Topic

This study aims to explore the relationship between fluctuations in birth rates and subsequent primary school enrollment trends in Hong Kong. By analyzing historical birth rate data alongside primary school enrollment figures, we seek to understand the degree to which changes in birth rates predict or correlate with changes in enrollment approximately six years later. This analysis will help identify potential challenges in educational planning and resource allocation, providing valuable insights for policymakers and educational institutions. Understanding these trends is crucial for proactive planning in the education sector.

Data description

The datasets comprise numerical data related to annual birth rates(Health) and primary school enrollment figures(Education) in Hong Kong. The birth rate dataset includes the number of live births per year. The primary school enrollment dataset provides the total number of students enrolled in primary schools each year and other variables related to the school system. To ensure accurate analysis, I will clean and structure the data using appropriate data manipulation techniques. This process will involve handling missing values, ensuring consistent data formats, and aggregating data as needed for analysis.
I would examine the data by figuring out how different variables are relevant with each other through different charting or through analysis.

Table 1 & 2 Description

To load the data for Table 1 (BirthRate) and Table 2 (Key Statistics on Primary Education) before any transformation, I would begin by importing the CSV files directly into Power BI using the "Get Data" function. In the Power Query Editor, I would first remove any null values and unnecessary rows or columns to ensure data cleanliness. For both tables, I would set the "Year" column as the primary key and format it as a whole number to ensure consistency. I would then check for any inconsistencies in data types across both tables, especially for numerical columns, and standardize them as needed. To facilitate easier syncing between the two tables, I would ensure that the "Year" columns in both tables cover the same range and are formatted identically. Finally, I would create a relationship between the two tables using the "Year" column as the connecting field in the Power BI model view. This approach ensures that both tables are clean, properly formatted, and ready for analysis and visualization in Power BI.

Data Model Description

To build the Data Model for this analysis, I would define a relationship between the "BirthRate" and "Key Statistics on Primary Education" tables using the "Year" column as the primary key, establishing a one-to-one relationship for time-based comparisons. The model would be structured with the "BirthRate" table containing yearly birth rate data, the "Key Statistics on Primary Education" table including annual education statistics, and a separate date dimension table to facilitate time intelligence functions. This date table would be connected to both main tables using the "Year" column, enabling consistent time-based analysis across the entire model. The resulting star schema design allows for flexible querying and supports various types of analysis, such as comparing lagged birth rates with student enrollment figures. To enhance the model's capabilities, I would add calculated columns and measures using DAX, such as year-over-year growth rates and moving averages, providing deeper insights into trends and relationships between birth rates and education statistics over time.

DAX column 1 - 3

DAX Column 1 - Yearly Growth Rate
To calculate the percentage change in total births (male + female) compared to the previous year. This helps identify trends in birth rate increases or decreases over time.
Formula:

```
Yearly Growth Rate =
VAR PreviousYearTotal = CALCULATE(SUM(Table[Male Known Births] +
Table[Female Known Births]), Table[Year] = Table[Year] - 1)
RETURN
IF(ISBLANK(PreviousYearTotal), BLANK(),
    DIVIDE(SUM(Table[Male Known Births] + Table[Female Known Births]) -
PreviousYearTotal, PreviousYearTotal) * 100)
```

DAX Column 2 - Crude Birth Rate Category
Categorize crude birth rates into bins (e.g., High, Medium, Low) for demographic analysis.

```
Birth Rate Category =
IF(BirthRate[Crude Birth Rate (No. of known live births per 1,000 population)] >= 12,
"High",
    IF(BirthRate[Crude Birth Rate (No. of known live births per 1,000 population)] >=
8, "Medium", "Low"))
```

This column groups crude birth rates into categories based on predefined thresholds.

DAX Column 3 - Mainland Student Integration Rate

```
Mainland Student Integration Rate =
DIVIDE(
    'Key Statistics on Primary Education'[No. of Newly Admitted Students from the Mainland],
    'Key Statistics on Primary Education'[Student Enrolment],
    0
)
```

This metric shows the proportion of newly admitted students from mainland China relative to total enrollment, indicating the level of integration of mainland students into the Hong Kong education system.

DAX Column 4 - Trained Teacher Retention Rate

```
Trained Teacher Retention Rate =
1 - ('Key Statistics on Primary Education'[Wastage Rate of Teachers (%) - Trained ] / 100)
```

This column calculates the retention rate of trained teachers, providing insights into the stability of the qualified teaching workforce.

Visualization 1 - 5

Visualization 1

Utilizing the sum of total birth & student enrollment we can create a scatter plot.
From the scatter plot and correlation analysis, we observe a strong positive correlation (between Total Births and Student Enrollment. This indicates that fluctuations in birth rates strongly influence primary school enrollment trends approximately six years later. Higher birth rates correspond to higher student enrollment numbers, while declining birth rates lead to reduced enrollment figures.

Visualization 2

The line chart visualization in Power BI compares the Sum of Student Enrollment from the "Key Statistics on Primary Education" table with the Sum of Lagged Total Births

from the "BirthRate" table. This visualization provides insights into how fluctuations in birth rates impact primary school enrollment trends approximately six years later.
The line chart reveals a clear pattern where peaks and troughs in lagged total births align closely with changes in student enrollment figures. For example:

- Years with higher lagged total births (e.g., 2012) correspond to higher student enrollment figures six years later (e.g., 2016–2018).
- Declines in lagged total births (e.g., post-2012) are followed by reductions in student enrollment.

Visualization 3

The percentage of trained teachers has also declined from 96.1% in 2018 to 93.6% in 2023, as shown in the green line chart. This decrease suggests a gradual erosion of workforce quality, which could impact the effectiveness of teaching and learning outcomes. Furthermore, wastage rates provide additional insights: while trained teachers have consistently lower wastage rates (e.g., 4.2% in 2018 to 7.9% in 2023), untrained teachers exhibit significantly higher wastage rates, peaking at 18.2% in 2022 before declining slightly to 15% in 2023. This disparity highlights the importance of investing in teacher training programs to improve retention.

Visualization 4

The visualization provides insights into three key metrics: the percentage of newly admitted students from the mainland (light blue), total student enrollment (dark blue), and the mainland student integration rate (orange). Over the years, there has been a sharp decline in newly admitted students from the mainland, dropping from 24% in 2018 to 12% in 2021, likely influenced by geopolitical tensions, stricter immigration policies, and pandemic-related disruptions. However, a recovery is observed post-2021, with admissions rising to 16% by 2023, indicating easing restrictions or improved cross-border educational programs. Simultaneously, total student enrollment has steadily decreased from 372,465 in 2018 to 325,564 in 2023 due to Hong Kong's low birth rates and demographic shifts. Despite these fluctuations, the mainland student integration rate has remained relatively stable at around 16–18%, suggesting consistent efforts to integrate mainland students into Hong Kong’s education system. These trends highlight demographic challenges and opportunities for policymakers to strengthen cross-border inclusion while adapting resources to address declining enrollment.

Visualization 5

The visualization highlights key trends in Hong Kong's primary education system, focusing on total student enrollment (dark blue), newly admitted students from the mainland (light blue), and the number of repeaters (orange). Over the years, there has been a noticeable decline in the percentage of newly admitted students from the mainland, dropping sharply from 24% in 2018 to around 12% in 2021. This decrease coincides with external factors such as geopolitical tensions, stricter immigration policies, and pandemic-related disruptions that limited cross-border mobility. Interestingly, as mainland student admissions declined, the number of repeaters increased significantly, peaking at over 2,000 in 2021 before gradually decreasing by 2023. This correlation may suggest that fewer mainland students contributed to a reduced diversity of academic backgrounds, which could have impacted classroom dynamics and led to higher repetition rates among local students.

Insight

The combined insights from all visualizations reveal a comprehensive picture of how demographic trends, teacher workforce dynamics, and cross-border integration influence Hong Kong's primary education system. The strong correlation between lagged total births and student enrollment highlights the critical role of demographic forecasting in educational planning. As birth rates decline, student enrollment figures follow suit approximately six years later, emphasizing the need for policymakers to proactively adjust resources, such as school capacities and teacher allocations, to meet future demands.

The analysis also uncovers challenges in maintaining workforce quality. The declining percentage of trained teachers (from 96.1% in 2018 to 93.6% in 2023) and the higher wastage rates among untrained teachers (peaking at 18.2% in 2022) suggest increasing instability in the teaching workforce. This trend could adversely affect teaching effectiveness and learning outcomes, necessitating targeted investments in teacher training programs and retention strategies to ensure a stable and qualified workforce.

Furthermore, the visualizations shed light on cross-border integration dynamics, with a sharp decline in newly admitted mainland students (from 24% in 2018 to 12% in 2021) due to geopolitical tensions and pandemic-related disruptions. Despite this decline, the mainland student integration rate has remained stable at around 16–18%, indicating consistent efforts by Hong Kong's education system to support cross-border inclusion.

However, the increasing number of repeaters during the same period suggests that reduced diversity in academic backgrounds may have impacted classroom dynamics and student performance.

Overall, these insights highlight interconnected challenges that require a multifaceted approach. Policymakers must address declining enrollment by aligning resources with demographic trends, invest in teacher training and retention programs to stabilize the workforce, and strengthen cross-border initiatives to maintain diversity and inclusion. By tackling these issues holistically, Hong Kong can ensure the sustainability and quality of its primary education system amidst ongoing demographic shifts and external pressures.

Reference

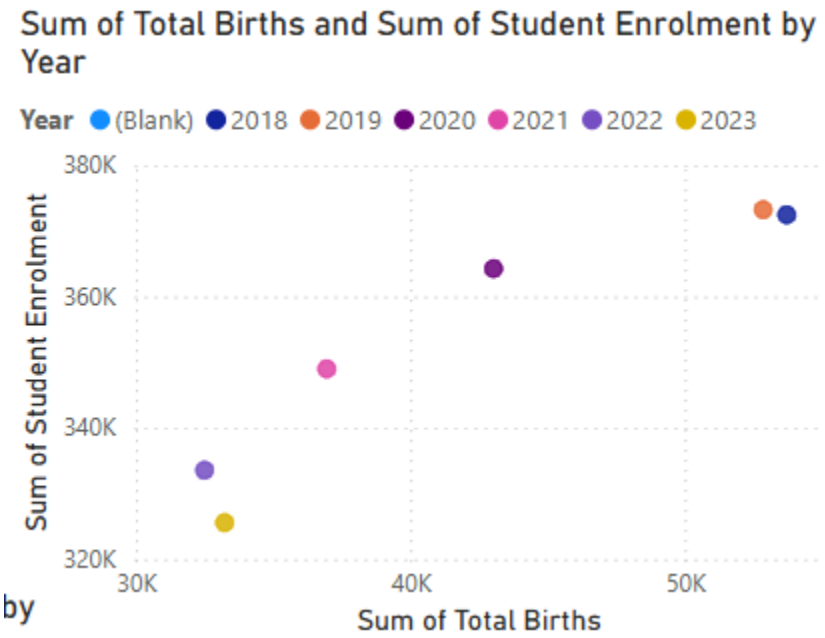
Birth Statistics | DATA.GOV.HK. (n.d.).

https://data.gov.hk/en-data/dataset/hk-dh-dh_ncddhss-ncdd-dataset-2

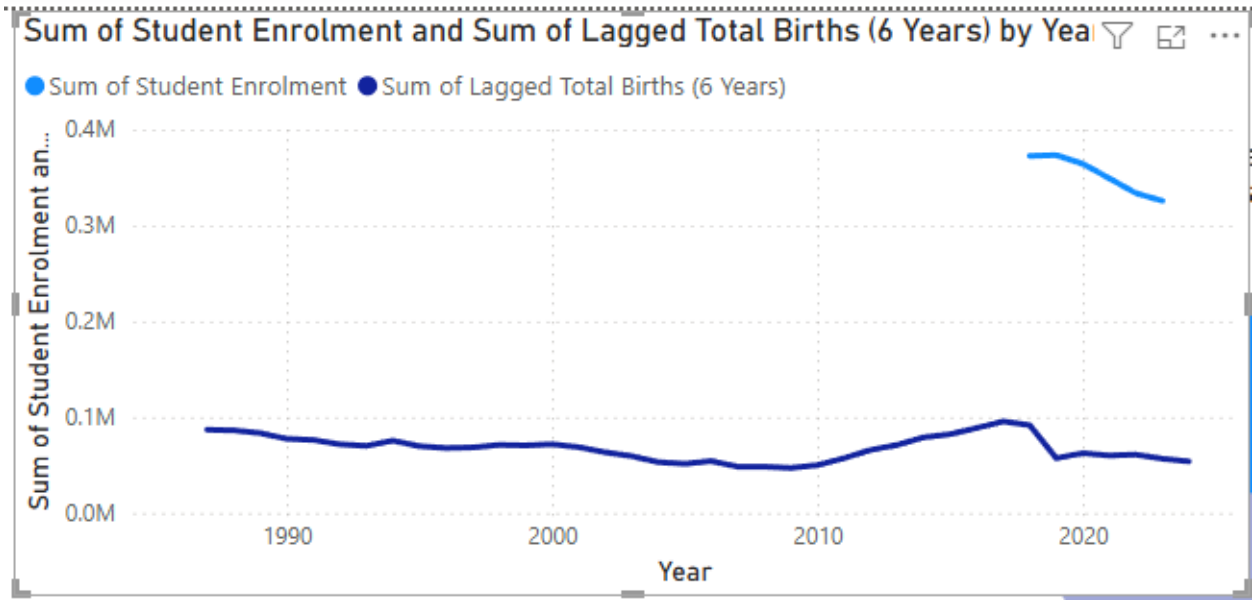
Key statistics on primary education | DATA.GOV.HK. (n.d.).

https://data.gov.hk/en-data/dataset/hk-edb-figustat-key-stat-primary-education

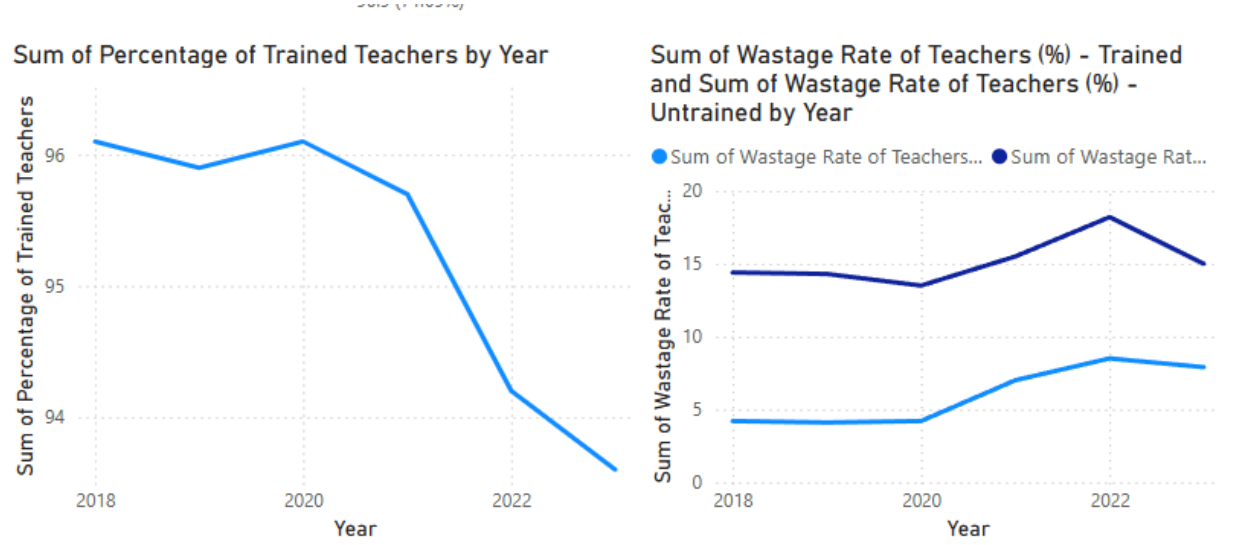
Appendix



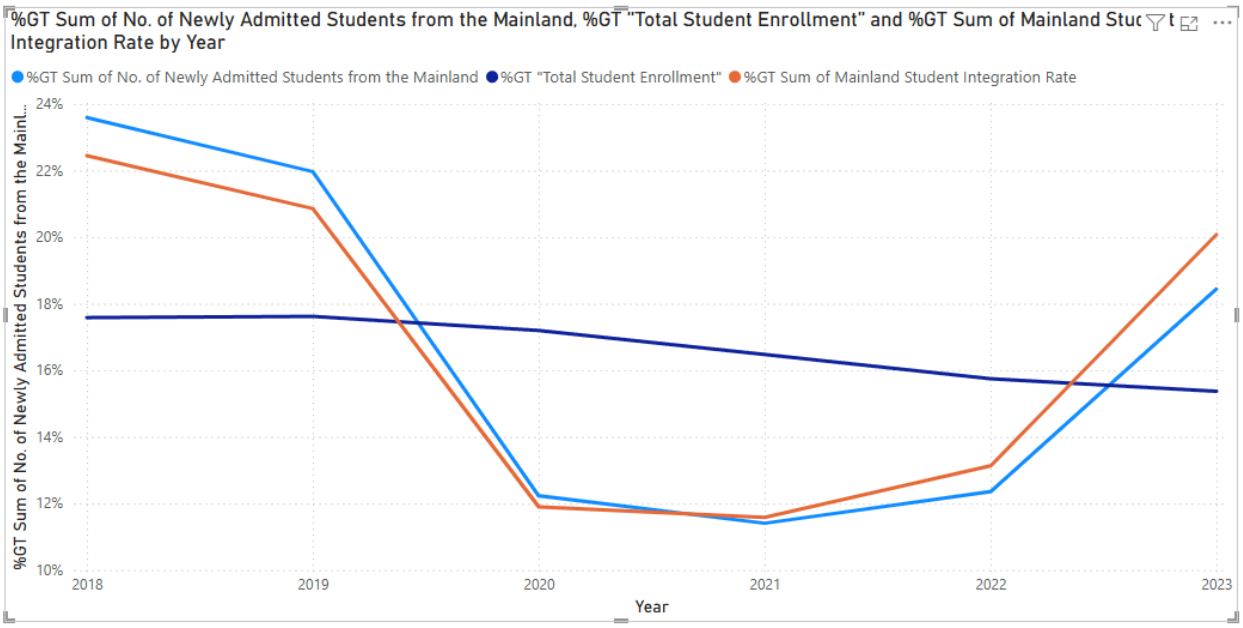
Visualization 1



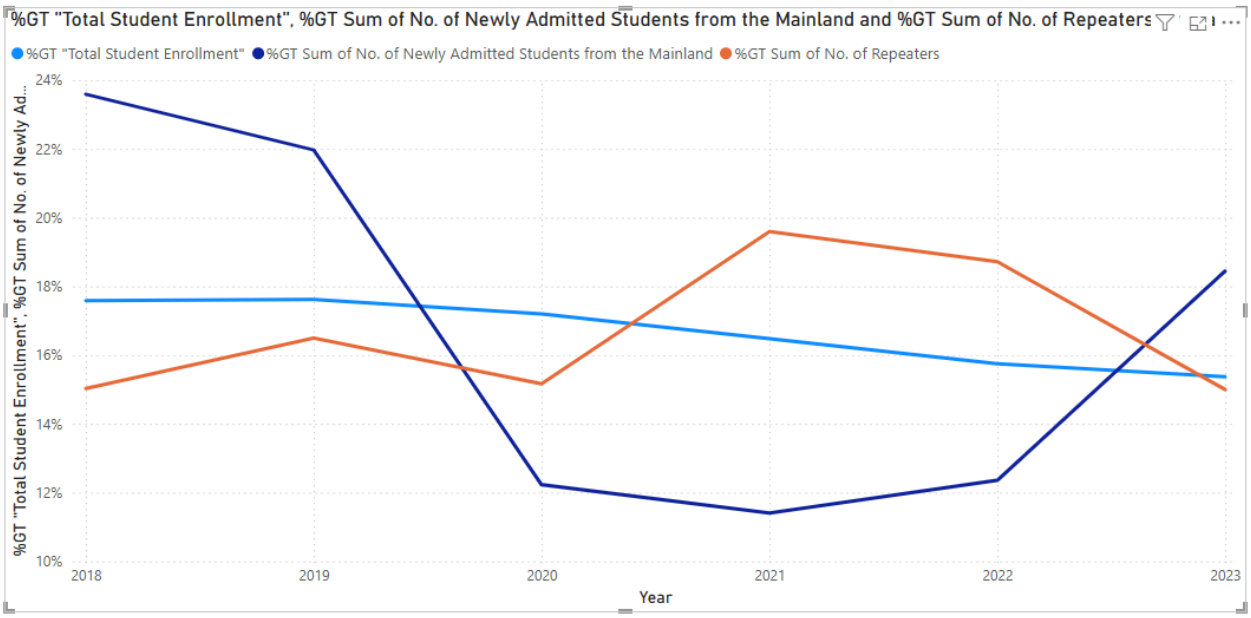
Visualization 2



Visualization 3



Visualization 4



Visualization 5