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HOW WOULD MOTHERS' DECISION TO WORK AFFECT CHILDBEARING IN MALAYSIA?

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Abstract. The authors analyze the dynamics of fertility and its determinants with a particular focus on the role of female education and working decisions. The analysis is based on multivariate co-integration framework and out-of-sample variance decompositions. Results provide support that in the long run, fertility decline may be the consequence of a complex dynamic interaction with per capita or household income, while self-inflicted female decision to pursue studies and career development may influence fertility decline in the short run for Malaysia. It is evident that both ideational and structural hypothesis explaining fertility are important for understanding fertility decline in Malaysia.
Keywords: Fertility; Labor Force Participation; Education; Income; Malaysia.
JEL Classifications: J1; C4

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ЯК РІШЕННЯ ПОТЕНЦІЙНИХ МАТЕРІВ ПРАЦЮВАТИ ВПЛИВАЄ НА НАРОДЖУВАНІСТЬ У МАЛАЙЗІЇ?
Анотація. Автори проаналізували динаміку народжуваності (фертильності) та її фактори, фокусуючись на ролі жіночої освіти і рішенні працювати. Аналіз базується на багатопараметричному коінтеграційному економетричному моделюванні та декомпозиції змінних поводження за межами вибірки. Результати дозволяють підтвердити, що в довгостроковій перспективі зниження фертильності буде наслідком комплексних динамічних взаємодій показників доходів на капітал і доходів домогосподарств, тоді як падіння народжуваності в короткостроковій перспективі викликано, насамперед, індивідуальними рішеннями жінок продовжувати освіту та досягти кар'єрного росту. Таким чином, стає очевидним, що скорочення народжуваності в Малайзії пояснюють як ідеаторна (пов'язана із логікою та освітою), так і структурна гіпотези.
Ключові слова: народжуваність; інтеграція у трудові ресурси; освіта; дохід; Малайзія.

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КАК РЕШЕНИЕ ПОТЕНЦИАЛЬНЫХ МАТЕРЕЙ РАБОТАТЬ ВЛИЯЕТ НА РОЖДАЕМОСТЬ В МАЛАЙЗИИ?
Аннотация. Авторы проанализировали динамику рождаемости (фертильности) и ее факторы, фокусируясь на роли женского образования и решении работать. Анализ базируется на многопараметрическом коинтеграционном эконометрическом моделировании и декомпозиции переменных поведения за пределами выборки. Результаты позволяют подтвердить, что в долгосрочной перспективе снижение фертильности будет следствием комплексных динамичных взаимодействий показателей доходов на капитал и доходов домохозяйств, тогда как падение рождаемости в краткосрочной перспективе вызвано, прежде всего, индивидуальными решениями женщин продолжить образование и строить карьеру. Таким образом, становится очевидным, что сокращение рождаемости в Малайзии объясняют как идеаторная (связанная с логикой и образованием), так и структурная гипотезы.
Ключевые слова: рождаемость; включенность в трудовые ресурсы; образование; доход; Малайзия.

1. Introduction

In 1982, Tun Dr. Mahathir Mohammad (then, the Prime Minister of Malaysia) announced the 70 Million Population Policy with the aim to build the foundational structure for demand and market of Malaysia's very own industrial products. Then, 30 years ago, this particular policy was sought to achieve a target population of 70 million by the year 2100. Between 1900 and 1985, the population of Malaysia has increased from 2 million to 10 million partly due to mass immigration from China and India and partly by natural birth increases of pre- and post-World War II periods. World Development Report of July 1983 forecasted that Malaysia would have 21 million populations by the year 2000 with the natural increase average 2.0% and the slow fertility rate decrease. Unfortunately, in the year 2000, total population in Malaysia was 16 million people – 5 million less than forecasted value.

Figure 1 shows that the population of Malaysia is increasing at a decreasing rate concomitant with the overall fertility decline throughout 1980 to 2010 which results in smaller family size. The decline in fertility may be attributed to the higher educational levels of the population, increasing urbanization, delayed marriages and improved standards of living. The consistent decrease in the fertility rate also intimidates socioeconomics and demography of the country, especially in realizing the

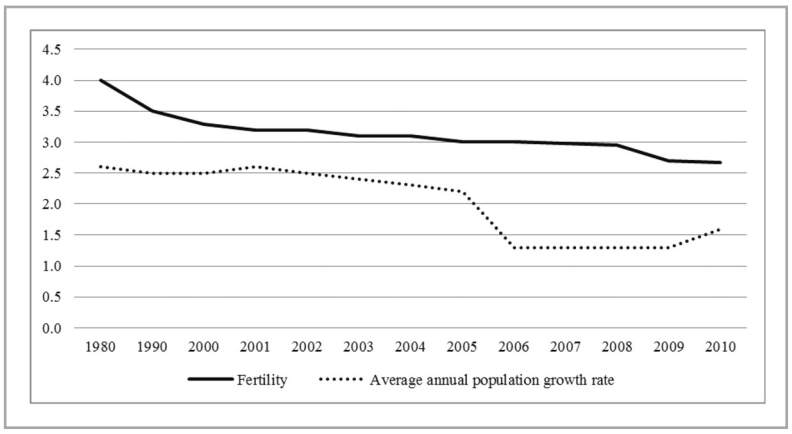

Figure: **Malaysian Annual Population Growth & Fertility Rate (%), 1980-2010**
Source: Department of Statistics, Malaysia & The World Bank

Vision 2020. Being categorized as a developing economy, decline in fertility rate is acceptable but intolerable in the long run, since population is the key strength for the growing economy such as Malaysia. Hence, it is important to understand the causes and dynamic of fertility transitions in Malaysia for further policies improvement, related to population growth in future. A. M. M. Masih and R. Masih (2000) [1] argued that the causes and dynamics of fertility transitions can be divided into the conventional «structural» hypothesis and modernized «ideational» hypothesis which requires the analysis of the data set to be tested within a multivariate causal framework.

In the late 70s and early 90s of the 20th century, the giant Third World countries had been facing modern demographic transitions in countries like Taiwan, Singapore and Korea to name a few (Hirschman & Fernandez, 1980) [2]. Malaysia also demonstrated precipitous decline in its total fertility rate (TFR) from the late 1950s which has continued so far, but in a less rapid manner. Several studies on Malaysia TFR decline and the factors influencing these declines had been carried out and blamed Year-of-the-Dragon (Subramaniam et al., 2012) [3], parents' preferences for the sex of their children (Pong, 1994) [4], rise in female age at marriage (Hirschman, 1986, and Ying, 1992) [5, 6], effective contraception practice (Leete, 1989) [7], age structure, marital pattern and fertility (Lim et al., 1987) [8], and rapid economic growth (Jones, 1990) [9] among others. Most of the studies heavily depend on survey-based qualitative or descriptive analysis instruments in explaining the causes of fertility which subjected to methodological constraint as outlined in A. M. M. Masih, and R. Masih (1996) [10].

Since populations play an important role in contributing to the economy through human development especially in developing economies, it is crucial to understand the dynamic of fertility in Malaysia through a comprehensive analysis that can help future policy formulation to increase fertility, hence the population growth and simultaneously boost the economic growth. The rest of the paper is constructed as follows with section 2 provides the methodology used for the analysis, penultimate sections present the results and the final sections conclude the overall findings.

2. Econometric Methodology

1. Theoretical Framework

The theoretical basis in explaining fertility transitions can be divided into conventional and diffusion hypothesis which differs most importantly in the effect these determinants has on fertility transitions over a period of time (Masih & Masih,1996) [10]. Following J. C. Caldwell (1992) [11], C. Hirschman and P. Guest (1990) [12], J. Cleland and C. Wilson (1987) [13] arguments on fertility declines based on Asian countries proved that family planning and years of mass female schooling are important determinants in influencing the decline in fertility which built new diffusion hypothesis of fertility transitions.

They argued that although initial fertility decline might be influenced by conventional structural socio-economic factors but sufficient explanations of the decline can be sought from infrastructural support which is the components of ideational hypothesis. Based on these arguments, the following theoretical model was postulated to study the causal integration between fertility and its determinants:

$$fert = flfp + gnipp + feet ,$$

where changes in fertility *(fert)* is hypothesized to be subjected to changes in female labor force participation rate *(flfp)*, gross national income per capita *(gnipp)* and female tertiary education enrolment rate *(feet)*.

Female labor force participation rate and GNI per capita are standing as proxies for conventional structural hypothesis while female tertiary education enrolment rate is the proxy for modern ideational hypothesis. All the variables are extracted from the World Bank data center and Department of Statistics, Malaysia.

2. Co-integration

When two or more variables in a system are found to be co-integrated, it is said to have a long-run equilibrium relationships. C. W. J. Granger (2004) [14] pointed out that a pair of integrated series must have the property that a linear combination of them is stationary – they are co-integrated. The co-integration series developed by S. Johansen and K. Juselius (1990) [15] provide a new insight in determining the long-run relationships between variables in a series before proceeding to the Granger causality test. Their test utilizes two likelihood ratios (LR) test statistics for the number of co-integrating vectors: namely the trace test and the maximum eigenvalue test.

The Johansen procedure is well known in the time series literature and the detail explanations are not presented here.

3. Granger Causality in a Vector Error Correction Model

R. F. Engle and C. W. J. Granger (1987) [16] exhibited that once variables are proven to be co-integrated; there will also be the existence of a corresponding ECM representation. This ECM implies that changes in the dependent variable are a function of the level of disequilibrium in the co-integrating relationship which captured by the error correction term as well as changes in other explanatory variables. For co-integrated model, we will test for the Granger causality in Vector Error Correction Model (VECM) by testing the significance of the error-correction term.

4. Forecasting Future Trends

All the estimation procedures explained earlier can be inferred as within-sample estimations which only carter for the variables relationship within the sample period analysed. This weakness can be fixed using variance decompositions (VDC) analysis which may be termed as out-of-sample causality tests. Having established all the relationship from the results, this paper advances to ascertain the relationships found earlier for beyond sample estimation. In order to gauge the relative strength of the variables and the transmission mechanism responses beyond the sample observed, we shocked the system and partitioned the forecast error variance decomposition for each of the variables in the system (Masih & Masih, 1996) [10].

The innovation of the VDCs will be represented in percentage form and strength of five variables to their own shocks and each other are measured by the value up to 100 per cent. A variable that is optimally forecast from its own lagged values will have all its forecast error variance accounted for by its own disturbances (Sims, 1982) [17]. The VDCs are executed using time horizons of 1 to 50 years.

3. Results and Discussion

The multivariate causal analysis were carried out for four structural and policy variables namely fertility rate *(fert)*, female labor force participation rate *(flfp)*, gross national income per capita *(gnipp)* and female tertiary education enrolment rate *(feet)*. Prior to co-integration analysis, pre-requisite of unit root tests was conducted for all the variables under observations and battery of unit root estimations provides consistent results of all variables being stationary in the first difference or $I(1)$. For brevity, unit root results are not provided here but are available upon request.

Results derived from S. Johansen and K. Juselius (1990) [15] multivariate co-integration tests presented in Table 1 indicates that all the variables are co-integrated or show a long- run relationship between them. The evidence of co-integration found in Table 1 rejects spurious correlations and implies that at least one direction of Granger causality will exist between the variables analyzed. Tests of restrictions on coefficients of the co-integrating vectors are illustrated in Table 2 which clearly identifies that all the variables in the system enter the vectors at a statistically significant level or it can be said that all the variables included in the system are appropriate.

Table 1: **Johansen's Test for Multiple Co-integrating Vectors**

Vectors	Hypothesis		Test Statistics	
	H_0:	H_0:	λmax	Trace
[fert, flfp, gnippr, feet]	$r = 0$	$r = 1$	33.13* (0.01)	50.71* (0.03)
	$r \leq 1$	$r = 2$	12.39 (0.51)	17.58 (0.60)
	$r \leq 2$	$r = 3$	5.11 (0.73)	5.19 (0.79)
	$r \leq 3$	$r = 4$	.08 (0.78)	.08 (0.78)

Notes: Asterisks (*) denote statistically significant at 5% level. The lag length (*k*) of one is chosen for the analysis and *r* represents the number of co-integrating vector(s). Figures in the parenthesis are the probabilities of rejection for Johansen tests. The test uses 95 critical values.

Source: Own research

Table 2: **Tests of Restrictions on Coefficients of Co-integrating Vectors**

Vector	Null Hypothesis			χ^2 Statistics
[fert, flfp, gnippr, feet]	*fert*	=	0	16.59* (0.00)
	flfp	=	0	19.15* (0.00)
	gnippr	=	0	18.66* (0.00)
	feet	=	0	17.87* (0.00)

Notes: Asterisks (*) denote statistically significant at 5% level. The statistic is distributed as chi-square with 1 degree of freedom.

Source: Own research

The findings of one co-integrating relationship in the system from the co-integration test will result in corresponding number of residual series and hence error-correction terms (ECTs) in the vector error-correction model (VECM) displayed in Table 3. The VECM tend to indicate that of all the co-integrating variables, it is the GNI per capita variables stand out econometrically exogenous as evidenced through the statistical significance of both the t-statistics and F-statistics values of the error-correction terms and Granger causality analysis respectively. It is evident that in the Granger- causal sense, the GNI per capita is the leading variables being the most exogenous of all and responsible to bring the system back into long-term equilibrium state. It is a support to the logic that household income (proxy of GNI per capita) is the main influence in the decision of working for women and also the ability to afford higher education for women and having kids in the long run. All other co-integrating variables had to bear the burden of short-run adjustment to long-term trend endogenously in different proportions in adjustment towards equilibrium. In this case, it will take approximately 50 years for the system to revert back to equilibrium through GNI per capita.

The Granger causal evidence shows that while GNI per capita can be Granger caused by fertility rate in the short run, female tertiary education enrolment rate female can cause labor force participation rate. The results shows that for the case of Malaysia in the short run, fertility rate (decision to have kids) can influence the GNI per capita of a household. In a modern Malaysian lifestyle, parents have difficulties in having kids not only due to the working pressures, but also to the financial pressure that they have to bear in raising kids. It is also evident that in the short run, female labor force participation rate is encouraged by educated women who have a tertiary education in Malaysia.

These results were further strengthened by the out-of-sample «unanticipated» impact of a variable on its dependent variables and simultaneously on itself. Interestingly, the results shows that the within sample exogenous variable found from VECM is not the same as the exogenous variables explaining «unanticipated» impact outside the sample found from VDC estimations. As highlighted in Table 4, it is clearly indicated that female tertiary education enrolment rate is the most exogenous variable followed by female labor force participation rate in explaining fertility. As shown in Table 4, although in the short run (1 to 2 years in this case) any unprecedented shocks on fertility will be explained by itself, in the long run (30 years onwards in this case), the combination of female tertiary education enrolment rate and female labor force participation rate will explain the shocks in fertility for about 91%.

This dynamic exercise between fertility and its determinants tends to indicate that about 89% to 98% after 30 years will be explained mostly be the combined impact of only two important variables namely, female tertiary education enrolment rate and female labor force participation rate. Unlike the results obtained by A. M. M. Masih and R. Masih (2000) [1], it is evident in Malaysian case that both cognitive and structural interpretation is important in understanding fertility dynamics. Significant impact of tertiary level education enrolment role on reproductive behavior is reflected on decision of female labor to focus on their vocation development rather than development in family structure. N. Abdullah and N. A. A. Bakar (2011) [18] found similar evidence to that of this study and they concluded that women labor force participation rate is negatively related to fertility for Malaysia.

Table 3: **Temporal Causality Results Based on Vector Error-Correction Model (VECM)**

Dependent Variables:	*F*-statistics				*t*-statistics
	Δ*fert*	Δ*flfp*	Δ*gnippr*	Δ*feet*	ECT ($\varepsilon_{1, t-1}$)
Δ*fert*	-	2.18 (0.14)	.20 (0.65)	.28 (0.60)	0.03 [1.63]
Δ*flfp*	0.23 (0.63)	-	.11 (0.74)	6.31 (0.01)*	0.19 [1.30]
Δ*gnippr*	5.45 (0.02)*	0.55 (0.46)	-	0.09 (0.77)	-0.02 [-2.50]*
Δ*feet*	0.26 (0.61)	0.38 (0.54)	.68 (0.41)	-	-0.20 [-0.60]

Notes: Asterisks (*) denote statistically significant at 5% level. The ECTs were derived by normalizing the co-integrating vector on the dependant variables resulting in *r* (in our case = 1) number of residuals for each VECM. *T*-statistics are the estimated t-statistics for ECTs testing the null that they are each statistically insignificant while *F*-statistics shows the asymptotic Granger causal estimations.

Source: Own research

Table 4: **Decompositions of Variance Analysis**

Horizons:	*fert*	*flfp*	*gnippr*	*feet*	cumulative
Panel 1: Fertility					
1	100.00	0.00	0.00	0.00	100
10	40.05	18.88	2.13	38.94	100
20	14.18	29.61	1.83	54.37	100
30	7.24	32.89	1.64	58.23	100
40	4.57	34.27	1.53	59.63	100
50	3.28	34.99	1.46	60.28	100
Panel 2: Female Labor Force Participation Rate					
1	8.12	91.88	0.00	0.00	100
10	6.79	82.47	1.77	8.97	100
20	6.69	80.25	3.81	9.26	100
30	6.02	70.55	5.73	17.70	100
40	5.10	58.53	7.10	29.28	100
50	4.24	47.86	7.93	39.97	100
Panel 3: Gross National Income Per Capita					
1	9.59	4.95	85.46	0.00	100
10	1.44	43.86	9.69	45.01	100
20	1.74	43.20	2.19	52.87	100
30	1.85	42.43	0.94	54.78	100
40	1.91	41.99	0.53	55.57	100
50	1.94	41.72	0.35	56.00	100
Panel 4: Female Tertiary Education Enrolment Rate					
1	4.98	5.43	0.26	89.32	100
10	2.07	18.52	0.46	78.96	100
20	2.11	24.42	0.12	73.36	100
30	2.13	26.82	0.07	70.97	100
40	2.15	28.07	0.08	69.71	100
50	2.16	28.81	0.08	68.95	100

Note: Figures in the first column refer to horizons (i.e. number of years). All other figures are estimates rounded to two decimal places – rounding errors/differences may prevent perfect percentage decomposition in some cases. The variance-covariance matrix of residuals was gauged through Choleski decomposition in order to orthogonalize the innovations across equations.

Source: Own research

4. Conclusion & Policy Implications

This study analyses the dynamics of fertility and its determinants in Malaysia with a particular focus on the role played by female labor force participation rate, gross national income per capita, and female tertiary education enrolment rate. It binds the relationship between fertility and its determinants within a multivariate co-integrated Granger-causal framework. The findings appear to support the arguments that although in the long term fertility decline may be the result of a complex dynamic interaction with per capita or household income, in the short term necessary condition of fertility decline may be attributed to a self-inflicted female decision to pursue studies and develop career for Malaysian case. Indeed, differences may arrived in the sense that religious and cultural differences related to race are taken into consideration since Malaysia consists of multi-ethnic population, however, it is generally accepted that education and career are among the reasons for fertility decline through increasing year of getting married, increasing work stress, increasing ideas of planned family members to name a few. Hence, to achieve 70 million populations by the year 2100, it is important to encourage female-focused policies to ensure that despite being a career woman, having kids will not be a burden for female populations. At the same time, campaign and increase education and awareness on the importance of having children is crucial because sustained decline in fertility rate will also harm the economic and social structure when in the long-run, all the children of Malaysia gone missing!

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