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DOES FINANCIAL DEVELOPMENT CONTRIBUTE TO FERTILITY DECLINE IN MALAYSIA? AN EMPIRICAL INVESTIGATION

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ABSTRACT

The "old-age security" and "complete substitutability" hypotheses suggest that financial market can affect individuals' decision to have less or more children. It has been recognised in the literature that at low level of financial development, children are considered an asset and a form of investment that could provide returns and security during old age. However, at higher level of financial development, individuals have more access to the financial market that can provide funds and financing during old age and as a result the demand for children is less. Furthermore, increase in women labour participation rate in the financial industry as well as in other economic sectors will also induce demand for fewer children. In Malaysia, the development of banks as well as the non-banking financial institutions (NBFIs) has broadened credit accessibility to households and it could affects household's decisions over the number of children they should have. Thus, the present paper empirically investigates the long-run relationship between fertility rate, financial development, income and household consumption in Malaysia for the period 1975 to 2013. In this study we employed the autoregressive distributed lag (ARDL) modelling approach for the testing of cointegration. Our results suggest that financial development and household consumption expenditure are negatively related to fertility, while fertility portrays an inverted *U*-shaped curve with income in Malaysia.

Keywords: Number of children, Fertility choices, Financial development, ARDL, Malaysia

1.0 Introduction

In Malaysia, the development in the banking system and also the shadow banking system has expanded credit availability and accessibility to households and firms. The shadow banking system is a system comprising of the non-bank financial institutions (NBFIs) that facilitate credit intermediation process. They offer services similar to the commercial banks and they compete with the commercial banks in lending funds to the public. In 2012, NBFIs have approved RM43 billion new personal financing facilities, an increase of 63.7% from the previous year. This is more than doubled the loans disbursed by the commercial banks for personal loans at RM19.4 billion in 2012. NBFIs supplied 60% of personal loans to the country while personal loans by the commercial banks clocked in at 9.1% (Bank Negara Malaysia, 2012). Certainly, this situation show that bank financing is considered an important activity since credit becomes a vital source of fund and thus provide future earning or income for the households. In addition, urbanization has increased the cost of household consumption expenditure and living standard of the household especially in the cities and encouraging them to make borrowings and thus, this further led to rapid growth of households' outstanding debt (Banerjee & Duflo, 2007).

On the other hand, fertility decisions of households are determined by the number of childrearing which is considered as one of the household's consumption expenditure. According to Becker and Lewis (1973), parent not only thinking about the quantity of children they have, but also the quality of those children. The quality of children has been related to the human capital accumulation and consumption possibilities of the children (Becker, Murphy & Tamura, 1990). If parents concern about their own human capital acquisition to take on debt to finance their education, they also place an importance consideration on the quality of their children. Since debt fundamentally decrease the resources available to allocate towards children, it may influence the fertility decision through a trade-off between one's own debt and the desired child's quality or quantity. Similarly, the importance of consumption expenditure on raising children was stressed by Kim, Engelhardt, Prskawetz and Aassve (2009) and they conclude that more number of children will negatively affect the household's consumption expenditure such as on children's education.

Nevertheless, as financial development spread worldwide, the opportunity and accessibility (the so-called financial inclusion) to the credit market has widened for households and firms. In the meantime, fertility shows a downward trend which is a cause for concern in most of the countries especially in the developed and developing countries that will be facing decreasing populations in the future (see Figure 1). Generally, we observed that trend in fertility rates have been on a declining trend irrespective whether in high, middle or low income countries.

Similarly, it is happening in Malaysia as economic development and financial development shows increasing in trend, while fertility rate is reducing (see Figure 2 and Figure 3). Malaysia shows a striking example of this pattern. Over the last five decades, Malaysia has experienced impressive progress in both economic development and financial sector development together with a dramatic fertility decline. Generally, Malaysia's real gross domestic product (GDP) per capita has increased by more than four times over the period 1961 to 2013, and total fertility rate fell by around 50% over the same period. This dynamic nature of the socio-economic changes and financial development combined with a large population has attracted considerable interest among researchers and policymakers. Our main questions are: Do these two phenomena show a spurious correlation or is it one causes the other? More importantly, does financial development as one of the driving forces that changes fertility behaviour in Malaysia?

Thus, the purpose of this study is to examine the relationship between fertility, financial development, income and household consumption expenditure for both in the short-run and long-run in Malaysia for the period of 1975-2013 by using the popular autoregressive distributed lag (ARDL) estimation method. Specifically, the results show, overwhelmingly that financial development (proxy by the ratios of M2 to GDP, M3 to GDP and domestic credit to the private sector to GDP) does influence the desired number of children among households in Malaysia.

The paper is organized as follow. In the next section we provide some related literature linking financial development and fertility rates. In section 3, we present the model of fertility incorporating measures of financial development in the study. In section 4, we discuss the empirical results and the last section contains our conclusion.

2.0 Litrerature Review

2.1 Fertility and Financial Development

Previous theoretical framework on the economics of fertility developed by Becker (1960), Leibenstein (1957) and Robinson and Horlacher (1971) relate the theory of consumer behaviour and childbearing. The microeconomic theory of fertility highlights the demand for children as the key to understanding fertility behaviour. It also takes into account the costs of controlling fertility. This conventional theory of consumer behaviour interpret individual is trying to maximize satisfaction given a range of goods, prices and his tastes and income. In the application of the theory of fertility, children are viewed as a special kind of goods and fertility is seen as a response to the consumer's demand for children relative to other goods (Easterlin, 1975). Later, Becker and Barro (1988) used dynamic altruistic model of fertility choice, consists of three conventional predictions and conclude that: (i) fertility is dependent of family income; (ii) children are a net financial burden to society; and (iii) individual consumption is negatively associated to individual income.

Recently, economists recognized that fertility choice should be responsive to financial development. The theoretical and empirical works of Cigno and Rosati (1992, 1996), Lehr (1999) and Filoso and Papagni (2011) emphasize the association between fertility and financial development. Basically these authors argued that accessibility to the financial market has adverse effects on fertility choice among households. Nevertheless, the empirical studies in relating financial development and fertility are still lacking. However, the works by Cigno and Rosati (1992), Filoso and Papagni (2011), Kuchler (2012) and Lehr (1999) had explored the possible link between fertility and financial development or the banking sector. Cigno and Rosati (1992) test the "old-age security" hypothesis by examining the saving and fertility decisions that are affected by the availability and attractiveness of market-based or state-provided alternatives to the family as a source of old age support. They employ the cointegration approach proposed by Engle and Granger (1987) to identify the long-run relationship between fertility rate and financial sector development in Italy for the period of 1960 to 1984. Their finding suggests that increase in social security coverage has a negative effect on fertility rate and a positive effect on saving. Further, greater access to the capital market is found to have negative effect on both fertility and saving. On the other hand, Billari and Galasso (2010) investigate the impact of pension reforms on fertility decisions in Italy for the period of 1970-2006; and found out that pension funds and fertility is negatively related in which individual who has less access to financial market tend to demand for more children.

Availability of credit and opportunity for financial investment are also found to influence fertility decisions. The "complete substitutability" hypothesis put forward by Cigno (1993), Lehr (1999) and Filoso and Papagni (2011) suggest that financial market is a substitute for children. According to these proponents, financial development provides funds and opportunities in investing in financial market that give returns that is much greater than the returns from raising children. Since the benefits of investing in financial markets are greater than returns from bearing and raising children, some household will reduce fertility as an investment. Furthermore, according to Lehr (1999), apart from providing investment opportunities to households, financial intermediation also influences fertility by raising market wages. Precisely, the improvement and development in the financial intermediation sector has facilitate the movement of labour from the traditional to the modern sector and contributing to the fertility decline experienced by many developing countries. The traditional sector is characterise with low output and low wages; but as firms are more accessible to the credit market as financial sector develop further, firms are able to raise output efficiently and as a result wages will also increase. The increase in wages in the modern sector will ultimately shift labour from the traditional to the modern sector and also will increase more women to participate in the labour market. Increase in women labour participation rate will ultimately reduce fertility rates.

Empirical work by Filoso and Papagni (2011) on 145 countries for the period 1980 to 2006 using panel fixed effect model; found out that households' greater demand for credit is at the expense of reducing fertility in poor countries, but increase fertility in high income countries. A recent study by Habibullah, Farzaneh and Din (2016) corroborate the findings by Filoso and Papagni (2011) in which they found out that financial development affect fertility positively in high-income countries, but for the low-income countries, financial development adversely affecting fertility rate. Similarly, Zakaria, Fida, Janjua and Shahzad (2017) found out that financial development has negative impact on fertility rates in Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. By employing the fully modified OLS (FMOLS) and dynamic OLS (DOLS) on a panel of these seven South Asian countries, they conclude that a 10% increase in financial development, fertility on average will decrease by 0.66 (FMOLS) to 0.74 (DOLS) births per woman.

3.0 Methodology

3.1 The Estimating Model

The theoretical work on the economics of fertility was earlier introduced by Leibenstein (1957) and Becker (1960); and later, Cigno and Rosati (1992), Lehr (1999) and Filoso and Papagni (2011) relate the association between financial development and fertility. In this study, we present the following fertility model for Malaysia for estimations,

$$\mathrm{LFERT_t} = \theta_0 + \theta_1 \mathrm{LRYPC_t} + \theta_2 \mathrm{LRYPC_t^2} + \theta_3 \mathrm{LFINDEV_{jt}} + \theta_4 \mathrm{LHCONSP_t} + \varepsilon_t \qquad (1)$$

where LFERT, θ's and ε denote total fertility rate, vectors of estimated coefficients and disturbance term, respectively; LRYPC is real GDP per capita to proxy for income or economic development; while LRYPC^2 is real GDP per capita squared; $\mathrm{LFINDEV_j}$ denotes financial development which will be proxy by three measures of financial sector development indicators, namely, ratio of money supply M1 to GDP (LM2Y), ratio of money supply M3 to GDP (LM3Y) and ratio of domestic credit to the private sector to GDP (LDCY); and LHCONSP is the ratio of household consumption expenditure to GDP. All variables are in logarithm and denote by L.

The relationship between fertility rate and income per capita has received a great deal of attention from the researchers. Higher levels of women participation in the labour force, higher urbanization rate and higher income per capita are associated with lower fertility rate. Filoso and Papagni (2011) found that an increase in GDP per capita is related to lower fertility rate. This result is consistent with the findings of other studies by Ha, Lim and Hwang (2012), Hafner and Mayer (2012), and Tournemaine and Luangaram (2012). The early work of Thomas and Price (1999) suggest negative correlation between fertility and income distribution at both the national and regional level. In addition, Abernethy (1991) argue that declining fertility is the reason for poverty. On the other hand, Angeles (2010) employs the Arellano and Bond (1991) difference-GMM estimator and found that the impact of GDP per capita on fertility is, however, statistically insignificant.

Nevertheless, we would expect a *priori* that $\theta_3, \theta_4 < 0$, and the relationship between fertility and income per capita to exhibit an inverted *U*-shaped curve as proposed by Dahan and Tsiddon (1998) with $\theta_1 > 0$ and $\theta_2 < 0$. According to Dahan and Tsiddon (1998), in the early stage of economic development, the income gap between the poor and the rich is widening. The poor comprises of uneducated parents while the rich are educated parents. The educated parents have fewer children than the uneducated parents. This is because the net return to education of the child of an educated parent is higher than the net return to education of the child of the uneducated parent, and the costs of raising children are measured in terms of parents' forgone earnings. In other words, there is a trade-off between the number of children and the quality of children. Further, Dahan and Tsiddon (1998) predicted that as long as the children of uneducated parents choose to remain uneducated, fertility is high and the supply of uneducated individuals' increases faster than the supply of educated individuals. When the uneducated parents foresee the higher net return to education, they are willing to sacrifice fewer children over having many children. Consequently, the overall level of education rises, fertility declines, income inequality narrowing and output per capita increases. Since the economy is dominates with poor parents in the early stage, but less poor parents in the second stage, therefore, the economy wide average rate of fertility first increases and subsequently declines, thus, an inverted *U*-shaped curve emerges.

The vast majority of empirical studies on the relationship between fertility and household expenditure suggest a negative relationship, consistent with prior expectation since the resources available are divided among more household members. The study by Desta (2014) document the effects of the number of children on consumption among Ethiopian households. The sample survey on rural and urban married women and by employing a two-stage least square (2SLS) method, their results confirm the theoretical prediction that the effect of having large number of children and therefore increase consumption expenditure of households is negative for rural households, whereas results for urban households are not as clear. Kim, Engelhardt, Prskawetz and Aassve (2009) found household preference for consumption of private goods such as children's education is negatively associated with fertility; it support the model of unitary household as a valid assumption for examining the relationship between fertility and household consumption. The estimate shows that new baby born between 1993 to 1997 experience 20% reduction of household consumption in Indonesia.

3.2 Method of Estimation

The present study employs the ARDL bounds testing approach as an estimation technique. The ARDL approach proposed by Pesaran, Shin and Smith (2001) has been applied widely in many fields of study. The method was selected due to a number of attractive features over other cointegration methods such as Engle and Granger (1987) and Johansen and Juselius (1990). The main advantage of ARDL approach is that it is applicable irrespective of whether the underlying series are I(0), I(1) or mutually cointegrated while the other standard cointegration approaches such as Engle-Granger (1987) and Johansen-Juselius (1990) require that variables be integrated at same level of integration. Nevertheless, the bounds test for cointegration is invalid when there is I(2). Second, the ARDL approach is relatively more efficient in small sample size compare to other approaches. Finally, it allows estimating both the short-run and long-run relationships at the same time which are important in economic analysis.

Long-run relationship is determined by specifying an ARDL 'unrestricted error-correction model' (ARDL-URECM) or the conditional ECM model. The model is estimated in order to examine whether $LRYPC_t$, $LRYPC_t^2$, $LFINDEV_{jt}$ and $LHCONSP_t$ are long-run forcing variables for $LFERT_t$ as shown in Equation (2).

$$\begin{aligned}\Delta LFERT_t = {} & \alpha_0 + \textstyle\sum_{i=1}^{n} \alpha_{1i}\Delta LFERT_{t-i} + \sum_{i=0}^{n} \alpha_{2i}\Delta LRYPC_{t-i} + \sum_{i=0}^{n} \alpha_{3i}\Delta LRYPC_{t-i}^2 \\ & + \textstyle\sum_{i=0}^{n} \alpha_{4i}\Delta LFINDEV_{jt-i} + \sum_{i=0}^{n} \alpha_{5i}\Delta LHCONSP_{t-i} + \beta_1 LFERT_{t-1} \\ & + \beta_2 LRYPC_{t-1} + \beta_3 LRYPC_{t-1}^2 + \beta_4 LFINDEV_{jt-1} + \beta_5 LHCONSP_{t-1} + v_t \qquad (2)\end{aligned}$$

By using the ARDL bounds test for cointegration, the null hypothesis of non-existence of long-run relationship (no cointegration) among the variables is tested on the null hypothesis, H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ against the alternative that, H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$. Two asymptotic critical bounds provide test for cointegration when the independent variables are integrated of the order I(d) with $0 \leq d \leq 1$. The lower bound applies if the regressors are I(0) and the upper bound for I(1). If the F-statistics lies above the upper level of the band, the null is rejected, indicating cointegration. If the F-statistics lies below the lower level band, the null hypothesis of no cointegration cannot be rejected, supporting the absence of cointegration. If the F-statistics fall within the lower and upper bound critical values, inference would be inconclusive.

We can derive the long-run model (which is our main interest) as per Equation (1) by estimating the following ARDL model:

$$LFERT_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} LFERT_{t-i} + \sum_{i=0}^{n} \gamma_{2i} LRYPC_{t-i} + \sum_{i=0}^{n} \gamma_{3i} LRYPC_{t-i}^2 + \sum_{i=0}^{n} \gamma_{4i} LFINDEV_{jt-i} + \sum_{i=0}^{n} \gamma_{5i} LHCONSP_{t-i} + \mu_t \quad (3)$$

By re-arranging and collecting the terms, we have the long-run model for fertility when, $\theta_0 = \frac{\gamma_0}{1-\sum \gamma_{1i}}$, $\theta_1 = \frac{\sum \gamma_{2i}}{1-\sum \gamma_{1i}}$, $\theta_2 = \frac{\sum \gamma_{3i}}{1-\sum \gamma_{1i}}$, $\theta_3 = \frac{\sum \gamma_{4i}}{1-\sum \gamma_{1i}}$, and $\theta_4 = \frac{\sum \gamma_{5i}}{1-\sum \gamma_{1i}}$.

Thus, by estimating Equation (3) and deriving the long-run Equation (1) from it, avoid us from directly estimating Equation (1) using OLS because estimating non-stationary variables and/or variables of mixed order of integration will results in spurious regression unless the variables are cointegrated. The ARDL procedure proposed by Pesaran et al. (2001) by estimating Equation (3) thus provide an alternative way to circumvent this problem, provided that there is cointegration among the variables.

The short-run relationship can be obtained by estimating the error-correction model. Thus, the error-correction representations of the ARDL specification model can be specify as follows:

$$\Delta LFERT_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i} \Delta LFERT_{t-i} + \sum_{i=0}^{n} \delta_{2i} \Delta LRYPC_{t-i} + \sum_{i=0}^{n} \delta_{3i} \Delta LRYPC_{t-i}^2 + \sum_{i=0}^{n} \delta_{4i} \Delta LFINDEV_{jt-i} + \sum_{i=0}^{n} \delta_{5i} \Delta LHCONSP_{t-i} + \lambda ECM_{t-1} + w_t \quad (4)$$

where Δ denotes first-difference operator, $ECMt_{t-1}$ is the lagged one-period residual, ε_{t-1}, from the cointegrating equation as per Equation (1) above. The significant of the error-correction ($ECMt_{t-1}$) term also indicates cointegration, and λ measures the speed of adjustment and the deviation from long-run equilibrium. Diagnostic tests for serial correlation, normality of the error term and heteroscedasticity are conducted to ascertain the goodness of fit of the ARDL model.

3.3 Sources of data

This study uses Malaysian annual time series data from the period 1975 to 2013. Times series data for total fertility rate (FERT), real GDP (constant 2010 US dollars) per capita (RYPC), ratio of money supply M2 to GDP (M2Y), ratio of domestic credit to the private sector to GDP (DCY) and ratio of household final consumption expenditure to GDP (HCONSP) were collected from the World Development Indicator (WDI), World Bank database at https://data.worldbank.org/indicator?tab=all. Data for the ratio of money supply M3 to GDP (M3Y) was collected from various issues of the Monthly Statistical Bulletin published by Bank Negara Malaysia. All variables were transformed into natural logarithm for all analysis.

4. Results and Discussions

To estimate Equation (1) we first determine the order of integration of all variables in the equation. Elliott, Rothenberg and Stock (1996) proposed an efficient test, modifying the Dickey-Fuller test statistic using a generalized least squares (GLS) procedure. They demonstrate that this modified test has the best overall performance in terms of small-sample size and power, conclusively dominating the standard Dickey-Fuller test (Dickey and Fuller, 1981). In particular, Elliott et al. (1996: 813) find that their "DF-GLS test has substantially improved power when an unknown mean or trend is present." The unit root test results using the DF-GLS procedure are presented in Table 1, with column 2 and column 3 for series in levels and column 3 and column 4 presenting the series in first-differences. Results in Table 1 clearly indicate that all variables are $\mathrm{I}(1)$, that is the series becomes stationary after first-differencing. These results clearly suggest that all variables are non-stationary in levels and there is absence of I(2) variable that could invalid the Pesaran et al. (2001) bounds testing procedure.

The results of the bounds test for cointegration are shown in Tables 2, 3 and 4. In Table 2 we present the results with financial development indicator proxy by the ratio of money supply M2 to GDP; Table 3 with the ratio of domestic credit to the private sector to GDP as proxy for the financial development indicator; while the ratio of money supply M3 to GDP use to proxy for financial development indicator is presented in Table 4. In all three tables we show the results of estimating Equation (2) for the bounds test for cointegration in Panel A. In Panel B we present the long-run model as per Equation (1) by estimating Equation (3). The diagnostics test shown below the long-run model refers to the tests result for the estimated ARDL model as per Equation (3). In Panel C we present the short-run model for fertility by estimating Equation (4) above. In all estimations, to determine the optimal lag length, n, we employ the Akaike information criterion (AIC) – where ARDL(2,2,3,3,0) for fertility model with M2Y, ARDL(2,3,3,3,1) for fertility model with DCY, and ARDL(2,2,3,2,2) for fertility model with M3Y.

From Tables 2, 3 and 4, as shown in Panel A, the null hypothesis of no cointegration is rejected at 1% level of significance since the ARDL bounds test F-statistics equal 70.155 for M2Y, 84.530 for DCY and 68.333 for M3Y; which fall above the upper bound of the asymptotic critical value tabulated in Narayan (2005). The result suggests that there is cointegration or long-run relationships between all the variables in the fertility model. The results imply that income, income squared, financial development and household consumption expenditure move together with fertility rates over time in Malaysia during the period under investigation. Moreover, cointegration between fertility and its determinants are further supported by the results of the short-run model or the error-correction model as shown in Panel C. The significance of the $\mathrm{ECM_t}$ term and with negative sign suggests cointegration among the variables. Clearly, in all three cases, we observed that the error-correction terms are statistically significant at the 1% level, thus indicate that the long-run relationships between fertility and its determinants were established.

The long-run model presented in Panel B is our model of interest. The estimated parameters are the long-run coefficients or elasticities since all variables are in logarithm. Our results for the long-run models suggest that for all three indicators of financial development, the long-run relationship between fertility rate and income or economic development in Malaysia demonstrate an inverted *U*-shaped curve. The two variables are significant at the 1% level for all three indicators. This non-linear relationship between fertility rate and economic development (measured by real GDP per capita) support the contention proposed by Dahan and Tsiddon (1998) that in the process of economic development, fertility (and income distribution) follow an inverted *U*-shaped curve. This implies that at lower level of income or economic development fertility rate increases, but as income increases or economic development progresses, fertility rate decreases suggesting households prefer quality children rather than quantity of children. The non-linear relationships between fertility and economic development are robust between the three measures of financial development indicators.

As for the effects of financial development on fertility, our results clearly suggest that variables LM2Y (in Table 2), LDCY (in Table 3) and LM3Y (in Table 4) are statistically significant at the 1%, 5% and 10% level respectively, and with negative sign. These results clearly indicate that financial development has contributed to the declining rate in fertility in Malaysia during the period under study. The results suggest that, for M2Y, a 10% increase in financial development will reduce fertility rate by 1.0%; while for DCY, a 10% in increase in the level of financial development will result in fertility decline by 1.6%; and for M3Y, fertility rate dropped by 1.68% when there is an increase of 10% in the level of financial development in Malaysia. Our findings on the negative impact of the financial development on fertility corroborate and consistent with earlier results found by Billari and Galasso (2010), Cigno and Rosati (1992), Lehr (1999) and more recently by Zakaria et al. (2017).

Lastly, our results also indicate that household consumption expenditure, LHCONSP, exhibit negative impact on fertility rate in Malaysia. LHCONSP is statistically significant at the 1% level in Tables 2 and 3, while it is significant at the 10% level in Table 4. Nevertheless, the sign is consistently negative suggesting that increase in household consumption expenditure will result in the decrease in the fertility rate. For example, a 10% increase in household consumption expenditure will decrease fertility rate by 2.9% (with M3Y) to 3.8% (with DCY).

5. Conclusion

This study examines the association between fertility rate and financial development using annual time series data for Malaysia covering the period from 1975 to 2013 by employing the ARDL bounds testing for cointegration. The finding suggests that the variables under study namely, real GDP per capita (proxy for income or economic development) and real GDP per capita squared (proxy for non-linear relationship between fertility and economic development), financial development (proxy by ratio of M2 to GDP, ratio of domestic credit to the private sector to GDP, and ratio of M3 to GDP) and household consumption expenditures (ratio to GDP) are bound together in the long-run. Our results show that an increase in the level of financial development and household consumption expenditures reduces fertility in Malaysia. This would suggest that the development of the banking system as well as the shadow banking system that provide credit accessibility to households is playing a very significant role in determining the desired number of children in Malaysia in the long-run. Last but not least, our study found out that the relationship between fertility rate and economic development is a non-linear fashion. Increase economic development increases fertility at first, but until to a certain optimal point ever increasing economic development will result in declining fertility rate.

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Table 1. Results of DF-GLS unit root tests

Series	Level:		First-difference:	
	Constant	Constant & trend	Constant	Constant & trend
$LFERT_t$	0.039 (4)	-2.541 (4)	-2.081** (3)	-3.401** (6)
$LRYPC_t$	0.777 (1)	-1.787 (0)	-5.731*** (0)	-6.008*** (0)
$LRYPC_t^2$	0.890 (1)	-2.109 (0)	-5.949*** (0)	-6.052*** (0)
$LM2Y_t$	-0.759 (0)	-2.289 (0)	-5.659*** (0)	-6.372*** (1)
$LDCY_t$	-0.207 (1)	-1.197 (1)	-4.550*** (0)	-5.230*** (0)
$LM3Y_t$	-0.002 (0)	-1.529 (0)	-2.494** (0)	-4.107*** (0)
$LHCONSP_t$	-1.094 (0)	-1.701 (0)	-7.094*** (0)	-7.364*** (0)

Notes: Variables LFERT, LRYPC, LRYPC-squared, LM2Y, LDCY, LM3Y and LHCONSP denote respectively, fertility rate, real GDP per capita, real GDP per capita squared, ratio of money supply M2 to GDP, ratio of domestic credit to the private sector to GDP, ratio of money supply M3 to GDP, and ratio of household consumption expenditure to GDP. L denotes natural logarithm. Asterisks (***), (**), (*) denote statistically significant at 1%, 5% and 10% level, respectively. The optimal lag length in round brackets, (.) was chosen based on Schwarz criterion (SC).

Table 2. ARDL estimation results for cointegration, long-run and short-run models, with M2Y as proxy for financial development

Dependent variable	Independent variables:						
Panel A: Conditional ECM model, ARDL(2,2,3,3,0):							
$\Delta LFERT_t$	Constant	$LFERT_{t-1}$	$LRYPC_{t-1}$	$LRYPC_{t-1}^2$	$LM2Y_{t-1}$	$LHCONSP_{t-1}$	$\Delta LFERT_{t-1}$
	-0.7156***	-0.0637***	0.2548***	-0.0177***	-0.0062**	-0.0192***	1.0107***
	(-4.2800)	(-15.592)	(6.0703)	(-6.8062)	(-2.8410)	(-3.0905)	(51.858)
	$\Delta LRYPC_t$	$\Delta LRYPC_{t-1}$	$\Delta LRYPC_t^2$	$\Delta LRYPC_{t-1}^2$	$\Delta LRYPC_{t-2}^2$	$\Delta LM2Y_t$	$\Delta LM2Y_{t-1}$
	-0.0094	-0.1554	0.0004	0.0116	0.0015***	0.0003	0.0038**
	(-0.0716)	(-1.2787)	(0.0584)	(1.5718)	(4.0197)	(0.1577)	(2.4666)
	$\Delta LM2Y_{t-2}$						
	0.0039**						
	(2.7088)						
Bounds F-stats=70.155***							
Panel B: Long-run relation, ARDL(2,2,3,3,0):							
$LFERT_t$	Constant	$LRYPC_t$	$LRYPC_t^2$	$LM2Y_t$	$LHCONSP_t$		
	-11.217***	3.9948***	-0.2790***	-0.0977***	-0.3023***		
	(-4.6530)	(7.3035)	(-8.5854)	(-2.9172)	(-3.4092)		
$\bar{R}^2$= 0.999	LM(1)=0.055 [0.814]		ARCH(1)=0.002 [0.959]		JB=1.625 [0.443]		
Panel C: Short-run relation, ARDL(2,2,3,3,0):							
$\Delta LFERT_t$	$\Delta LFERT_{t-1}$	$\Delta LRYPC_t$	$\Delta LRYPC_{t-1}$	$\Delta LRYPC_t^2$	$\Delta LRYPC_{t-1}^2$	$\Delta LRYPC_{t-2}^2$	$\Delta LM2Y_t$
	1.0107***	-0.0094	-0.1554*	0.0005	0.0116**	0.0015***	0.0003
	(117.08)	(-0.1187)	(-2.0329)	(0.0964)	(2.4837)	(5.7426)	(0.2301)
	$\Delta LM2Y_{t-1}$	$\Delta LM2Y_{t-2}$	ECM_{t-1}				
	0.0038***	0.0039***	-0.0637***				
	(3.4814)	(3.3612)	(-22.552)				
$\bar{R}^2$= 0.995							

Notes: Asterisks (***), (**) and (*) indicate statistically significant at 1%, 5%, and 10% significance level, respectively. LM(.), ARCH(.) and JB (.) are Lagrange multiplier test for residual serial correlation, ARCH test for heteroscedasticity, and test for normality of the residuals, respectively. Figures in round (.) brackets are *t*-statistics, and figures in square [.] brackets are *p*-values.

Table 3. ARDL estimation results for cointegration, long-run and short-run models, with DCY as proxy for financial development

Dependent variable	Independent variables:						
Panel A: Conditional ECM model, ARDL(2,3,3,3,1):							
$\Delta LFERT_t$	Constant	$LFERT_{t-1}$	$LRYPC_{t-1}$	$LRYPC^2_{t-1}$	$LDCY_{t-1}$	$LHCONSP_{t-1}$	$\Delta LFERT_{t-1}$
	-1.0778***	-0.0535***	0.3353***	-0.0221***	-0.0086***	-0.0203***	0.9932***
	(-5.0766)	(-9.1985)	(6.7597)	(-7.6663)	(-2.8958)	(-3.0123)	(47.876)
	$\Delta LRYPC_t$	$\Delta LRYPC_{t-1}$	$\Delta LRYPC_{t-2}$	$\Delta LRYPC^2_t$	$\Delta LRYPC^2_{t-1}$	$\Delta LRYPC^2_{t-2}$	$\Delta LDCY_t$
	-0.0670	-0.3606**	-0.1658	0.0039	0.0235**	0.0112	-0.0021
	(-0.5261)	(-2.5105)	(-1.2969)	(0.5228)	(2.7624)	(1.4764)	(-0.5927)
	$\Delta LDCY_{t-1}$	$\Delta LDCY_{t-2}$	$\Delta LHCONSP_{t-1}$				
	0.0059**	0.0036	-0.0116*				
	(2.4217)	(1.4427)	(-1.8358)				
Bounds F-stats=84.530***							
Panel B: Long-run relation, ARDL(2,3,3,3,1):							
$LFERT_t$	Constant	$LRYPC_t$	$LRYPC^2_t$	$LDCY_t$	$LHCONSP_t$		
	-20.111***	6.2581***	-0.4142***	-0.1604**	-0.3797***		
	(-3.8450)	(4.8360)	(-5.3966)	(-2.3092)	(-3.3347)		
$\bar{R}^2$= 0.999	LM(1)=1.358 [0.243]		ARCH(1)=0.327 [0.567]		JB=4.478 [0.106]		
Panel C: Short-run relation, ARDL(2,3,3,3,1):							
$\Delta LFERT_t$	$\Delta LFERT_{t-1}$	$\Delta LRYPC_t$	$\Delta LRYPC_{t-1}$	$\Delta LRYPC_{t-2}$	$\Delta LRYPC^2_t$	$\Delta LRYPC^2_{t-1}$	$\Delta LRYPC^2_{t-2}$
	0.9932***	-0.0670	-0.3606***	-0.1658**	0.0039	0.0235***	0.0112**
	(129.05)	(-0.8323)	(-4.8218)	(-2.4547)	(0.8213)	(5.2085)	(2.7467)
	$\Delta LDCY_t$	$\Delta LDCY_{t-1}$	$\Delta LDCY_{t-2}$	$\Delta LHCONSP_{t-1}$	ECM_{t-1}		
	-0.0021	0.0059***	0.0036**	-0.0116**	-0.0535***		
	(-1.0329)	(2.8276)	(2.0911)	(-2.5633)	(-24.948)		
$\bar{R}^2$= 0.996							

Notes: Asterisks (***), (**) and (*) indicate statistically significant at 1%, 5%, and 10% significance level, respectively. LM(.), ARCH(.) and JB (.) are Lagrange multiplier test for residual serial correlation, ARCH test for heteroscedasticity, and test for normality of the residuals, respectively. Figures in round (.) brackets are *t*-statistics, and figures in square [.] brackets are *p*-values.

Table 4. ARDL estimation results for cointegration, long-run and short-run models, with M3Y as proxy for financial development

Dependent variable	Independent variables:						
Panel A: Conditional ECM model, ARDL(2,2,3,2,2):							
$\Delta LFERT_t$	Constant	$LFERT_{t-1}$	$LRYPC_{t-1}$	$LRYPC^2_{t-1}$	$LM3Y_{t-1}$	$LHCONSP_{t-1}$	$\Delta LFERT_{t-1}$
	-0.8014***	-0.0550***	0.2630***	-0.0176***	-0.0092**	-0.0158*	0.9852***
	(-3.8178)	(-11.665)	(5.4083)	(-6.3141)	(-2.1431)	(-1.7754)	(39.174)
	$\Delta LRYPC_t$	$\Delta LRYPC_{t-1}$	$\Delta LRYPC^2_t$	$\Delta LRYPC^2_{t-1}$	$\Delta LRYPC^2_{t-2}$	$\Delta LM3Y_t$	$\Delta LM3Y_{t-1}$
	0.0187	-0.2334*	-0.0008	0.0162*	0.0012**	0.0022	0.0127***
	(0.1495)	(-1.7805)	(-0.1128)	(2.0637)	(2.7604)	(0.3791)	(2.8425)
	$\Delta LHCONSP_t$	$\Delta LHCONSP_{t-1}$					
	-0.0116	-0.0113*					
	(-1.5349)	(-1.8184)					
Bounds F-stats=68.333***							
Panel B: Long-run relation, ARDL(2,2,3,2,2):							
$LFERT_t$	Constant	$LRYPC_t$	$LRYPC^2_t$	$LM3Y_t$	$LHCONSP_t$		
	-14.560***	4.7782***	-0.3211***	-0.1680*	-0.2887*		
	(-3.3518)	(4.6546)	(-5.4617)	(-1.9226)	(-1.8955)		
$\bar{R}^2$= 0.999	LM(1)=0.319 [0.572]		ARCH(1)=0.066 [0.796]		JB=0.555 [0.757]		
Panel C: Short-run relation, ARDL(2,2,3,2,2):							
$\Delta LFERT_t$	$\Delta LFERT_{t-1}$	$\Delta LRYPC_t$	$\Delta LRYPC_{t-1}$	$\Delta LRYPC^2_t$	$\Delta LRYPC^2_{t-1}$	$\Delta LRYPC^2_{t-2}$	$\Delta LM3Y_t$
	0.9852***	0.0187	-0.2334***	-0.0008	0.0162***	0.0012***	0.0022
	(118.49)	(0.2272)	(-2.9120)	(-0.1708)	(3.3420)	(3.5352)	(0.5875)
	$\Delta LM3Y_{t-1}$	$\Delta LHCONSP_t$	$\Delta LHCONSP_{t-1}$	ECM_{t-1}			
	0.0127***	-0.0116**	-0.0113**	-0.0550***			
	(3.8452)	(-2.0924)	(-2.4821)	(-22.341)			
$\bar{R}^2$= 0.995							

Notes: Asterisks (***), (**) and (*) indicate statistically significant at 1%, 5%, and 10% significance level, respectively. LM(.), ARCH(.) and JB (.) are Lagrange multiplier test for residual serial correlation, ARCH test for heteroscedasticity, and test for normality of the residuals, respectively. Figures in round (.) brackets are *t*-statistics, and figures in square [.] brackets are *p*-values.

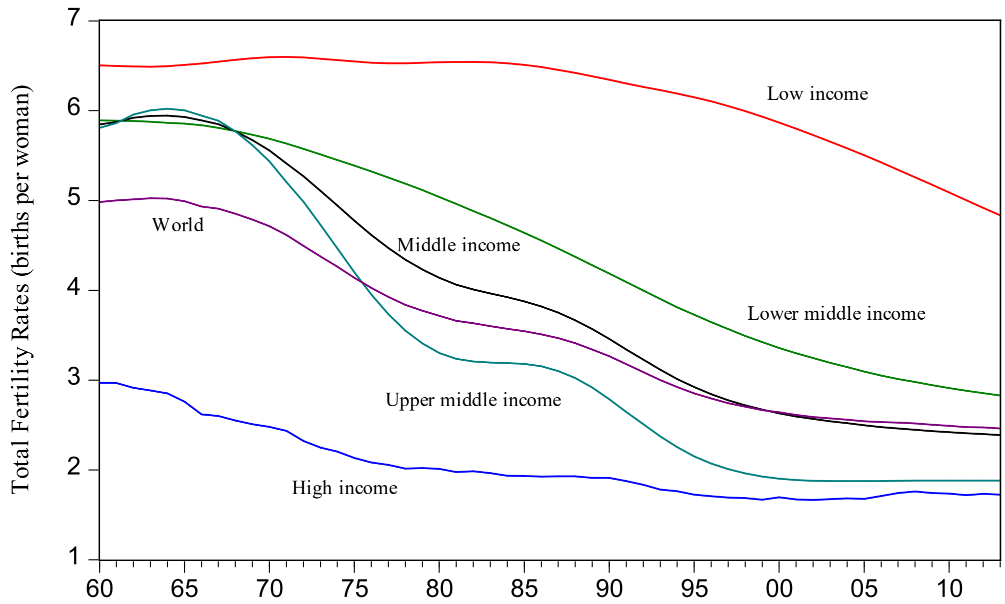

Figure 1. Trends in total fertility rates by high, middle and low income countries

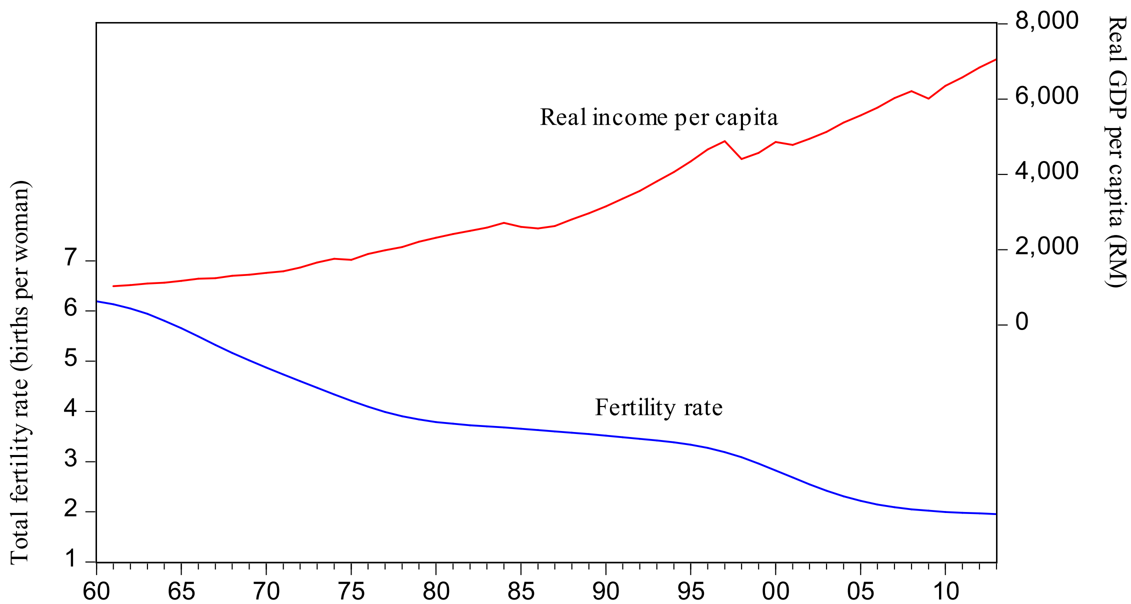

Figure 2. Trend in total fertility rate and economic development in Malaysia

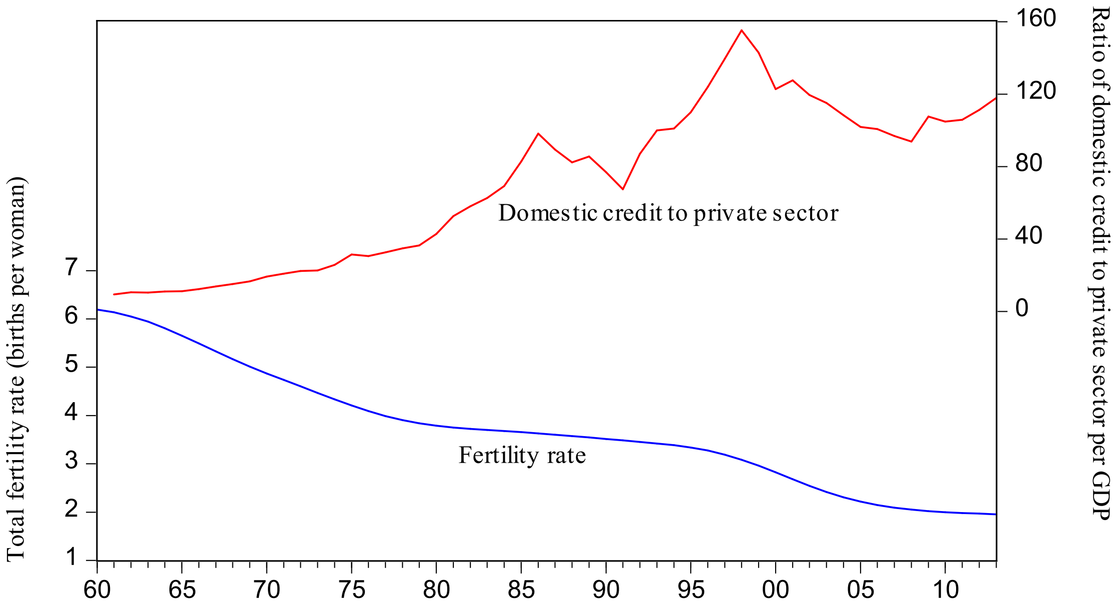

Figure 3. Trend in total fertility rate and financial development in Malaysia