Can Financial Incentives Boost Fertility Rate? Evidence From Hong Kong

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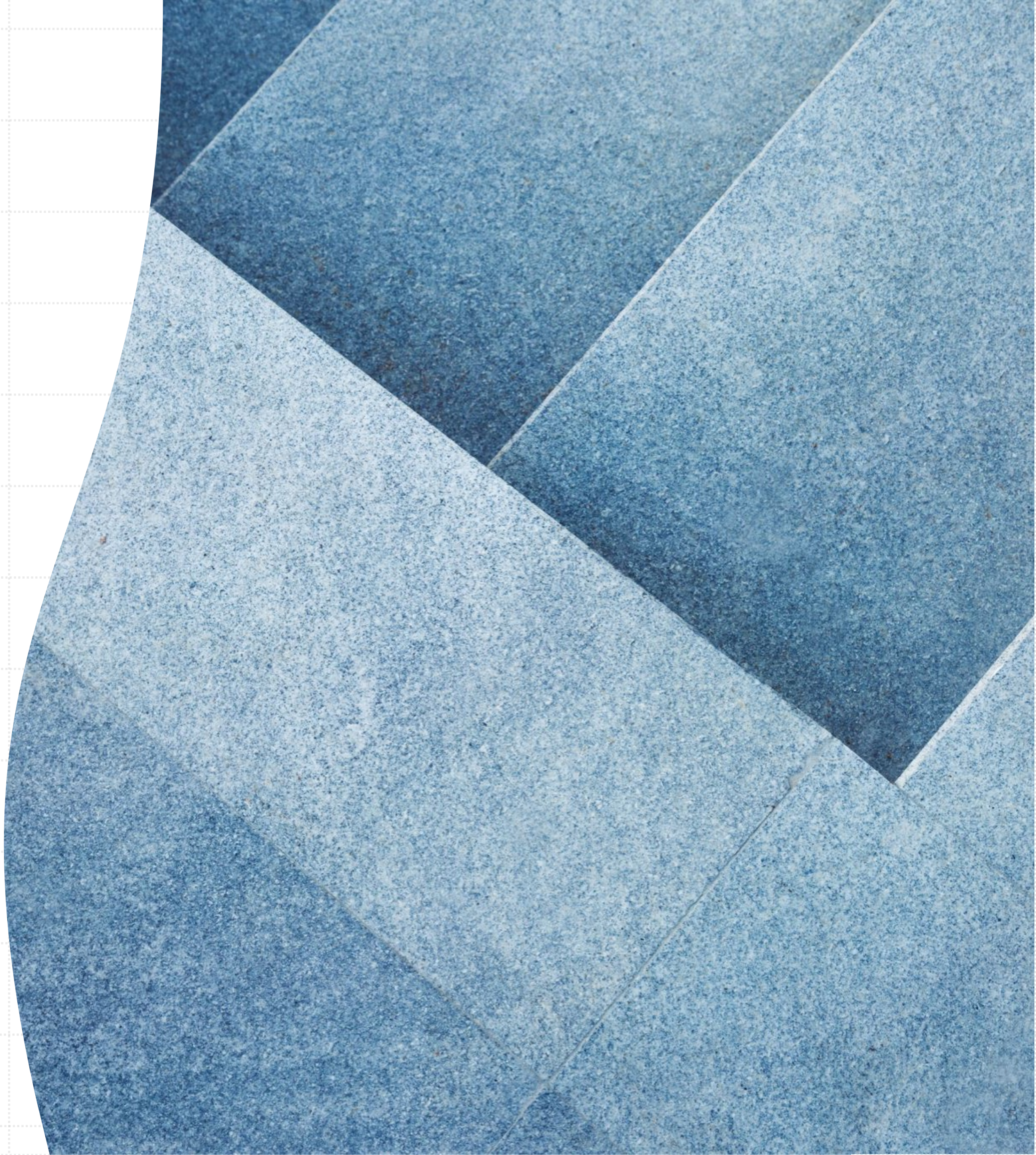
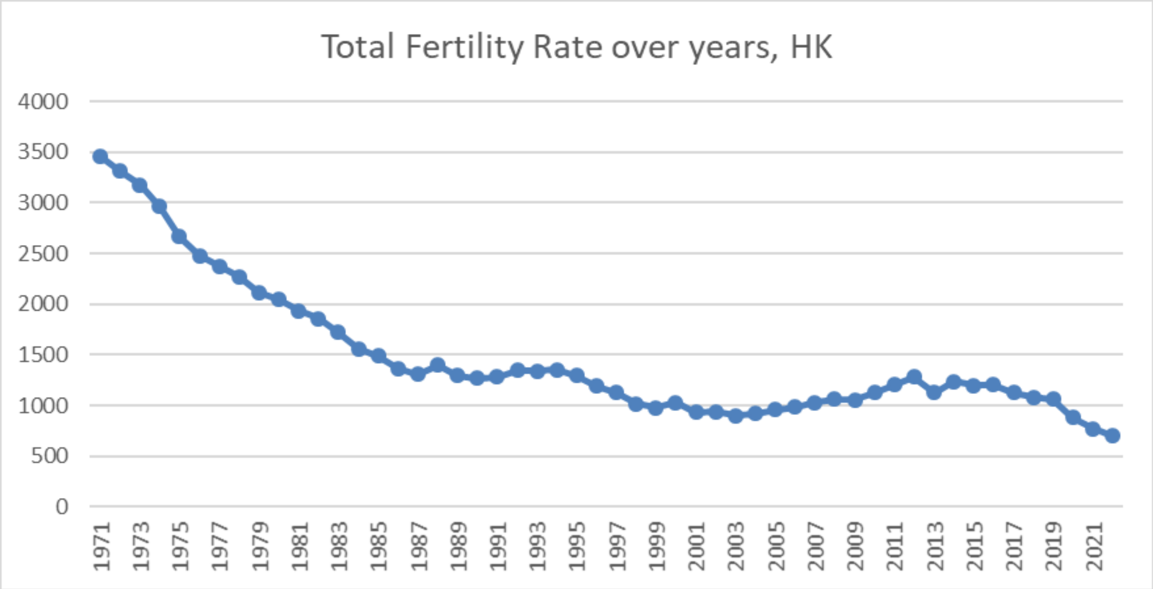
MSc Applied Economics

May 2023



I. Introduction

- Total Fertility Rate (number of birth per 1000 women in a year) has been persistently low in Hong Kong.
- Low fertility causes adverse social issues:
  - Shortage of labor supply
  - Shifts age structure and leads to aging society.
- Encouraging childbearing has been the agenda for policymakers around the world.



I. Introduction

- Tax incentive is an important policy tool to enhance the fertility rate world widely.
- In Hong Kong, under the salary tax scheme the
  - **Married Person Allowance (MPA)** and **Child Allowance (CA)** dated back long.
  - **Additional Child Allowance (ACA)** introduced in 2007 to provide extra support.
- **Research question: Whether the increase in tax allowance (financial incentives) has improved the Total Fertility Rate in Hong Kong in the last three decades?**

II. Tax Allowances

- **Married Person Allowance (MPA)**: applicable at the year of getting married. (HK$ 66,000 in 1989 and HK$164,000 in 2021)
- **Child Allowance (CA)**: applicable annually for each child until they reach adulthood. (HK$13,000 in 1989 and HK$120,000 in 2021)
- **Additional Child Allowance (ADA)**: one-off allowance at the year of birth, same amount with CA.
- Tax allowance is the amount in the net income that can be exempt from salary tax.
- **Tax payable = net income – allowance**

$$PV\ of\ all\ benefit = 0.15 \times \left(\sum_{n=1}^{18} \frac{Child\ Allowances}{(1+r)^n} + MPA + CA \right)$$

III. Hypothesis

- Hypothesis:
  - Children are normal goods; its demand increases with income.
  - Increase in tax incentives bring extra income, therefore, should positively related to fertility.
- Other social factors that also influence fertility:
  - Housing Price (-ve), male earnings (+ve), female earnings (-ve), Female labor force participation rate (-ve),
  - Minimum Allowable wage for FDH as a proxy for the cost of housekeeping works (-ve).

$$\frac{\partial TFR}{\partial Benefit} > 0 \quad (1)$$

$$\frac{\partial TFR}{\partial HP} < 0 \quad (2)$$

$$\frac{\partial TFR}{\partial ME} > 0 \quad (3)$$

$$\frac{\partial TFR}{\partial FE} < 0 \quad (4)$$

$$\frac{\partial TFR}{\partial FLFPR} < 0 \quad (5)$$

$$\frac{\partial TFR}{\partial MAW} < 0 \quad (6)$$

IV. Data

- Annual aggregate time series data from 1989 to 2021.
- Dependent Variable: Total Fertility rate
- Independent Variable of interest: Tax benefit
- Logarithm transformation, tax benefit, earnings and wages for FDHs are CPI adjusted.
- Non-stationary time series, mostly integrated in the order of 1.

Table 1. Summary Statistics

Variables	Definition	N	Mean	SD	Min	Max
TFR	Total Fertility Rate	33	1109.88	154.38	774	1355
HP	Housing Price Index (=2000)	33	70.45	18.6	33.1	103
FLFPR	Female Labour Force Participation Rate	33	51.32	3.04	46.3	55.3
FE	Female Monthly Median Earning	33	9051.52	2917.63	3500	15000
ME	Male Monthly Median Earning	33	12575.76	4202.16	5000	20000
MAW	Minimum Allowable Wage for FDH	33	3759.39	475.08	2800	4630
Benefit	Estimated total benefit receivable	33	103728.01	61180.91	27180.63	217113.48

Note: all variables are aggregate data provided by government official sites.

V. Specification

- Auto Regressive Distributed Lagged (ARDL) model.
- To avoid spurious result, all the variables are differenced.
- p and q both equals to 3, gives the most accurate result.

$$\Delta fert_t = \alpha_0 + \alpha_i \Delta fert_{t-1} + \boldsymbol{\beta}_{\boldsymbol{k,i}} \boldsymbol{\Delta X}_{\boldsymbol{k,t-1}} + \varepsilon_t$$

$$\Delta fert_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta fert_{t-i} + \sum_{i=0}^{q} \boldsymbol{\beta}_{\boldsymbol{k,i}} \Delta \boldsymbol{X}_{\boldsymbol{k,t-i}} + \varepsilon_t$$

VI. Empirical Results

F-tests of three forms:

$$H_0: \alpha_1 = \alpha_2 \dots = \alpha_p = 0 \qquad \text{(a)}$$

$$H_0: \beta_{k,0} = \beta_{k,1} \dots = \beta_{k,q} = 0 \qquad \text{(b)}$$

$$H_0: \beta_{k,0} + \beta_{k,1} \dots + \beta_{k,q} = 0 \qquad \text{(c)}$$

- Failed to reject all the F-tests hypotheses.
- None of independent variable Granger causes the fertility rate to change.
- There is no significant long-run propensity impact on fertility either.

Table7. F-test Statistics

the dependent variable is log(fertility)			
Equations	(a)	(b)	(c)
independent variables:			
$\Delta\ln(fert)$	0.3334	-	-
	0.5712	-	-
$\Delta\ln(benefit)$	-	0.3124	0.0232
	-	(0.74)	(0.88)
$\Delta\ln(HP)$	-	1.746	0.8969
	-	(0.20)	(0.36)
$\Delta\ln(FLFPR)$	-	1.2572	0.0136
	-	(0.31)	(0.91)
$\Delta\ln(FE)$	-	1.3795	2.4052
	-	(0.28)	(0.14)
$\Delta\ln(ME)$	-	0.8034	0.5508
	-	(0.46)	(0.47)
$\Delta\ln(MAW)$	-	1.8041	0.5198
	-	(0.19)	(0.48)

Note: (a), (b) and (c) corresponds to three different null hypotheses of the F-test.

VII. Conclusion

- The tax benefits are positively correlated with fertility rate; however, the impact is subtle.
- Limitations:
  - Aggregate data misses out cross-sectional variations. (e.g., age profile, income levels and professions)
  - The single equation regression may suffer endogeneity problem; but we are not promising causal relationship here.

Reference

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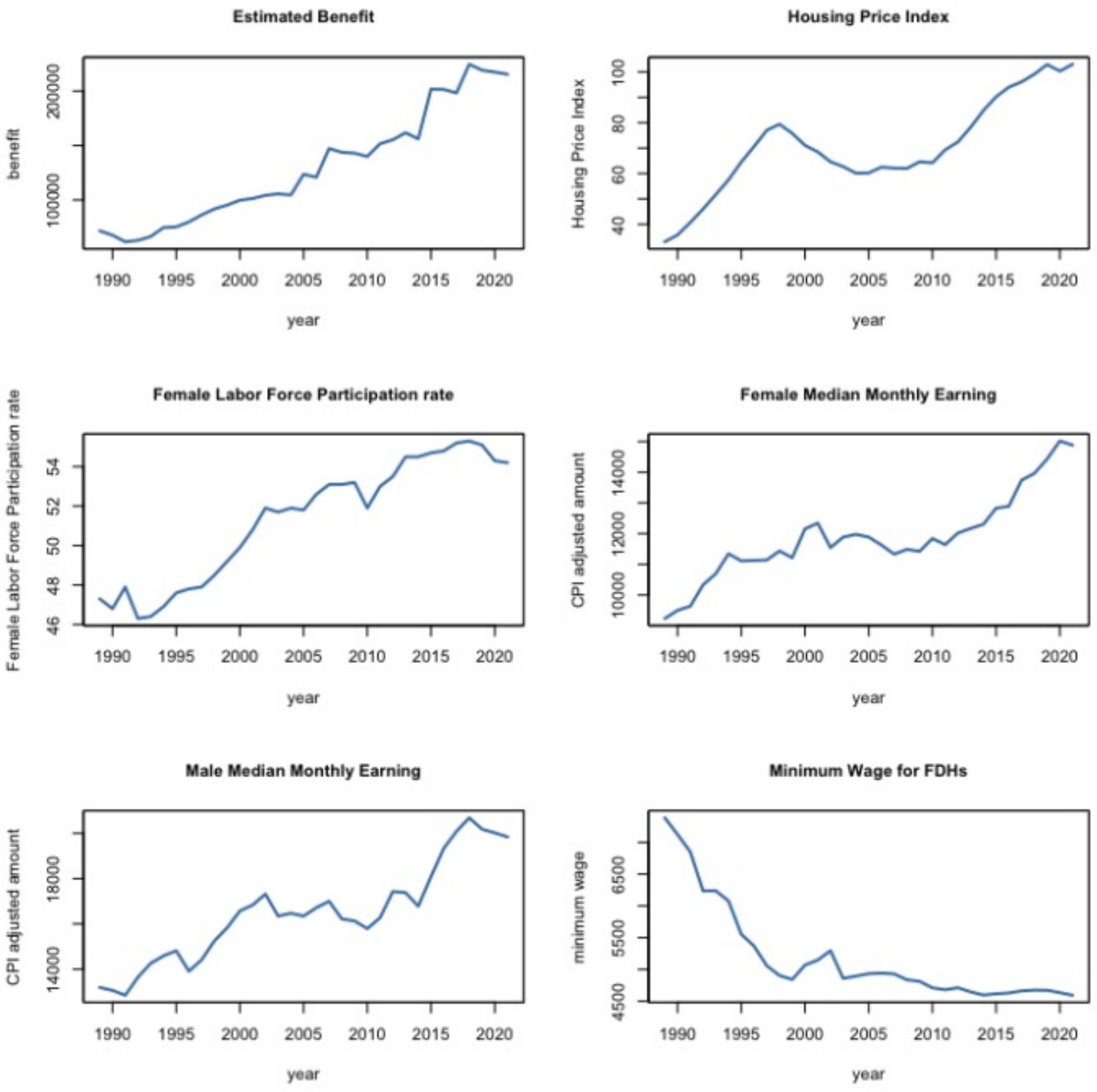
Appendix A: Data source

- Inland Revenue Department:
  - Tax allowance data
- Census and Statistics Department Hong Kong:
  - Total Fertility Rate
  - Housing Price Index
  - Female and male Median Monthly Earnings
  - Female Labor Force Participation Rate
  - Minimum Allowable Wage for FDHs

Time series trends of variables



Appendix B: Unit root tests and Residual diagnosis

Table 2. ADF Tests

Type	H0	Statistics	TFR	HP	FLFPR	FE.adj	ME.adj	MAW.adj	Benefit.adj	5pct CV
No trend no drift	$\gamma=0$	$\tau1$	-1.1342	0.6653	2.1116	2.4951	1.6066	-1.8109	3.2168	-1.95
With drift no trend	$\gamma=0$	$\tau2$	-0.692	-2.2386	-1.2743	-0.7697	-1.3117	-3.7488	-0.2912	-2.93
	$\alpha\_0 = \gamma = 0$	$\varphi1$	0.8571	2.8762	3.1395	3.3929	2.2144	9.2783	5.1086	4.86
With trend with drift	$\gamma=0$	$\tau3$	-0.9794	-3.3933	-1.0649	-1.6312	-2.7057	-2.835	-4.0901	-3.5
	$\_0 = \alpha\_2 = \gamma =$	$\varphi2$	0.9772	4.1674	2.2656	3.0286	3.542	6.2925	10.8427	5.13
	$\alpha\_2 = \gamma = 0$	$\varphi3$	0.8436	5.8174	1.1037	1.3305	3.7419	7.2201	8.3727	6.73

Note: ADF test results, optimal lag length selected using "BIC" Criteria; the last column is the 5% critical value for each statistics.

Appendix B: Unit root tests and Residual diagnosis

Table 3. KPSS tests

CPI adjusted values	
Variables	P-value
TFR	0.1
HP	0.01686
FLFPR	0.01
FE	0.01
ME	0.01
MAW	0.01017
Benefit	0.01

Note: KPSS null = "Level"

Appendix B: Unit root tests and Residual diagnosis

Table 4. Optimal Lag Selection

AIC(n)	HQ(n)	SC(n)	FPE(n)
3	3	3	2

Appendix B: Unit root tests and Residual diagnosis

Table 6. Residual Diagnosis

Model Specifications	Durbin Watson H0: no autocorrelation	Jarque Bera H0: normality	Breusch-Pagan H0: homoscedasticity
Eq (1):	d = 1.783 p-value: 0.2655	$\chi^2 = 0.99567$ p-value: 0.6078	$\chi^2 = 13.524$ p-value: 0.4082
Eq (2):	d = 1.9931 p-value: 0.3422	$\chi^2 = 0.958$ p-value: 0.254	$\chi^2 = 20.113$ p-value: 0.4509
Eq (3):	d = 1.9765 p-value: 2.2e-16	$\chi^2 = 1.7024$ p-value: 0.4269	$\chi^2 = 23.972$ p-value: 0.6319

Note: Both Eq(1) and Eq(2) have a residual free of autocorrelation and non-normality.