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The dynamics of divorce, income, and female labor force participation in Singapore.

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Abstract

Singapore has experienced rising income and female labor force participation over the years. This growth, however, is also accompanied by increasing divorce rate. This paper utilizes Granger causality tests within a multivariate error correction framework to examine the short-run and long-run causal interactions among divorce, income and female labor force participation in Singapore. The long–run results suggest the presence of tradeoffs between income, female labor participation and the family unit, with the twin objectives of economic expansion and the move to draw more women into the labor market having a negative impact on the institution of marriage.

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1. INTRODUCTION

Divorce rate in the republic of Singapore has doubled over the last two decades with as many as three out of ten marriages ending in the rocks. The sizeable increase in the number of divorces has resulted in much speculation regarding the factors influencing such a decision. Commonly cited sources of marital breakdown include the pressure faced by 'sandwiched' families where working couples have to take care of both their elderly parents and their young children, greater demands at work, competing aspirations, evolving societal values with less stigma associated with being divorced and the inability or unwillingness of the husband to contribute to maintaining the household (Statistics on Marriages and Divorces, 2009). Of course, rising female labor force participation, by reducing the opportunity cost of divorce, has also been frequently cited in the literature as a cause of marital dissolution (see e.g. Spitze and South, 1985, 1986; Mincer, 1985; Cherlin, 1981). The chain of causality can also work in reverse. Studies by Lombardo (1999), Greene and Quester (1982), Johnson and Skinner (1986) further provide clear causality argument that divorce increases female labor participation.

Several studies have reported associations between divorce rate and the business cycle, albeit with mixed results. While some claim that divorce rate rises in periods of prosperity and falls during economic recession (see e.g. Ogburn and Thomas, 1922; Norton and Glick, 1979), South (1985) found statistical evidence to the contrary with divorce rate falling following periods of relative prosperity and rising following economic contraction.

Despite the different findings, most past studies in the area of divorce tend to share one thing in common i.e. they are confined mainly to Western countries. However, as Asian culture is different with much higher priority being placed on family harmony and loyalty, it may be worthwhile investigating if such findings are applicable in an Asian context. This paper therefore aims to analyse the short-run and the long-run dynamics amongst output per capita, female labour force participation and divorce in Singapore using the Granger causality test. The rest of this article is structured as follows – the data, methodology and results are presented in Section 2, followed by discussion and conclusion in Section 3.

2. DATA, METHODOLOGY AND RESULTS

Our data set is compiled from two sources: World Development Indicators Online and Department of Statistics, Ministry of Trade and Industry, Republic of Singapore. This paper uses annual time series data on GDP per capita measured in year 2000 USD, total number of divorces and annulments, and female labour force participation (as measured by females as a percentage of the total labour force), covering the period 1980 to 2004. We are unable to use data earlier than 1980 due to non-availability of data on total number of divorces and annulments. These annual data are defined as follows: GDP per capita (GDP), total number of divorces and annulments (DIVORCE) and female labour force participation (FEMALE).

In implementing Granger causality test, most researchers adopt a 3-step approach (see Srivastava, 2006; Narayan and Smyth, 2006; Kim and Kim, 2006). First, the order of integration associated with each variable is investigated. If these variables are integrated of order one, researchers check for the presence of cointegration amongst these variables. Finally, based on the results of cointegration test, different model specifications are formulated. However, in finite samples, conventional unit root tests, such as Dickey and Fuller (1979, 1981) and Philips and Perron (1988) have low power to distinguish between a unit root process and a near unit root process. They also have low power to distinguish between a unit root process and a trend stationary process. Perron (1989) shows that conventional unit root tests cannot reject the null of nonstationarity against trend stationary alternative if a time series has a structural change. The detailed discussion on the problems of unit root tests can be found in Blough (1992), Campbell and Perron (1991) and Perron (1989).

Further, if a mix of unit root tests has been implemented, researchers may obtain contradictory conclusions regarding the presence of unit root in each time series. When either an intercept is introduced or an intercept and a time tend are added to the model specification of a unit root test, the results of this test may also change. Cointegration tests, such as the Engle and Granger (1987), Johansen (1988) and Johansen and Juselius (1990) approaches are well-known to be unreliable in a finite sample, but they are still commonly used for detecting cointegration amongst variables.

In light of our relatively small sample size of only 25 observations, we have to consider an alternative approach which is more robust. This study therefore uses the bounds testing approach within the autoregressive distributed lag (ARDL) framework and based on the F-statistic developed by Pesaran et al. (2001). Pesaran and Shin (1999) show that the long-run coefficients obtained from the reparametisation of ARDL model are super-consistent in a small sample size. Due to the desirable small sample properties of the bounds test, a number of studies have adopted this approach to detect cointegration in small sample size. For instance, Pattichis (1999) utilizes only 20 observations in the estimation of disaggregated import demand for Cyprus, while Tang (2001) employed annual data from 1973 – 1997 (25 observations) in modeling inflation in Malaysia. Tang and Nair (2002) also used the ADLR approach in estimating an import demand function for Malaysia using 29 observations and Tang (2002) made use of 26 observations in estimating a money demand function for Malaysia. Another advantage of the bounds test is that it allows researchers to avoid the problems associated with conflicting results of the conventional unit root tests because this test can be used irrespective of whether the variables are pure I(1), I(0) or mutually cointegrated. We do not conduct unit root tests in this study because most of time series variables are either I(1) or I(0).

The bounds test examines whether a long-run relationship exists in the following unrestricted error correction models:

$$\Delta DIVORCE_t = a_0 + \sum_{i=1}^{p} a_{Di} \Delta DIVORCE_{t-i} + \sum_{i=1}^{p} a_{Gi} \Delta GDP_{t-i} + \sum_{i=1}^{p} a_{Fi} \Delta FEMALE_{t-i}$$

$$+ a_1 DIVORCE_{t-1} + a_2 GDP_{t-1} + a_3 FEMALE_{t-1} + \varepsilon_{1t} \qquad (1)$$

$$\Delta GDP_t = b_0 + \sum_{i=1}^{p} b_{Di} \Delta DIVORCE_{t-i} + \sum_{i=1}^{p} b_{Gi} \Delta GDP_{t-i} + \sum_{i=1}^{p} b_{Fi} \Delta FEMALE_{t-i}$$

$$+ b_1 DIVORCE_{t-1} + b_2 GDP_{t-1} + b_3 FEMALE_{t-1} + \varepsilon_{2t} \qquad (2)$$

$$\Delta FEMALE_t = c_0 + \sum_{i=1}^{p} c_{Di} \Delta DIVORCE_{t-i} + \sum_{i=1}^{p} c_{Gi} \Delta GDP_{t-i} + \sum_{i=1}^{p} c_{Fi} \Delta FEMALE_{t-i}$$

$$+ c_1 DIVORCE_{t-1} + c_2 GDP_{t-1} + c_3 FEMALE_{t-1} + \varepsilon_{3t} \qquad (3)$$

In equation 1, the null hypothesis of no cointegration amongst the variables is H_0: $a_1=a_2=a_3=0$ against the alternative hypothesis of H_1: $a_1 \neq a_2 \neq a_3 \neq 0$. In equation 2, the null hypothesis of no cointegration amongst the variables is H_0: $b_1=b_2=b_3=0$ against the alternative hypothesis of H_1: $b_1 \neq b_2 \neq b_3 \neq 0$. In equation 3, the null hypothesis of no cointegration amongst the variables is H_0: $c_1=c_2=c_3=0$ against the alternative hypothesis of H_1: $c_1 \neq c_2 \neq c_3 \neq 0$. The null hypothesis of no cointegration of each equation is stated in the second column of Table I. The bounds test requires the disturbance terms of each of the above-equations to be serially uncorrelated. Therefore, sufficient number of lagged first difference of each variable is to be added. However, each unit increase in the value of p leads to a fall in the degree freedom by three. In order to minimize the loss of degree freedom and to meet the assumption of no autocorrelation required by the bounds test, the value of p in each equation is the lowest value where the Breusch-Godfrey Lagrange multiplier test with lag order of 2 is unable to reject the null hypothesis of no autocorrelation at 5% significance level. Each of the stated null hypotheses can be tested with F-test that has a non-standard distribution. The distribution depends on the unit root properties of the time series and the number of independent variables. The critical values for bounds test are obtained from Table CI(iii) in Pesaran et al. (2001). At k=2, the critical value bounds are (3.17, 4.14) at 10% significance level, (3.79, 4.85) at 5% significance level and (5.15, 6.36) at 1% significance level. The null of no cointegration is rejected if the computed F-statistic exceeds the corresponding upper critical value. If the computed F-statistic is lower than the corresponding lower critical value the null hypothesis is accepted. If the computed F-statistic falls within the lower and upper critical values, no conclusive decision can be made unless the order of integration of the variables under consideration is known.

Table I. The results of the bounds test for cointegration

Equation	**H_0**	**p**	**F-value**
(1)	$a_1=a_2=a_3=0$	2	7.4734***
(2)	$b_1=b_2=b_3=0$	1	2.9629
(3)	$c_1=c_2=c_3=0$	1	1.6458

*, ** and *** indicate statistically significant at 10%, 5% and 1% levels, respectively.

The null of no cointegration is unable to be rejected when GDP or FEMALE is the dependent variable even at 10% significance level. Therefore, Granger causality test is applied on the VAR estimation with only first differences for each of these two variables. The null of no cointegration is rejected when DIVORCE is the dependent variable at 1% significance level. It is clear that there is a long-run relationship between DIVORCE, GDP and FEMALE when DIVORCE is the dependent variable but long-run relationship amongst these variables when either GDP or FEMALE is the dependent variable is not found. Granger (1988) points out there will be causality amongst DIVORCE, GDP and FEMALE in at least one direction if there exists a cointegration between them. Based on Granger's suggestion and the results of the bounds test, we conclude that the long-run causality is from GDP and FEMALE to DIVORCE.

An ARDL model shown by equation (4) is estimated:

$$\mathrm{DIVORCE}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{Di} \mathrm{DIVORCE}_{t-i} + \sum_{i=0}^{q} \alpha_{Gi} \mathrm{GDP}_{t-i} + \sum_{i=0}^{r} \alpha_{Fi} \mathrm{FEMALE}_{t-i} + \mu_t \quad (4)$$

The values of p, q and r are selected with Akaike Information Criterion (AIC). The maximum possible values of p, q and r are restricted to 4 because this study uses a relatively small sample size and annual data. AIC selects p=0, q=3 and r=4. The obtained ARDL is reparametized to obtain the long-run coefficients which is reported in equation (5):

$$\mathrm{DIVORCE}_t = -6525.3 + 0.3572\mathrm{GDP}_t + 129.9786\mathrm{FEMALE}_t + \hat{\varphi}_t \quad (5)$$

where $\hat{\varphi}_t$ is the estimated error correction term.

Based on the results of the bounds test, equations (6), (7) and (8) are estimated for the investigation of Granger causality. Granger causality test is applied on an error correction model for DIVORCE because Engle and Granger (1987) indicate that the VAR estimation without the inclusion of lagged error correction term is misleading. The value of p corresponding to each equation is increased till the Breusch-Godfrey Lagrange multiplier test is unable to reject the null of no autocorrelation at lag order 2 at 5% significance level. The standard Granger causality test is applied on them.

$$\Delta\mathrm{DIVORCE}_t = A_0 + \sum_{i=1}^{p} A_{Di} \Delta\mathrm{DIVORCE}_{t-i} + \sum_{i=1}^{p} A_{Gi} \Delta\mathrm{GDP}_{t-i} + \sum_{i=1}^{p} A_{Fi} \Delta\mathrm{FEMALE}_{t-i} + A_D \mathrm{ECT}_{t-1} + \varepsilon_{At} \quad (6)$$

$$\Delta\mathrm{GDP}_t = B_0 + \sum_{i=1}^{p} B_{Di} \Delta\mathrm{DIVORCE}_{t-i} + \sum_{i=1}^{p} B_{Gi} \Delta\mathrm{GDP}_{t-i} + \sum_{i=1}^{p} B_{Fi} \Delta\mathrm{FEMALE}_{t-i} + \varepsilon_{Gt} \quad (7)$$

$$\Delta FEMALE_t = C_0 + \sum_{i=1}^{p} C_{Di} \Delta DIVORCE_{t-i} + \sum_{i=1}^{p} C_{Gi} \Delta GDP_{t-i} + \sum_{i=1}^{p} C_{Fi} \Delta FEMALE_{t-i} + \varepsilon_{Ft} \qquad (8)$$

where ECT is error correction term. Since ECT_{t-1} of Equation (7) is not observable, it is replaced by $\hat{\varphi}_{t-1}$ obtained from equation (5). The results for equations (6), (7) and (8) are reported in Table II. From equation (6), the estimated coefficient of $\hat{\varphi}_{t-1}$ is negative and is statistically significant at 1% level. Based on the suggestion of Granger (1988), these results reconfirm that there is a long-run causality from FEMALE and GDP to DIVORCE. Since equation (5) reports that the estimated long run coefficients of GDP and FEMALE are both positive, we conclude that in the long-run both GDP and FEMALE have positive impact on DIVORCE. The results for short-run Granger causality are reported in Table III. There is a bidirectional short-run Granger causality between DIVORCE and FEMALE. There is a unidirectional short-run Granger causality from GDP to DIVORCE. From equation (6), it is observed that the estimated coefficient of ΔGDP_{t-1} is negative and the estimated coefficient of $\Delta FEMALE_{t-1}$ is positive. Therefore, we conclude that in the short-run, GDP has a negative impact and FEMALE has a positive impact on DIVORCE. We conclude that DIVORCE has a negative impact on FEMALE because, from equation (8), the estimated coefficient of $\Delta DIVORCE_{t-1}$ is negative.

Table II. The results of equations (6), (7) and (8)

	Equation		
	(6)	**(7)**	**(8)**
$\Delta DIVORCE_{t-1}$	0.2066 (0.1620)	-0.1498 (0.4356)	-1.29×10^{-4}** (5.98×10^{-5})
ΔGDP_{t-1}	-0.1661* (0.0910)	-0.1673 (0.2460)	-2.29×10^{-5} (3.35×10^{-5})
$\Delta FEMALE_{t-1}$	1415.858*** (314.5128)	-35.4477 (644.4397)	0.8725*** (0.0879)
$\hat{\varphi}_{t-1}$	-0.6406*** (0.1202)		
Constant	-169.6090 (115.0805)	756.2297** (272.8249)	0.0471 (0.0372)

*, ** and *** indicate statistically significant at 10%, 5% and 1% levels, respectively, based on 2-tailed t-test.
The value in each parenthesis is standard error.

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Table III. The results of Granger's causality test: short-run

Dependent Variable	ΔDIVORCE	ΔGDP	ΔFEMALE
ΔDIVORCE		3.3340*	20.2658***
ΔGDP	0.1166		0.0030
ΔFEMALE	4.6553**	0.4663	

*, ** and *** indicate statistically significant at 10%, 5% and 1% levels, respectively, based on F-test.

The stability of the long-run relationship amongst DIVORCE, FEMALE and GDP when DIVORCE is the dependent variable is also tested based on equation (6) with the approach suggested by Pesaran and Pesaran (1997). This step is important because if the estimated long-run parameters change over the time, the results may be biased. Pesaran and Pesaran (1997) propose the use of CUSUM and CUSUM of squares (CUSUMSQ) tests developed by Brown et al. (1975) to test for the stability of the long-run parameters. These tests are applied to the residuals of equation (6). The CUSUM test indicates parameter stability if cumulative sum of the recursive residuals is within the two critical lines. If the cumulative sum of squared recursive residuals is within the two critical lines, the CUSUMSQ test indicates parameter stability. From Figures 1 and 2, the results suggest the presence of long-run parameter stability because the plot of CUSUM and the plot CUSUMSQ are within the two critical lines determined at 5% significance level.

Figure 1. Plot of CUSUM test for equation (6)

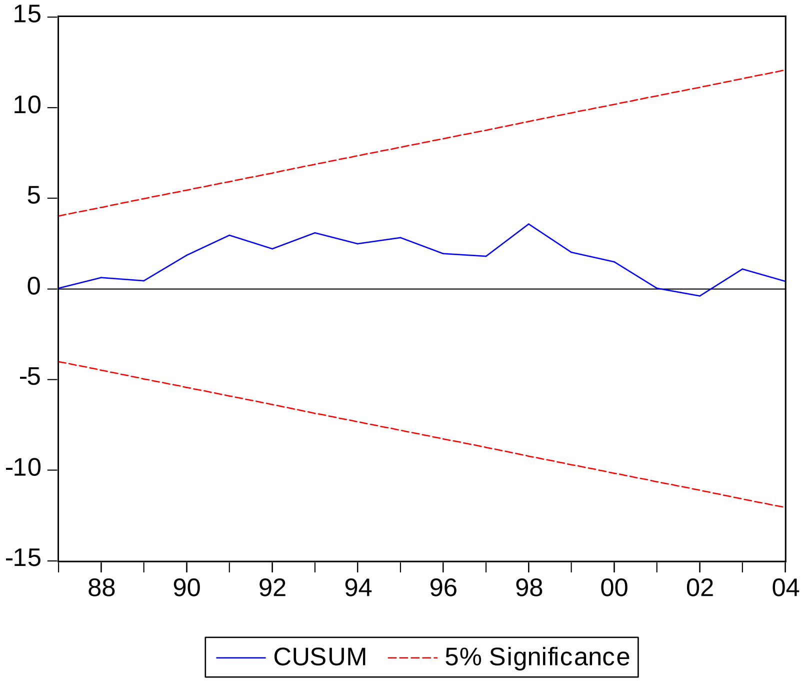
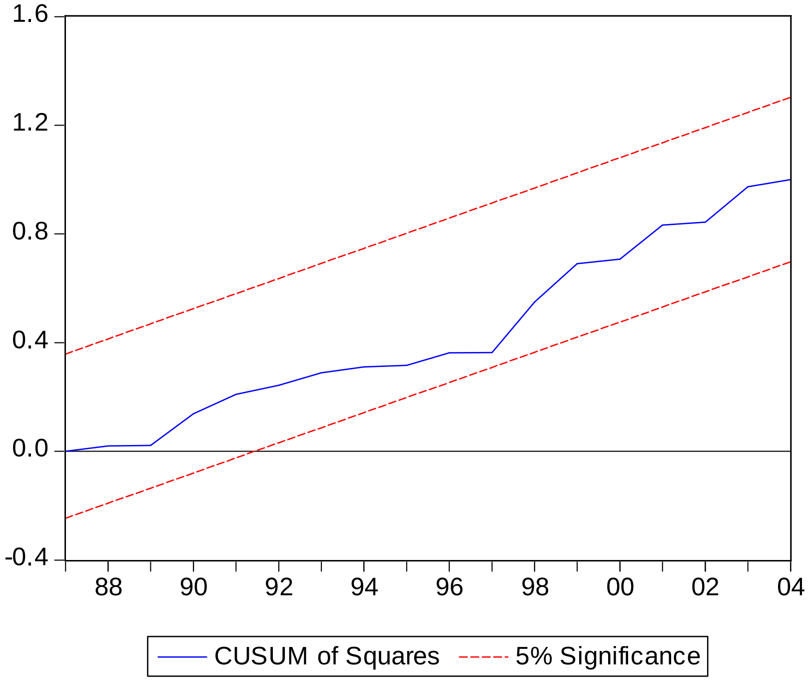


Figure 2. Plot of CUSUMSQ test for equation (6)



3. DISCUSSION AND CONCLUSION

The finding that women's employment increases marital dissolution in both the short-run and the long-run lends support to the role specialisation (or interdependence) hypothesis espoused by Parsons (1959) and Becker (1981), which holds that as women participate in paid economic activities, this reduces specialisation of roles between husbands and wives (as the female is now less focused on nonmarket human capital), and with that the gains to marriage declines and this increases the risk of divorce. Of course, as the economic opportunities for women expand, females may become less dependent on marriage for financial support, and may also use their increased bargaining power from paid employment to assert their independence, thus destabilizing marriages (Scanzoni, 1979). This result is also consistent with studies by Spitze and South (1985, 1986) who showed that an increase in female labour participation leads to increase in family conflict and hence, an increase in divorce rates.

The short-run negative causality from divorce rate to female labour participation is somewhat surprising given that most studies seem to favour an opposite sign (see e.g. Lombardo, 1999; Greene and Quester, 1982; Johnson and Skinner, 1986). Bremmer and Kesselring (2004), in supporting a positive causality from divorce to female labour participation, argue that rising divorce rate sends a signal to all married females that the probability of remaining married for a lifetime is waning. Hence, a more bankable option for females is to move away from housework and childrearing to the labor market. But equally, one could also argue that the fragility of marriage itself may send a signal to females that this institution is not to be taken for granted and much effort and sacrifices are needed for it to work. This realisation, in turn, may drive women into giving up, or at least put less weightage, on formal labour in favour of non-market activities. This argument may be relevant when weighted against studies that have found Singaporean women to place a strong emphasis on marriage and childbearing (see e.g. Straughan, 2004) and also where women there face more competition in finding a partner due to the imbalanced gender ratio.

Where the relationship between GDP per capita and divorce rate is concerned, we find the presence of unidirectional causality from GDP per capita to divorce rate, with opposing signs in the short- and long-run. In the long run, divorce rate tends to rise with economic expansion, while in the short-run, the rate falls as the economy grows. Ogburn and Nimkoff (1955) draw a distinction between two types of factors that influence the probability of divorce – those influencing the ‘motivation’ to divorce and those influencing the ‘opportunity’ to divorce. Economic conditions affect these two components in opposing ways, with economic growth raising the opportunity to divorce by making divorce more affordable, but reduces the motivation to divorce by putting less financial stress on marriages. Our study shows the dominance of the ‘motivation’ effect in the short-run, while the ‘opportunity’ effect is stronger in the long-run. One possible explanation for this may lie in Singapore’s changing social and economic conditions. As South (1985) argues, the relative strength of the ‘motivation’ and ‘opportunity’ effects are contingent upon the social and economic context in which divorce occurs. Thus, it is possible that with a more liberal legal climate coupled with the lessening of stigma attached to divorcees, as well as sustained economic prosperity (which reduces the need for either husband or wife to depend on their partner for added financial security), all of which are changes that can only occur in the long-run, this may explain the dominance of the ‘opportunity’ effect in the long-run, but not the short-run.

Overall, the long–run results of this study suggest the presence of trade offs between economic growth, female labour participation and the family unit, with the twin objectives of economic expansion and the move to draw more women into the labour market having a negative impact on the institution of marriage. We note of course, that this study suffers from several limitations. First of all, we used only aggregate data. As such, the findings of this study may not be applicable at the individual household level. Future studies, conceivably, can start at the micro-foundation level i.e. beginning with a simple theoretical framework before moving on to empirical testing. Secondly, we used only GDP per capita as the proxy for income. Further research in this area could look into distinguishing between male and female income as past studies have shown the different effects of male and female income on divorce (see e.g. Cherlin, 1979; Mott and Moore, 1979; Becker, Landes, and Michael, 1977; D’amico, 1983; Hoffman and Duncan, 1995).

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