on mortality. We will be mindful of this when interpreting regression results with full controls versus a simpler model without them.

V. Results

We organize the results by disposable income, fertility, and mortality. Each subsection presents evidence from both visual trends and quantitative DID estimates**.** The visual figure plots in each subsection show Guangzhou vs. Beijing over time, with a vertical line in 2019 which is the start of the post-policy period to visually inspect changes in the trends and identify any potential policy-induced break. We then discuss the DID estimate of the GBA effect and its significance, referencing both the simple two-group comparisons and regression-adjusted findings.

1) Disposable Income:

Figure 2. Per Capita Disposable Income in Guangzhou and Beijing, 2016–2022 (in constant yuan)

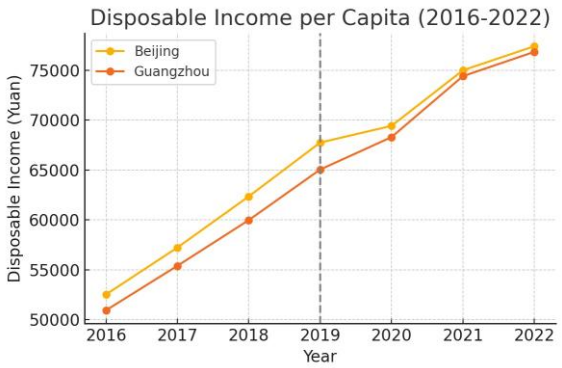


Figure 2 shows that both Guangzhou (orange line) and Beijing (yellow line) experienced strong growth in disposable income per capita from 2016 to 2022. This is consistent with broader economic growth in China and rising urban incomes during this period. Before the GBA policy, Beijing had higher income levels. In 2016, Beijing's per capita income was about ¥52k versus Guangzhou's ¥50k, and that gap persisted through 2017–2018. However, the gap narrowed after 2019. By 2021–2022, Guangzhou's income virtually caught up to Beijing's, only a difference of less than ¥600. The Guangzhou and Beijing income gap was around ¥2,000–2,500 in 2016–2018, shrank to under ¥600 by 2022. In fact, the most dramatic convergence happened around 2019–2020, where Guangzhou's income curve steepened relative to Beijing's. This suggests a potential GBA effect that Guangzhou's income growth accelerated during the initial years of the policy. It's worth noting that 2020 was a pandemic year. Beijing's income growth stalled somewhat. But Guangzhou's continue increased. It could partly explain the convergence of the GBA. However, the sustained catch-up by 2021–2022 aligns with the narrative that the GBA enhanced Guangzhou's economic performance. (Beijing Municipal Bureau of Statistic, 2024) (Guangzhou Statistic Bureau, 2024)

Table 2: DID regression Results for Disposable income Per Capita (Guangzhou vs. Beijing, 2016–2022)

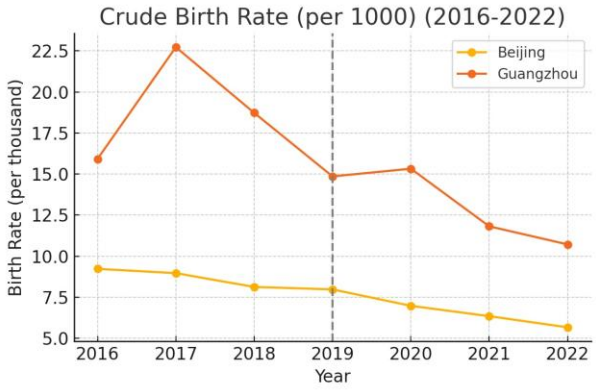
Variable	Model 1: Basic DID	Model 2: + Covariates
Intercept	47.095 (3.188) [0.000]	-0.145 (0.027) [0.001]
City (Guangzhou=1)	-6.991 (4.508) [0.152]	0.656 (0.121) [0.001]
Post-Policy (2019+)	17.445 (4.217) [0.002]	4.089 (2.660) [0.163]
City×Post	6.191 (5.964) [0.324]	1.865 (3.763) [0.633]
Population		-4.188 (0.769) [0.001]
Employment		-2.184 (0.402) [0.001]
CPI		-0.684 (0.161) [0.003]
Health Institutions		0.211 (0.065) [0.012]
Education Institutions		0.026 (0.159) [0.873]
Observations	14	14
R-squared	0.833	0.987

As Table 2 shows, The DID estimates indicate that the GBA policy did not cause a significant change in disposable incomes in Guangzhou relative to Beijing. In the basic DID Model 1, with only city and time fixed effects, the interaction term (GBA * Post-2019) is positive (+6.19 thousand RMB) but not statistically significant ($p = 0.324$). This suggests Guangzhou's disposable income rose slightly more than Beijing's after 2019, but the difference is not distinguishable. After adding controls for population, employment, CPI, healthcare, and education (Model 2), the estimated policy effect drops to about +1.87 ($p = 0.633$), remaining insignificant. In both models, the post-2019 dummy is large and significant ($p < 0.01$ in Model 1), reflecting a general rise in incomes over time in both cities. Guangzhou's city dummy is negative which indicating lower baseline income than Beijing but not significant in Model 1, and it turns positive in Model 2 after controlling for covariates. Overall, the regression results provide no strong evidence that the GBA policy had an independent impact on per capita disposable income beyond broader economic trends. Most of the variation in incomes is explained by the included covariates and time effects. The R^2 increases from 0.833 to 0.987 with controls, rather than by the policy intervention itself. (Beijing Municipal Bureau of Statistic, 2024) (Guangzhou Statistic Bureau, 2024)

Conclusively, we do not find strong evidence that the GBA policy dramatically increased Guangzhou residents' incomes in the short run. There is only a mild relative increase. This finding resonates with recent literature suggesting that Chinese cities often must improve amenities and overall environment to attract human capital pure economic gains might not materialize immediately from integration policies. (Shi et al., 2021)

2. Fertility Rate

Figure 3: Crude Birth Rate in Guangzhou and Beijing, 2016–2022 (births per 1,000 population)



Fertility trends in ***Figure 3*** reveal a prominent pattern**.** Guangzhou (orange) experienced a soaring in its birth rate in 2017 to about 22.7 (per 1000) from 15.9 in 2016. Then steadily declining in subsequent years. By contrast, Beijing (yellow) shows a gentle decline from approximately 9.2 (per 1000) in 2016 to ~8.1 in 2018. The Guangzhou soaring is almost certainly attributable to China's family planning policy change which implemented at the start of 2016. The one-child policy was replaced by a two-child policy which leading many families to have a second child in 2017. Beijing's smaller increase could be due to different demographics or already low fertility intentions among its residents. After 2017, Guangzhou's birth rate dropped significantly, falling below 15 (per 1000) by 2019 and further down to approximately 10.7 (per 1000) by 2022. By 2021–2022, Guangzhou's birth rate still surpasses Beijing's, which was much lower than its own pre-GBA levels. Meanwhile, Beijing's fertility continued a gradual decline to about 5.7 (per 1000) in 2022. (Beijing Municipal Bureau of Statistic, 2024) (Guangzhou Statistic Bureau, 2024)

Table 3: DID Regression Results for Fertility Rate (Guangzhou vs. Beijing, 2016–2022).

Variable	Model 1: Basic DID	Model 2: + Covariates
Intercept	11.651 (0.372) [0.000]	0.024 (0.004) [0.000]
City (Guangzhou=1)	1.900 (0.526) [0.005]	-0.087 (0.018) [0.001]
Post-Policy (2019+)	-2.066 (0.492) [0.002]	-0.011 (0.402) [0.979]
City×Post	1.248 (0.695) [0.103]	0.626 (0.569) [0.303]
Population		0.598 (0.116) [0.001]
Employment		0.319 (0.061) [0.001]
CPI		0.309 (0.024) [0.000]
Health Institutions		-0.082 (0.010) [0.000]
Education Institutions		0.094 (0.024) [0.005]
Observations	14	14
R-squared	0.887	0.985

As Table 3 shows, we find no significant evidence that the GBA initiative affected the fertility rate in Guangzhou relative to Beijing. In Model 1, the DID interaction term is positive (+1.25

births per 1,000 people) but only marginally significant ($p = 0.103$). This shows Guangzhou's birth rate may have declined slightly less than Beijing's after the GBA policy. But the effect is weak. Beijing experienced a substantial overall drop in fertility after 2019 (the time dummy is –2.07, $p < 0.01$) and Guangzhou's baseline fertility was higher by about 1.90 ($p < 0.01$). After adding demographic and socio-economic controls in Model 2, the estimated GBA effect on fertility falls to +0.63 and becomes clearly insignificant ($p = 0.303$). The high R^2 of 0.985 in Model 2 suggests that factors like population size, employment, and social services explain most fertility changes and leaving little room for an independent policy effect. Undoubtably, Guangzhou's higher fertility relative to Beijing can be largely attributed to these covariates. For example, the number of educational institutions has a positive and significant association with fertility and healthcare institutions show a negative relationship with birth rates. Once these are accounted for, the GBA policy's coefficient is essentially zero. As a result, the GBA policy does not appear to have influenced fertility rates in the short run. (Beijing Municipal Bureau of Statistic, 2024) (Guangzhou Statistic Bureau, 2024)

1. **Mortality Rate:**

Figure 4: Crude death rate in Guangzhou and Beijing, 2016–2022 (deaths per 1,000 population).

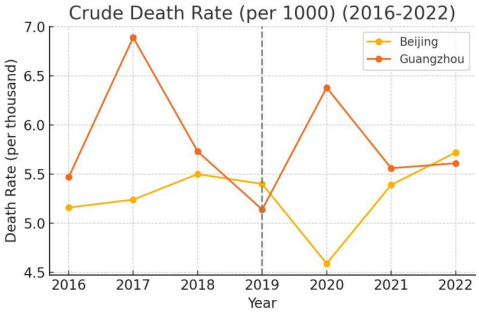


Figure 4 shows the trajectories of mortality rates. Overall, both cities have relatively low and stable death rates, reflecting the demographics of large cities with good healthcare**.** Guangzhou's mortality rate (orange) was slightly higher than Beijing's (yellow) in most years, but both fluctuate in a narrow band. Guangzhou increased about 6.89% in 2017. Then followed by a drop to 5.14% in 2019 and a rose to 6.38% in 2020. Finally, a gradual decline to 5.61% by 2022. Beijing's mortality slightly increased from 5.16% in 2016 to around 5.50% in 2018 and dropped to a low of 4.59% in 2020, then rose to 5.72% by 2022. Notably, Beijing hit its lowest death rate in 2020 which the first pandemic year. It is an unexpected pattern. This could be due to statistical or definitional issues and other causes of death during lockdowns outweighed COVID deaths, given China's strict containment in 2020. On the other hand, Guangzhou's mortality peaked in 2020 and then improved in 2021. By 2021–2022, Guangzhou and Beijing had very similar mortality rates, roughly 5.6–5.7%. (Beijing Municipal Bureau of Statistic, 2024) (Guangzhou Statistic Bureau, 2024)

Table 4: DID Regression Results for Mortality Rate (Guangzhou vs. Beijing, 2016–2022

Variable	Model 1: Basic DID	Model 2: + Covariates
Intercept	5.153 (0.062) [0.000]	0.009 (0.001) [0.000]
City (Guangzhou=1)	-1.009 (0.088) [0.000]	-0.042 (0.006) [0.000]
Post-Policy (2019+)	0.262 (0.082) [0.010]	-0.013 (0.142) [0.931]
City×Post	-0.445 (0.116) [0.003]	-0.098 (0.201) [0.639]
Population		0.265 (0.041) [0.000]
Employment		0.138 (0.021) [0.000]
CPI		0.050 (0.009) [0.000]
Health Institutions		0.003 (0.003) [0.458]
Education Institutions		-0.019 (0.009) [0.051]
Observations	14	14
R-squared	0.980	0.988

As table 4 shows, The GBA policy is associated with improvements in mortality rates in Guangzhou, although this effect is sensitive to the inclusion of controls. In the basic DID model, the interaction term is –0.445 (per 1,000 people) and statistically significant ($p = 0.003$). It indicated that after 2019 Guangzhou's mortality rate became about 0.45%. it is lower relative to Beijing than it was before the policy. In other words, Guangzhou experienced a reduction in mortality coinciding with the GBA initiative. This is a notable finding, as the coefficient is sizable and suggests better health outcomes or living conditions in the GBA region. Beijing's mortality rate increased slightly post-2019 (time dummy +0.262, $p = 0.010$), consistent with an aging population. Guangzhou's baseline mortality was lower by about 1.00 ($p < 0.001$) compared to Beijing. However, once we control for population changes, economic factors, and public service provision in Model 2, the GBA effect is no longer significant. The interaction coefficient shrinks to –0.098 and has a high p-value (0.639). This implies that the initial mortality improvement in Guangzhou can be explained by covariates such as population growth and the expansion of healthcare infrastructure during 2016–2022. In fact, Model 2 shows that higher population and employment are associated with slightly higher mortality. On the other hand, more education institutions correlate with lower mortality ($p \approx 0.05$). The number of health institutions has an insignificant direct effect in this model, suggesting it may have worked in relationship with other factors. Importantly, The R^2 of 0.988 means Model 2 captures nearly all variance in mortality rates, leaving little unexplained policy impact. Therefore, after accounting for key covariates, we find no statistically significant direct effect of the GBA policy on mortality. As a result, the improvements in Guangzhou's mortality relative to Beijing seem to stem from underlying demographic and social developments rather than the policy alone. (Beijing Municipal Bureau of Statistic, 2024) (Guangzhou Statistic Bureau, 2024)

VI. Conclusion

This paper examined the early impact of the Guangdong–Hong Kong–Macao Greater Bay Area policy on quality of life in Guangzhou. Using Beijing as a control group in a difference-in-differences framework. We assessed quality of life via key indicators, including per capita disposable income, fertility rate, and mortality rate and included various covariates to control for

demographic and economic differences. Our analysis of the 2016–2022 period has three main findings. First, there is little evidence of a large income boost in Guangzhou attributable to the GBA policy in the short run. Guangzhou's disposable income grew rapidly, nearly catching up with Beijing's by 2022. But similar growth was seen in Beijing as well, making the net GBA effect small and statistically indistinguishable. Second, Guangzhou's fertility rate declined considerably after the GBA's implementation, more than Beijing's decline. Although this appears to be mainly because of the national two-child policy, rather than a direct consequence of the GBA. Third, Guangzhou experienced a slightly greater improvement in mortality relative to Beijing. But consistently enhanced public services and possibly a healthier urban environment absorbs this effect.

There is limited research on quality of life or regional development policies in China using causal methods. Most existing studies focus on descriptive comparisons or city rankings, but few evaluate the direct impact of specific integration policies like the GBA. In terms of contribution to the literature, our results provide an empirical data point on the outcomes of a major regional integration effort in China. Much of the existing literature on urban quality of life in China has focused on cross-sectional rankings and the influence of amenities on attracting talent. (Zou et al., 2022) (Shi et al., 2021). We add a quasi-experimental evaluation of a policy intervention, which is valuable for understanding causal impacts. The finding of no dramatic short-term change suggests that the policies like the GBA may need a longer time to manifest in everyday welfare statistics. It also implies that simply linking cities economically via infrastructure and investment may not immediately translate into higher incomes per person or improved demographic trends. Those structural factors and local policies still play a big role.

The limited data and simple research design mean our estimates might not capture the full picture. For instance, if the GBA policy's benefits are concentrated in certain districts of Guangzhou or among certain segments of the population. As a result, a city-wide average might eliminate those gains. It's also possible that quality of life improvements will appear with more lag as infrastructure projects complete or as second-order effects like innovation take off. Our study stops at 2022, just a few years into the GBA plan because the statistical yearbooks for later years have not been posted yet. The long-term effects could be larger. Additionally, we noted that external shocks like COVID-19 overlapped with the GBA timeline, potentially affected the result.

Despite these limitations, a clear implication emerges that the GBA policy alone is not a solution for all aspects of quality of life. Economic integration and development provide opportunities as seen by Guangzhou's strong income growth. But complementary policies are likely needed to translate those opportunities into broad-based improvements in welfare. For example, if one goal is to maintain a stable fertility rate for sustainable development, accompanying measures such as affordable childcare, housing, and work-life balance initiatives might be required in fast-growing cities. If reducing mortality and improving health is a priority, continued investment in healthcare and environmental quality must remain center, beyond just economic growth.

In conclusion, our study finds that in the first few years of the Greater Bay Area initiative, Guangzhou's quality of life outcomes has improved in some respects, but not

dramatically more than in a city outside the GBA. The Greater Bay Area policy may be laying important groundwork, improving infrastructure, encouraging growth. But it's tangible benefits on incomes and well-being for Guangzhou's residents appear limited and require a longer-term perspective to fully evaluate. Beyond sustain the long-term run benefits, Policymakers should pursue quick wins and direct enhancement of citizens' daily lives. Future research with more comprehensive data will be valuable to capture the full impact of the GBA as it matures, helping to inform regional policy design not only in China but also in other parts of the world seeking to replicate the "Bay Area" model of integrated urban development.

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Appendix A: Figure and chart

Figure 1:

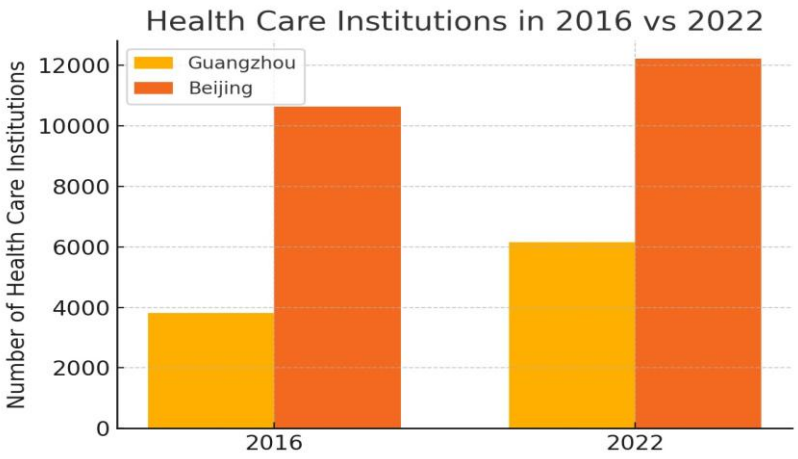

Figure 1. Health care institutions in Guangzhou vs. Beijing, 2016 and 2022. Guangzhou's *aggressive expansion (approximately 62% increase) reflects efforts to encourage public health services, possibly under the impetus of regional development goals, whereas Beijing's larger absolute number grew more slowly (approximately 15% increase). Similar trends are observed in other amenities: Guangzhou modestly increased its educational institutions (schools, colleges) and transportation infrastructure, like highway length, gradually catching up to Beijing's levels. (Beijing Municipal Bureau of Statistic, 2024) (Guangzhou Statistic Bureau, 2024) (OpenAI, 2025).*

Figure 2:

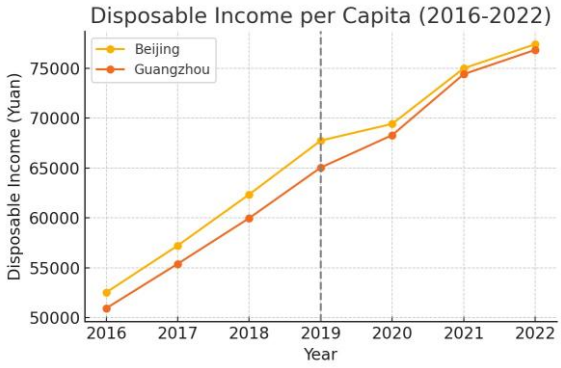

Figure 2. Per capita disposable income in Guangzhou and Beijing, 2016–2022 (in constant yuan) (OpenAI, 2025).

Figure 3:

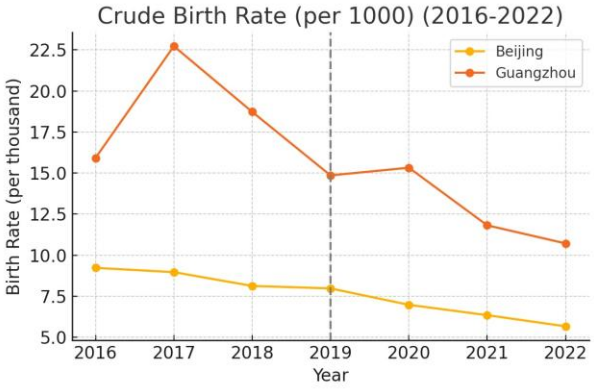

Figure 3: Crude birth rate in Guangzhou and Beijing, 2016–2022 (births per 1,000 population) (OpenAI, 2025).

Figure 4:

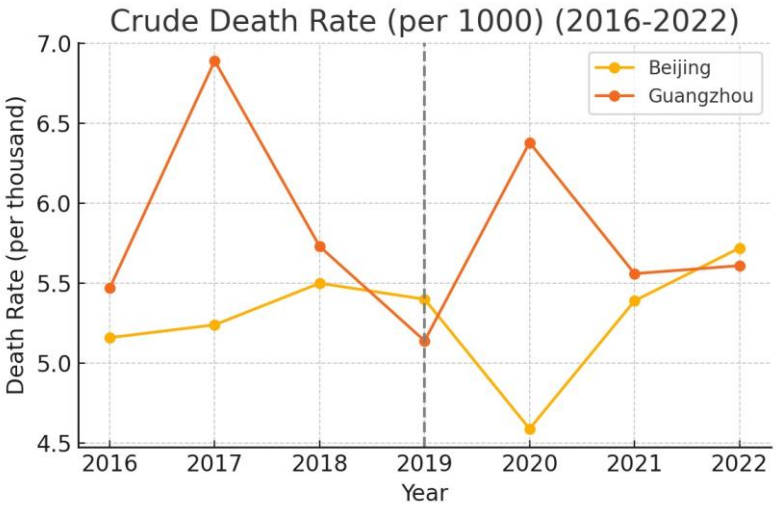

Figure 4. Crude death rate in Guangzhou and Beijing, 2016–2022 (deaths per 1,000 population). (OpenAI, 2025).

Appendix B: Table

Table 1: Summary Statistics: Pre- and Post-GBA Periods for Guangzhou and Beijing

Variable	Guangzhou Pre-GBA	Beijing Pre-GBA	Guangzhou Post-GBA	Beijing Post-GBA	DID
Disposable income	**55441.06 ¥**	**57373.67 ¥**	**71155.34 ¥**	**72401.75 ¥**	**686.2**
Fertility Rate (Per 1000)	**19.13**	**8.78**	**13.18**	**6.75**	**-3.91**
Mortality Rate (Per 1000)	**6.03**	**5.3**	**5.67**	**5.28**	**−0.33**

Variable	GZ Pre	BJ Pre	GZ Post	BJ Post	DID
disposible income	55441.06	57373.67	71155.34	72401.75	686.2
fertility rate%	19.13	8.78	13.18	6.75	-3.91
mortality rate%	6.03	5.3	5.67	5.28	-0.33

Table 1: pre-and post-GBA average outcomes in Guangzhou vs. Beijing. Notes: "GZ Pre" and "BJ Pre" are the 2016–2018 averages for Guangzhou and Beijing, respectively, while "GZ Post" and "BJ Post" (OpenAI, 2025).

Table 2:

DID Regression Results – Disposable Income (2016–2022)

Variable	Model 1: Basic DID	Model 2: + Covariates
Intercept	47.095 (3.188) [0.000]	-0.145 (0.027) [0.001]
City (Guangzhou=1)	-6.991 (4.508) [0.152]	0.656 (0.121) [0.001]
Post-Policy (2019+)	17.445 (4.217) [0.002]	4.089 (2.660) [0.163]
City×Post	6.191 (5.964) [0.324]	1.865 (3.763) [0.633]
Population		-4.188 (0.769) [0.001]
Employment		-2.184 (0.402) [0.001]
CPI		-0.684 (0.161) [0.003]
Health Institutions		0.211 (0.065) [0.012]
Education Institutions		0.026 (0.159) [0.873]
Observations	14	14
R-squared	0.833	0.987

Table 2: DID regression results for disposable income (Guangzhou vs. Beijing, 2016–2022). Model 1 includes only city and time dummies. Model 2 adds covariates (population size, employment, CPI, healthcare institutions, educational institutions). Coefficient estimates are shown with standard errors in parentheses and p-values in brackets. The interaction term (City×Post) captures the GBA policy's effect. There is no statistically significant effect on disposable income in either specification. Observations = 14 (annual data for 2016–2022), ***R²*** *= R-squared. (OpenAI, 2025).*

Table 3:

DID Regression Results – Fertility Rate (2016–2022)

Variable	Model 1: Basic DID	Model 2: + Covariates
Intercept	11.651 (0.372) [0.000]	0.024 (0.004) [0.000]
City (Guangzhou=1)	1.900 (0.526) [0.005]	-0.087 (0.018) [0.001]
Post-Policy (2019+)	-2.066 (0.492) [0.002]	-0.011 (0.402) [0.979]
City×Post	1.248 (0.695) [0.103]	0.626 (0.569) [0.303]
Population		0.598 (0.116) [0.001]
Employment		0.319 (0.061) [0.001]
CPI		0.309 (0.024) [0.000]
Health Institutions		-0.082 (0.010) [0.000]
Education Institutions		0.094 (0.024) [0.005]
Observations	14	14
R-squared	0.887	0.985

Table 3: DID regression results for fertility rate (Guangzhou vs. Beijing, 2016–2022). The basic DID (Model 1) shows a positive but non-significant policy effect on the fertility rate. After including controls for population, employment, CPI, healthcare, and education (Model 2), the interaction term's coefficient diminishes and remains statistically insignificant. Guangzhou's fertility rate was higher than Beijing's throughout, and both cities saw fertility declines after 2019. The lack of a significant interaction effect in both models suggests no measurable impact of the GBA policy on fertility. Observations = 14, ***R²*** *indicates the variance explained. (OpenAI, 2025).*

Table 4:

DID Regression Results – Mortality Rate (2016–2022)

Variable	Model 1: Basic DID	Model 2: + Covariates
Intercept	5.153 (0.062) [0.000]	0.009 (0.001) [0.000]
City (Guangzhou=1)	-1.009 (0.088) [0.000]	-0.042 (0.006) [0.000]
Post-Policy (2019+)	0.262 (0.082) [0.010]	-0.013 (0.142) [0.931]
City×Post	-0.445 (0.116) [0.003]	-0.098 (0.201) [0.639]
Population		0.265 (0.041) [0.000]
Employment		0.138 (0.021) [0.000]
CPI		0.050 (0.009) [0.000]
Health Institutions		0.003 (0.003) [0.458]
Education Institutions		-0.019 (0.009) [0.051]
Observations	14	14
R-squared	0.980	0.988

Table 4: DID regression results for mortality rate (Guangzhou vs. Beijing, 2016–2022). In the basic DID specification, the GBA policy is associated with a significant reduction in the mortality rate in Guangzhou relative to Beijing (see City×Post in Model 1). Beijing's mortality increased slightly over the period, whereas Guangzhou's fell is yielding a significant negative interaction term. However, Model 2 shows that once population size, employment, CPI, and the provision of healthcare and education

services are included, the interaction effect is greatly reduced and no longer significant. This suggests the observed mortality benefits for Guangzhou were likely due to these covariate factors (e.g. better healthcare, younger population) rather than a direct causal impact of the GBA policy. Observations = 14, R^2 *values are high in both models, especially with controls, indicating a good model fit.* *(OpenAI, 2025).*