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The effects of education and fertility on female labour force participation in Malaysia

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The Effects of Education and Fertility on Female Labour Force Participation in Malaysia

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CERTIFICATION

I, Lim Fui Yee Beatrice, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy (Integrated), in the School of Accounting, Economics and Finance, Faculty of Business, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for any qualifications at any other academic institution.

Lim Fui Yee Beatrice
30th of June 2017

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ABSTRACT

Malaysia experienced rapid economic growth and an increased standard of living between 1970 and 2010. During this period, female educational attainment has also increased substantially, and the fertility rate declined. Curiously though, the rate of female labour force participation experienced only moderate growth in the span of these four decades. The underutilisation of trained human resources deteriorates the stock of human capital and therefore may be costly to a country. From the Malaysian perspective, understanding the determinants of female labour supply is of particular interest especially for policymakers considering the country's goal to increase the rate of female labour force participation rate to 57% by the year 2020. The main purpose of this thesis is therefore to identify the key determinants of female labour force participation in Malaysia and their changing impacts over time. This thesis presents three complementary empirical analyses on the issue of female labour force participation with an emphasis on education and fertility using data drawn from the various Malaysia Population and Housing Censuses.

In the first empirical chapter, the change in the female labour force participation rate between 1970 and 2000 in Peninsular Malaysia was decomposed into changes in characteristics and coefficients using Fairlie's (1999; 2005) non-linear decomposition method, which is an extension of the Blinder-Oaxaca (1973) decomposition method. The estimates using Fairlie (1999; 2005) decomposition reveals that the majority of the change in female labour force participation rate can be attributed to the change in characteristics on both the education and fertility variables.

The second empirical analysis in this thesis offers new evidence on the causal effect of higher education on female labour force participation. The difference-in-differences strategy shows that a higher education reform in Malaysia increases the tertiary educational attainment among females by 2.7 percentage points. Subsequently, by exploiting the reform in higher education as an exogenous source of variation in education, the results estimated using the instrumental variable strategy establish that higher education has a positive causal effect on female labour

force participation. This result points to the fact that investment in education should continue to be the country's priority.

In the third empirical contribution, the instrumental variable strategy was used to identify the causal effect of fertility on female labour force participation. The findings from the instrumental variables strategy indicate that fertility has a larger negative effect on female labour force participation for planned births as compared to unplanned births, at 15.5% and 6%, respectively. The estimates in this analysis, using the multiple births and sibling-sex composition as instrumental variables, are consistent with that in the developed countries, including the US and Australia. In Malaysia, where ethnic heterogeneity is the central focus of any public policy, the causal effect of fertility on female labour force participation by ethnicity is examined. Fertility has a larger negative effect among the Bumiputera than the non-Bumiputera women. Chinese women have strong son preference. However, the causal effect of fertility on female labour force participation, examined using son preference instrument is not significant.

This thesis advances the literature in the area of female labour force participation in several ways. First, this is one of the few decomposition analyses exploring the drivers of trends in female labour force participation globally. Second, this is one of few studies that examined the causal effect of higher education on female labour force participation. Third, the causal effect of fertility on female labour force participation is analysed by taking into account the behaviour among females of different ethnicities within the same labour market institutions. Finally, in the local context of Malaysia, this study addressed the issues of endogeneity in education and fertility on female labour force participation, which to date has been limited. The findings in this thesis have important policy implications. While the Malaysian Government should continue to focus on improving access to education, the most pressing issue is to design policies that could improve work-life balance in order to encourage greater growth in female labour force participation in Malaysia.

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ABBREVIATIONS

ASEAN	Association of South East Asian Nations
CEDAW	Convention on the Elimination of all forms of Discrimination Against Women
DID	Difference-In-Differences
DOSM	Department of Statistics Malaysia
EPU	Economic Planning Unit
HEARTS	Housewives Enhancement And Reactive Talent Scheme
ILO	International Labour Organization
IPUMS	Integrated Public Use Microdata Series
GDP	Gross Domestic Product
GNI	Gross National Income
LATE	Local Average Treatment Effects
NACIWID	National Advisory Council on the Integration of Women in Development
NEP	New Economic Policy
NPP	New Population Policy
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
RM	Ringgit Malaysia
UNESCO-UIS	United Nations Educational, Scientific, and Cultural Organization Institute for Statistics
UNICEF	United Nations Children's Emergency Fund
US	United States
USD	United States Dollar
2SLS	Two-Stage Least Squares

CHAPTER 1 INTRODUCTION

1.1 Background of the study

Education and fertility are widely held to be the key determinants of female labour force participation in both developed and developing economies. The level of female educational attainment and the fertility rate in most countries has changed in a direction that presumptively increases the rate of female labour force participation. However, reports indicate that the global rate of female labour force participation has been stagnant for the past two decades (Elborgh-Woytek et al. 2013). The main purpose of this thesis is therefore to understand the effect of education and fertility on female labour force participation decisions.

Since the latter part of the nineteenth century, the role of women has evolved to one that assumes both work at home and in the labour market. There is an ongoing emphasis on the importance of the role of women in the labour market. The inclusion of women in the economy and the development of their full labour market potential are not only necessary but beneficial as this can generate significant gains to both individuals and society. An educated and skilled female labour force, as a result of increased education, can contribute to an increased level of productivity and efficiency in an economy (Steinberg & Nakane 2012). In developing countries especially, a higher female labour force participation level and greater earnings by women are among the most important tools to reduce poverty as better educated women are found to invest more in the education of their children (Heintz 2006). Furthermore, greater female labour force participation can mitigate the impact of a shrinking work force in economies that face the challenge of ageing populations (Elborgh-Woytek et al. 2013).

Empirical studies examining the various impacts of socio-economic determinants on female labour force participation have been published extensively (see for example Killingsworth & Heckman 1986). These studies at an aggregate level have shown that trends in the female labour force participation rate can be linked to the long-run relationship between female labour force participation and the level of economic

development, which is hypothesised as a U-shaped curve (Durand 1975; Goldin 1995; Pampel & Tanaka 1986; Psacharopoulos & Tzannatos 1989). In general, the rate of female labour force participation is high in both low-income and highly-developed countries and relatively low in middle-income countries. Based on this hypothesis, the declining portion of the U is a result of the structural changes in an economy while the rising portion of the U results from a decline in fertility and an increase in education (Gaddis & Klasen 2014).

In many countries, including emerging economies, the level of female education has increased substantially over the past decades, with an accompanying decline in the rate of fertility. One such country that has undergone rapid economic development, including significant changes in the levels of female education and fertility, is Malaysia. Although Malaysia has acknowledged and has been actively promoting the role and involvement of women in the country's economic development through various policies and initiatives post-independence, the growth in the female labour force participation rate is considerably lower when compared to neighbouring countries in the Southeast Asia region (World Bank 2016).

Theoretically, a higher level of educational attainment and a decline in fertility are posited to increase the level of female labour force participation. If higher female educational attainment and the decline in fertility motivate Malaysian women to enter the labour market, as hypothesised in conventional economic theories, the combined effects of education and fertility should be reflected in a rising rate of female labour force participation. Yet, there has been only a moderate growth in the female labour force participation rate in Malaysia. Considering the many significant gains that could result from greater female labour force participation, the overarching goal of this thesis is therefore to investigate empirically the reasons for this moderate growth by considering the effects of education, especially higher education, and fertility on female labour force participation decisions in Malaysia. A systematic analysis of this empirical issue can assist policymakers in designing labour market policies that could address this conundrum *vis*-à-*vis* the integration of women into the economy, not only for Malaysia but also for other emerging economies that face similar challenges.

This chapter is organised into the following sections. Section 1.2 deliberates on the problem statement and discusses the significance of the study. Section 1.3 puts forward the research questions and objectives of the study. The scope and methodology of the study is discussed in Section 1.4. Section 1.5 provides the definition of the concept used in this study. Section 1.6 presents the layout of the chapters in this study.

1.2 Problem statement and significance of the study

The industrialisation and urbanisation process in Malaysia during the 1970s and 1980s has led to rapid economic growth and higher income, which has continued into the twenty-first century. Female labour force participation in Malaysia increased tremendously from 37.2% in 1970 to 42.2% in 1980 as a result of the adoption of export-oriented industrialisation, which generated many employment opportunities for females, especially in the manufacturing sector. However, while economic growth continued into the 2000s, the female labour force participation rate was only 46% in 2010, which is only a small increase compared to 1980.

During this period, female educational attainment has increased significantly. Beyond the secondary school level, the enrolment of girls outnumbered boys (Economic Planning Unit 1991; Department of Statistics Malaysia 2002; Ministry of Women, Family and Community Development 2014). The acquisition of higher education often reflects the changing tastes and preferences of females for labour market work (Becker 1975). However, this is not observed in Malaysia, where, for the majority of Malaysian women, gains in education have not translated into increased labour force participation. Considering the Government's heavy investment to enhance the stock of human capital in Malaysia, the underutilised labour in the form of unrealised productivity potential is costly to the country. In the long term, the underutilisation of trained human resources may deteriorate the stock of human capital. Meanwhile, fertility has declined since 1960. This study therefore aims to investigate the reasons behind the moderate growth in female labour force participation, with an emphasis on the roles of education and fertility, given that the Government has continually implemented policies to encourage an increase in female labour force participation.

This attempt to examine the role of education and fertility on female labour force participation decisions is particularly important in the case of Malaysia, for both empirical and policy concerns. From an empirical point of view, the relationship between education and fertility on female labour force participation is often plagued by issues of endogeneity. The positive associations between education and female labour force participation could be a result of unobserved factors that are correlated to both variables. On the one hand, individuals with a greater innate ability and higher career aspirations may acquire more education. On the other hand, individuals from advantaged backgrounds may enjoy better employment opportunities and therefore acquire more schooling (Riddell & Song 2011, p.3). In a similar vein, fertility and female labour force participation decisions may be jointly determined, for example where mothers with strong labour force attachments are more likely to have fewer children when compared to mothers with lower earning potential. This issue indicates that it is often challenging to obtain empirical evidence suitable for policy guiding as estimates based on correlations can be biased (Schlotter, Schwerdt & Woessmann 2011, p. 4). This thesis therefore focuses on establishing the causal effects of education and fertility on female labour force participation.

Existing research on female labour force participation in Malaysia carried out to date focuses mainly on identifying the association or correlation of the independent and dependent variables of interest, for example, the correlation of education and female labour force participation or fertility and female labour force participation. The use of causal inference, for example, has become increasingly popular in policy evaluation including in the field of education (Schlotter, Schwerdt & Woessmann 2011). Furthermore, from a policy point of view, there is an increasing need for evidence-based policy. An empirical study like this, which exploits the occurrence of natural experiments, is useful for policymakers considering the fact that many countries continue to design and implement policies for education, social protection and work-family balance to encourage female labour force participation. Without establishing the causal inference of these policies, it is challenging to determine their effectiveness. In this study, a natural experiment in the form of higher education reform will be used to establish the causal inference of education on female labour force participation.

Apart from the changing landscape in female educational attainment, the fertility rate in Malaysia has also decreased in the period studied in this thesis and this change in fertility has an impact on the population structure. In Malaysia, the median age of the population has increased from 23.6 years (2000) to 26.2 years (2010). The dependency ratio decreased from 59.2% to 48.5% during these periods. This indicates the transition towards an aging population (Department of Statistics Malaysia 2011a). In the year 2010, the population aged 60 and above was a total of 7.9% of the Malaysian population and this is projected to increase to 9.5% by the year 2020. With the increasing challenges of an aging population in the future, the underutilised female resources remain the best alternative workforce available in the country. The effort to increase female labour force participation therefore continues to be a key policy focus for the Malaysian Government. Social policies or family friendly policies, including those related to child-bearing and child-rearing such as parental leave, provisions for childcare and flexible working arrangements, have been implemented to induce more females to enter the labour market. Increasing female labour force participation will not only enable women to be financially independent but the country can also reduce its dependency on foreign labour.

Understanding the causes of female labour market stagnation in Malaysia is important for several reasons. First, the behaviour of female labour supply has important implications on social behaviour such as marriage, fertility, divorce and family earnings distribution as well as the male-female wage gap (Killingsworth & Heckman 1986). Second, the size of the labour force is central to the construction of a measure of the country's gross domestic product (GDP) and to project future GDP growth. For example, the entry of married women into the United States (US) labour force in the 1970s and 1980s expanded the labour force and potential GDP (Juhn & Potter 2006). The Asia-Pacific Human Development Report indicates that if female labour force participation increased to 70% in Malaysia, the country's GDP would increase by 2.9% (United Nations Development Programme 2010). Third, a low female participation rate, especially when the level of schooling has increased, represents a stock of underutilised labour where potential human capital in a society is restricted to household endeavours (Hirschman & Aghajanian 1980). According to Klasen and Pieters (2015, p.2), employment and earnings can improve women's

bargaining power in the household, which in turn is a tool to improve females' and children's well-being. In conclusion, by taking all the factors discussed here into account, the undertaking of this study is significant as it provides an overview of the underlying causes of the pattern and change in the female labour force participation rate in Malaysia. This exercise can provide an insight to how female labour force participation decisions may evolve in the future.

1.3 Research questions and objectives

The main objective of this study is to conduct an empirical investigation on the effect of education and fertility on female labour force participation in Malaysia. The central question of this study is: to what extent do the exogenous changes of education and fertility affect female labour force participation in Malaysia?

Specifically, the four main research questions addressed in this thesis are:

1. What are the main determinants of female labour force participation between 1970 and 2000 in Peninsular Malaysia and to what extent do these determinants affect the female labour force participation rate?
2. What is the impact of the 1996 higher education reform on female higher educational attainment in Malaysia?
3. Does education have a causal effect on female labour force participation in Malaysia?
4. Does fertility have a causal effect on female labour force participation in Malaysia?

The first question is addressed using a decomposition method to identify the causes of changes in the female labour force participation rate in Peninsular Malaysia between 1970 and 2000. The second research question on the impact of higher education reform in Malaysia on female educational attainment will be investigated using a difference-in-differences (DID) methodology. The instrumental variable strategy will also be used to analyse the causal effect of increased education on female labour force participation. In order to address both the third and fourth research questions on the causal effect of education and fertility on female labour force participation in Malaysia, instrumental variable regressions will be employed by exploiting the occurrence of natural experiments relevant to the topic.

1.4 Scope of study and methodology

From the discussion above, this thesis seeks to identify the effect of education and fertility on female labour force participation. The empirical analyses cover the period between 1970 and 2010. The secondary cross-sectional data used is drawn from the Population and Housing Census of Malaysia for the years 1970, 1980, 1991, 2000 and 2010. The census data for the years 1970, 1980, 1991 and 2000 was obtained from the Integrated Public Use Microdata Series, International (IPUMS-International) database. The census data for the year 2010 was provided by the Department of Statistics Malaysia. One of the main limitations of this dataset is the unavailability of income data. However, due to the nature of the econometric tools employed in Chapters 5 to 7 that require a large representative dataset, the census data is the best source of data available. Furthermore, due to the slight differences in the information (or variables) available in the census data, the period investigated in each empirical chapter differs. However, in all cases, the most up-to-date data available from the census is used.

This thesis employs econometric models which have been adapted to the context of the Malaysian economy as well as to the availability of data. The methodologies used include the Fairlie (1999; 2005) decomposition technique to identify the determinants of the trends in the female labour force participation rate. The DID framework is used to examine the effect of reform in tertiary education on female educational attainment. The causal effect of tertiary education on female labour force participation is investigated using the instrumental variable regression model. Similarly, the causal effect of fertility on female labour force participation is analysed using instrumental variable analysis. The Stata/SE 14.1 software is used for data analysis.

1.5 Definition of concept

The main dependent variable in this study is female labour force participation for females. According to the International Labour Organization (2015), the labour force participation rate is a measure of the proportion of a country's working-age population that engages actively in the labour market, either by working or looking for work. It provides an indication of the size of the supply of labour available to

engage in the production of goods and services, relative to the population at working age.

The labour force participation in this thesis include individuals between 15 and 64 years who are either employed or unemployed (DOSM 2012). Employed individuals include individuals who have jobs but are not at work in the reference period. Pre-2013, employment was linked to being engaged in activities that are included in the System of National Accounts. The official international definition of employment has changed in 2013 following the adoption of 'Resolution concerning statistics of work, employment and labour underutilization' at the 19th International Conference of Labour Statisticians of the International Labour Organization. Employment is redefined as work for pay or profit, in cash or in kind, (hence excluding own-use producers of goods) (International Labour Organization 2013). However, these definitional changes do not directly affect the analyses in this thesis, which uses pre-2013 data.

1.6 Structure of the study

This thesis consists of eight chapters. This introduction chapter presents the background, problem statement, significance, objective, scope and methodology and the main concept used in this study. The structure of the remainder of this thesis is provided below.

Chapter 2 provides an overview of the Malaysian labour market highlighting the trend of female labour force participation from 1970 to 2000. This includes a comparison of the trend with other neighbouring countries especially the member countries of the Association of South East Asian Nations (ASEAN). This chapter begins with an overview of the Malaysian economic structure and its economic performance followed by a background of the trends for female educational attainment and fertility. The chapter also describes the government policies and initiatives that were implemented to encourage female labour force participation.

Chapter 3 describes the theoretical models underpinning the empirical analyses in this thesis. The basic neoclassical theory of allocation of time, the household production model and the human capital theory are reviewed and discussed.

Chapter 4 reviews the literature of female labour force participation which is organised around two main themes, namely the relationships of (1) education and (2) fertility with female labour force participation. In particular, the issue of potential endogeneity of education and fertility on female labour force participation is discussed. The research gap addressed in this thesis is highlighted in this chapter.

Chapter 5 decomposes the trend of the female labour force participation rate in Peninsular Malaysia between 1970 and 2000 using the Blinder-Oaxaca (1973) decomposition method, incorporating the extension for a non-linear model proposed by Fairlie (1999; 2005). The main purpose of this decomposition exercise is to identify the main determinants of female labour force participation in Malaysia over the period studied. Additionally, the contribution of the determinants on the change in female labour force participation is quantified.

Chapter 6 explores the issue of education and female labour force participation. In the first section, the impact of tertiary education reform on the level of female educational attainment in Malaysia is addressed using the DID framework. In the second section of the chapter, the causal effect of education on female labour force participation is examined using instrumental variable regression.

Chapter 7 investigates the causal effect of fertility on female labour force participation using instrumental regression variables by adapting the Angrist and Evans (1998) model using various instruments including twin births (Rosenzweig & Wolpin 1980), mixed-sex siblings (Angrist & Evans 1998) and son preference (Chun & Oh 2002). Due to the potential heterogeneity of the impact of fertility on labour force outcome as a result of cultural background, results based on ethnicity are also presented.

Chapter 8 draws together the main findings of the study and provides policy implications and recommendations based on the empirical findings. This chapter also reiterates the contributions and significance of the study. The chapter concludes by addressing the limitations of this study as well as providing recommendations for future research.

CHAPTER 2 OVERVIEW OF THE MALAYSIAN LABOUR MARKET

2.1 Introduction

In the period post-independence, Malaysia shifted from an agriculture-based to a manufacturing-based country in the 1970s with the introduction of export-oriented industrialisation policies. The industrial development in this sector saw a surge in the demand for young female workers, described by Ariffin (1992, p.423) as an "exodus of female labour migration from rural areas to the urban-based factories". The purpose of this chapter is to trace the changing trend in the female labour force participation rate in Malaysia against the backdrop of the changing economic structure of the country.

Malaysia in particular stood out as a country worth investigating for several reasons. First, in the 1990s, the country experienced rapid economic growth and was categorised as a newly industrialised country. Second, the educational attainment of females increased tremendously, including at the tertiary level. Third, there was a substantial decline in fertility. Despite these changes and the fact that Malaysian women have advanced remarkably in social, economic and political spheres, female labour force participation in Malaysia shows only modest growth. Between 1980 and 2010, the female labour force participation rate in Malaysia plateaued well below neighbouring ASEAN countries and other middle-income and industrialised countries (Leete 2007; World Bank 2016). This issue has concerned the Malaysian Government considering that greater participation of women in the labour market can be a source of inclusive economic growth which spills over to the well-being of Malaysian society. Furthermore, the Malaysian Government has designed and implemented various policies aimed to increase female labour force participation which involved significant cost to the Government budget.

This chapter begins with an overview of the Malaysian economy (section 2.2) and the changing economic structure since the country gained independence in 1957 (section 2.3). Section 2.4 introduces the characteristics and ethnic heterogeneity of the Malaysian population. Section 2.5 discusses the trend of female labour force participation in Malaysia and women's advancement in the economy. Sections 2.6

and 2.7 review the topics on female educational attainment and fertility in Malaysia. Section 2.8 describes the policies implemented to encourage female labour force participation in Malaysia. Section 2.9 concludes.

2.2 The Malaysian economy

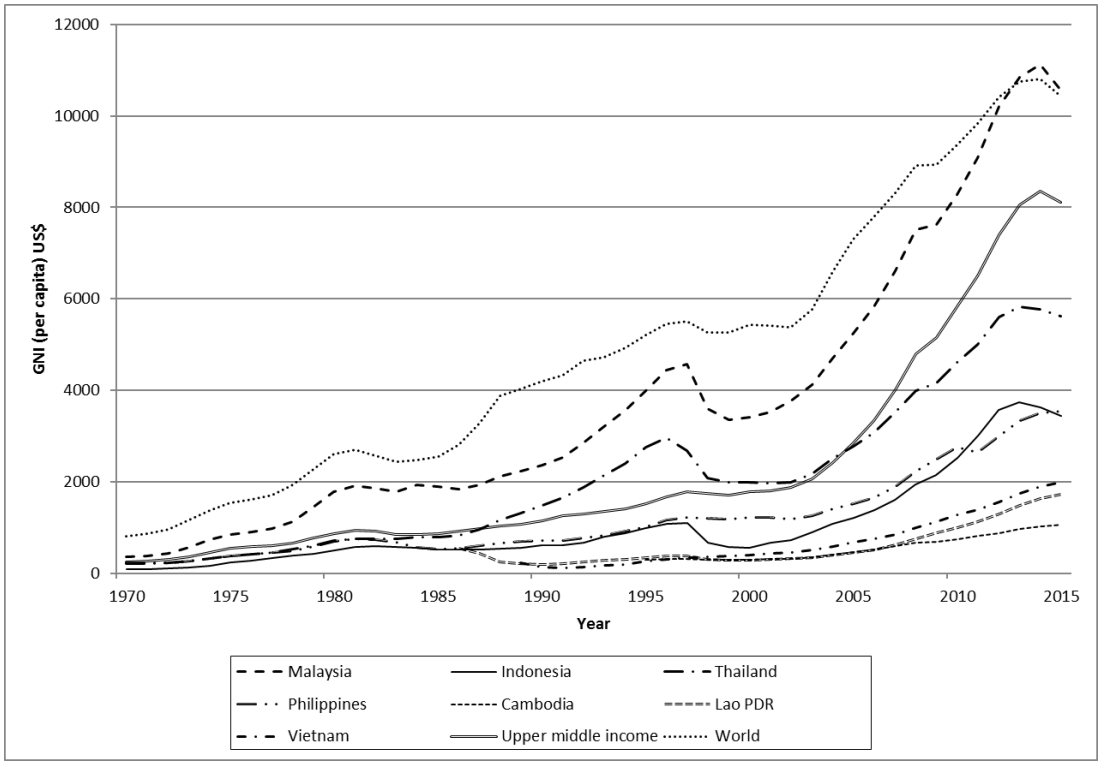
Malaysia is located in Southeast Asia and consists of 13 states and 3 federal territories. Peninsular Malaysia, also known as West Malaysia, is bordered by Thailand to the north. East Malaysia, which is separated by the South China Sea from the Peninsular, is located on the island of Borneo, sharing borders with Indonesia and Brunei Darussalam. The Federation of Malaya declared independence from the British Government on the 31st of August 1957. On the 16th of September 1963, the Borneo states, namely Sabah and Sarawak, joined the Federation and the merger resulted in the modern Malaysia of today (Wong 2007).

Dubbed one of the fastest growing economies in South East Asia, the Malaysian economy recorded remarkable growth throughout the post-independence period. According to World Bank classifications, Malaysia is categorised as an upper-middle-income country with a Gross National Income (GNI) per capita falling between USD4,036 and USD12,475. As shown in Figure 2.1, Malaysia's GNI per capita increased close to sixfold from USD1,790 in 1980 to USD10,570 in 2015, well above the average of other upper-middle-income countries (World Bank 2016). Among the developing countries in the ASEAN region, the GNI per capita for Malaysia is the highest.

After Malaysia gained independence in 1957, the country's real GDP growth accelerated from -0.1% to 7.8% (1966) before declining to 6.0% in 1970. During this period, living standards improved, access to health and education increased and urbanisation increased. In the 1970s, the Government promoted export-oriented industries which saw significant growth in the manufacturing sector. From 1971 to 1980, the economy grew at an average annual rate of 7.9%. In the 1980s, the prolonged global recession resulted in a sharp fall of commodity prices dropping the average annual growth rate to 6.0%. From 1991 to 1996, the annual average growth rate registered a staggering 9.6% as a result of heavy involvement of the private sector in the economy and an increased inflow of foreign direct investment.

However, the country was affected by the Asian financial crisis in 1997 and later the world trade recession in 2001.[1]

Figure 2.1: Gross national income per capita for selected ASEAN countries,[2] 1980 to 2015.



Source: World Development Indicators, World Bank 2016.

Between 2000 and 2012, the average GDP growth rate of Malaysia was an average of 1.18% before plummeting to -7.6% in March 2009 (Lai & Yussof 2014). The global financial crisis in 2008-2009, which started from the housing crisis in the US, sent ripples across export-dependent Asian economies including Malaysia, seeing a collapse in the country's exports as well as a slowdown in foreign direct investment (Goh & Lim 2010). In 2015, real GDP growth was moderated to 5.0% due to moderate domestic demand (Malaysian Institute of Economic Research 2016). In the next section, the structural change in the Malaysian economy is discussed.

[1] This discussion is drawn from Ang (2007).

[2] Figures measured using Atlas method in current USD. The developed countries in ASEAN, Singapore and Brunei Darussalam are not included. For Myanmar, only data for 2014 is available (USD1,280).

2.3 Structural change and development of the Malaysian economy

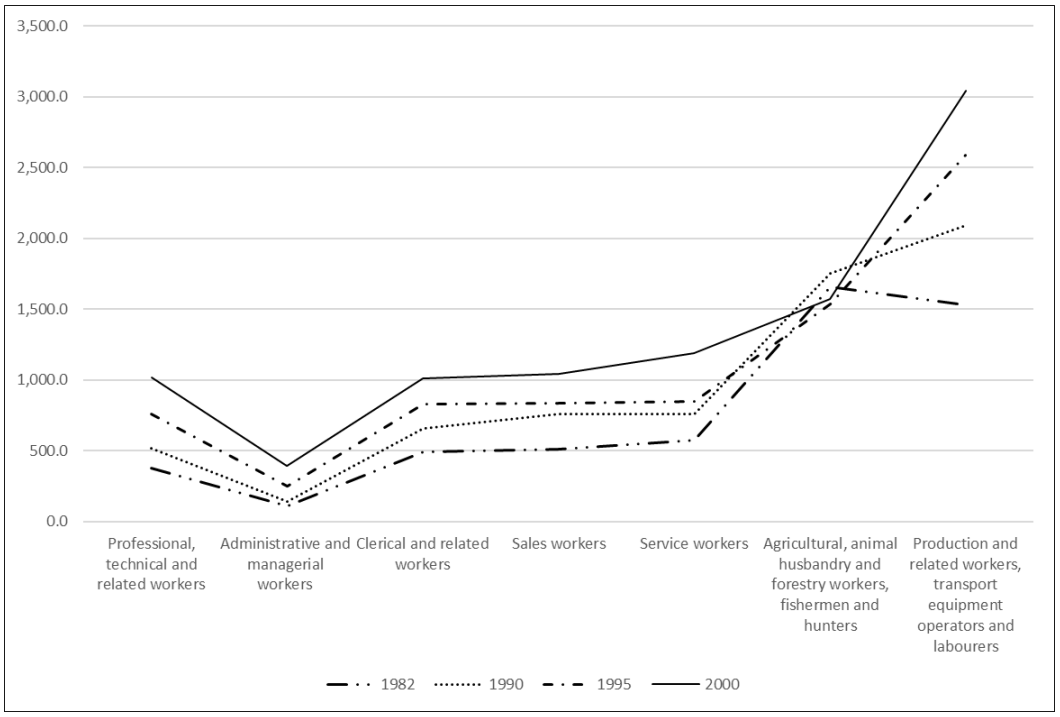
Malaysia has undergone a remarkable economic transformation and structural change in the 50 years since independence, moving from a low income, agriculture-based rural economy to a middle-income, manufacturing and service-based urban economy and now to an upper-middle-income, knowledge-based service economy (Leete 2007). The transformation of the Malaysian economic structure consequently affects the pattern of female labour force participation in the country. The economic structure of the country is described in this section.

At the time of independence in 1957, Malaysia was an agricultural country with a high dependency on rubber and tin which contributed to 70% of the country's exports and provided 36% of the country's employment (EPU 2016). The price of these commodities was highly volatile which led the Government to diversify into oil palm, pepper, cocoa and pineapple (Ariff 1998). At the same time, the Government introduced the Pioneer Industries Act (1958) to encourage import substitution industries (Jomo & Wee 2014). In the decade between 1960 and 1970, Malaysia achieved impressive growth with considerable infrastructure development. However, the problem of economic imbalance remained, seen in the wide gaps between income and living conditions between the traditional and modern sectors and the rural and urban areas as a result of differences in opportunities for education, employment and ownership of business resources (Comber 2009, p. 59). The majority of the Chinese, living in the urban areas, enjoyed better access to social infrastructure and economic opportunities, while the Malays lived in the rural areas which were less developed (Comber 2009, p. 57). This racial imbalance intensified the tension between the Malays and the Chinese. These inequities, escalated by the general election results in 1969 where Chinese-led opposition parties gained more seats than in previous elections, sparked a racial riot on the 13th May 1969 which to this day is known as the darkest day in Malaysian history (Comber 2009, p. 68). Following the racial riot in May 1969, the New Economic Policy (NEP) was formulated and implemented in 1971. It was two-pronged: (1) to eradicate poverty; and (2) to restructure Malaysian society in order to reduce and eliminate identification of ethnicity with economic function and geographical location. The overriding objective of the policy was to increase national unity (EPU 1976, p. 9).

In the 1970s, there was a radical shift from inward-looking import substitution to outward-looking, export-oriented industrialisation policies, and these policies were pursued rigorously into the mid-1980s (Ariff 1998, p. 3; Ariffin 1992, p. 44). Following the introduction of the Promotion of Investment Act in 1986 which allowed foreigners greater equity participation in companies, Malaysia quickly became one of the largest recipients of foreign direct investment in Asia (Jomo & Wee 2014; Ng & Chee 1999). The country experienced major growth in industries such as electronics, food processing, plastics, textiles and garments (Ariffin 1992, p.25). Malaysia was badly hit by the world recession in the 1980s due to the nature of these industries which relied heavily on world demand (Ariffin 1992, p. 26). During this time, Malaysia shifted its focus to resource-based higher technology which is more capital intensive (Ariffin 1992, p. 26). At the same time, the service sector expanded rapidly in the 1980s, especially in education and public administration (Ariffin 1992, p. 27; Athukorala 2001). While the economic growth in Malaysia was robust throughout the 1990s, the economic growth in recent decades has remained sluggish, especially after the Asian financial crisis (EPU 2010a, pp. 58 & 61).

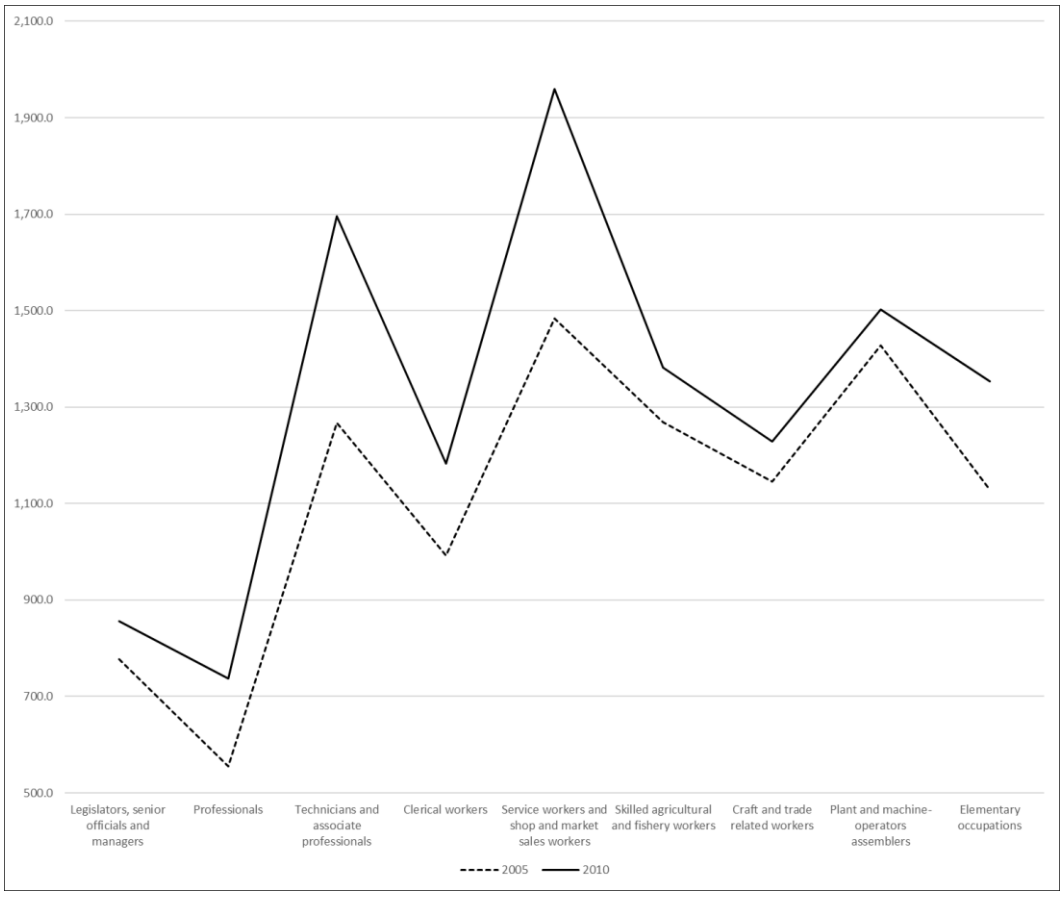
Figure 2.2 shows the changes in employed persons by occupation in Malaysia between 1982 and 2000. The occupation is classified according to the Dictionary of Occupational Classification, 1980. The number of employed persons has increased in all occupations except for agricultural related sectors. This shows a gradual shift from agriculture-related activities to manufacturing and services activities in the country. The change in the distributions by occupations for year 2005 and 2010 is shown in Figure 2.3. The occupation for year 2005 and 2010 is classified according to the Malaysia Standard Classification of Occupations 1998 (MASCO-98). Based on Figure 2.3, there is a huge increase in the number of service workers employed. The number of persons employed in occupations such as legislators, senior officials, and managers, professional, technical and clerical workers have also increased. The number of persons employed in agriculture-related occupations decreased.

Figure 2.2: Employed persons by occupation, Malaysia, 1982 to 2000.



Source: Department of Statistics Malaysia 2017.

Figure 2.3: Employed persons by occupation, Malaysia, 2005 and 2010.



Source: Department of Statistics Malaysia 2017.

Moving forward, Malaysia aims to become a high-income nation that is both inclusive and sustainable by 2020 (EPU 2010a, p. 58). According to a report on the Malaysian Economic Transformation Program (EPU 2010a, p. 63), Malaysia is at risk of remaining a middle-income country, no longer competitive as high-volume and low-cost producer, yet at the same time not able to move up the value chain to be competitive with developed countries. Therefore, a systematic programme to transform the underlying structure of the country's economy is necessary to attain high-income country status. While a detailed discussion of the efforts towards achieving this goal is beyond this thesis, the Government's focus does include increasing the productivity level of the country, requiring the development of an economy that is driven by skills, innovation and knowledge (EPU 2010a, p. 59). This suggests that continued investment in human capital is important in Malaysia.

2.4 Population and ethnic heterogeneity in Malaysia

Malaysia is a multi-ethnic country with three distinct ethnic groups, namely the Malays, Chinese and Indians. The racial makeup is derived from the immigration policies of the colonial past with the Chinese and Indians who were at that time perceived as non-permanent settlers (Barlow 2001; Hirschman 1986). According to the latest Population and Housing Census conducted in 2010, the total population in Malaysia was 28.3 million. The Bumiputera groups made up 67.4% of the total population (which includes 63.1% Malays) followed by the Chinese (24.6%), the Indians (7.3%) and others (0.7%) (DOSM 2015). The Bumiputera (sons of the soil) groups consist of the Malays and other indigenous natives including the Ibans and the Kadazans, while the Chinese, Indians and other ethnicities are non-Bumiputera. These diverse ethnic groups live side by side, sharing a common government and similar basic economic constraints. Yet, they each have a distinct culture, norms and behaviours (Pong 1994, p. 137).

Albeit the presence of cultural pluralism in Malaysia pre-dated the coming of Western colonialism, it was subsequent elaborations by colonialism that gave rise to the ethnicism and completion between ethnicities presently inherited by the modern Malaysian nation-state (Ibrahim 2004, pp. 115-6). One of the major consequences of the British policy of 'divide and rule' in the then Malaya was a clear ethnic division of labour among the three major ethnic groups; namely Malay, Chinese and Indian

(Heng 1997). The Malays were predominately rural and engaged in agricultural farm work. They received less schooling and were socio-economically depressed. The Chinese were urban and had more access to education. They were the most prosperous and were concentrated in trade and commercial activities. The Indians worked as labourers on the rubber estates and in public works. There were minimal schooling facilities on these estates but they fared slightly better than the Malays in terms of education. The ethnic association with education, occupation and poverty resulting from these colonial policies persisted after independence (Heng 1997; Sudha 1997). This resulted in disproportionately high income and sectoral imbalances between the Malays and the non-Malays by 1970 (Heng 1997). Additionally, the gender division of labour was evident in agriculture, mining, fishing and handicraft industry with women being given less arduous tasks while men concentrated on heavier tasks (Kaur 1999).

The implementation of the NEP between 1971 and 1990 introduced comprehensive policies to enhance economic growth and development regardless of race (Comber 2009, p. 84). Poverty reduction intervention policies were specifically targeted at rural areas which aimed to increase the Malays' income through the expansion of employment opportunities in the rural sector (Heng 1997; Sudha 1997). To this day, employment outcomes can be exacerbated by differences between urban and rural living strata. However, the level of urbanisation in Malaysia is on the rise which may cause the trend of female labour force participation, for example, to equally rise with it over time. Additionally, the NEP also aimed to raise Malay corporate equity from 2.4% to 30% by 1990 (Heng 1997; Sudha 1997). The Malays were accorded preferential access to educational opportunities, business licences, employment and promotion especially in the public sector (Jones 1990; Pong 1993; Jomo & Wee 2014). There was also pressure for private firms to hire Malays, and this was taken into account for governmental loan approval (Pong 1993). While the NEP period ended formally in 1990, many policies introduced during this period continue to the present time.

The salient features of ethnic diversity in Malaysia should strengthen the country rather than divide it. However, excessive focus on ethnicity-based resources has

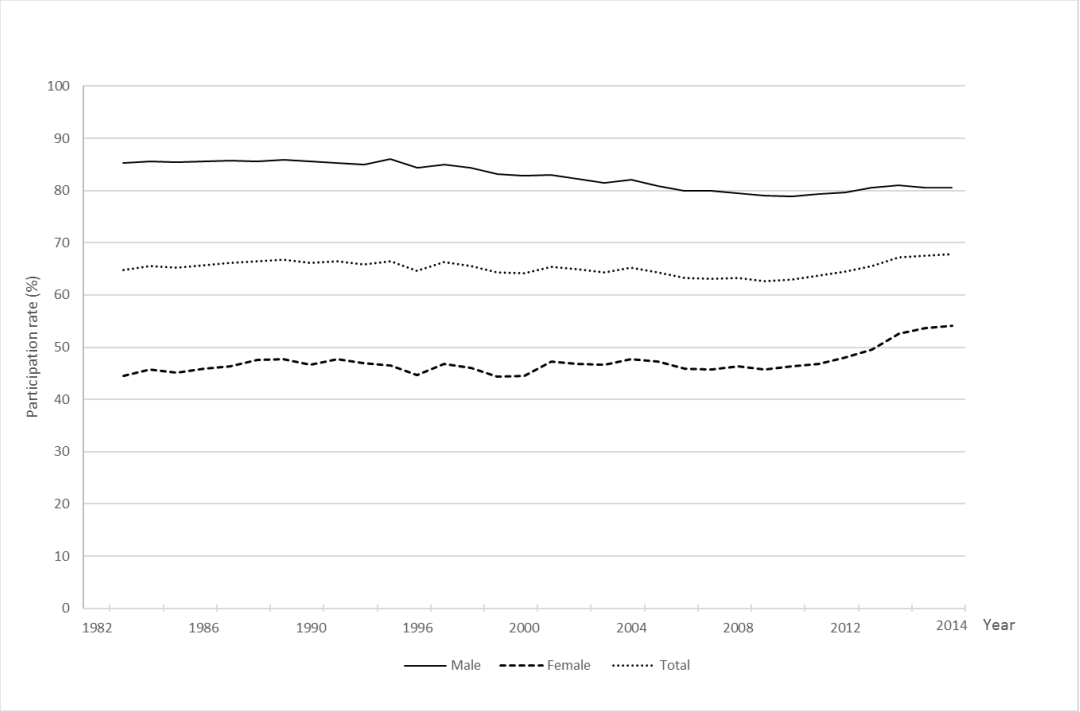
contributed to separateness and dissension (National Economic Advisory Council 2010, p. 10). Therefore, policymakers face continuous challenges to ensure that public policy is balanced and inclusive. The New Economic Model launched in 2010 aims to create an inclusive society. A market-friendly affirmative action plan was outlined which, among other things, aimed to "allow access to resources on the basis of need and merit to enable improvement in capacity, incomes and well-being" (National Economic Advisory Council 2010, p. 10). Assistance is targeted at the bottom 40% of households where 77.2% are Bumiputeras and many are located in East Malaysia. The bottom 40% of income earners includes a range of women in both rural and urban areas who do seek employment opportunities (National Economic Advisory Council 2010). Against the backdrop of a distinctly heterogeneous population, understanding the changes in the pattern of female labour force participation can potentially assist policymakers in the design and implementation of public policies.

2.5 Female labour force participation in Malaysia

The labour force participation rate in Malaysia for persons aged between 15 and 64 fluctuated between 64.8% and 67.9% from 1982[3] to 2015 (see Figure 2.4). Due to increasingly unstable commodity prices in the 1960s, the Malaysian Government introduced policies to encourage export-oriented industries in the 1970s. This resulted in increased employment in the economy which peaked in 1988 with a labour force participation rate of 66.8%. After 1997, there was a slight decrease of labour force participation rate from 65.6% and it has fallen to 63.7% in 2010 as a result of the slower growth in the country's economy post-Asian crisis (DOSM 2016; National Economic Advisory Council 2010).

[3] Time series data from the Labour Force Survey is only available from 1982 onwards. The data was not collected in 1991 and 1994.

Figure 2.4: Trends in labour force participation rates in Malaysia (15 to 64 years of age), 1982-2015.



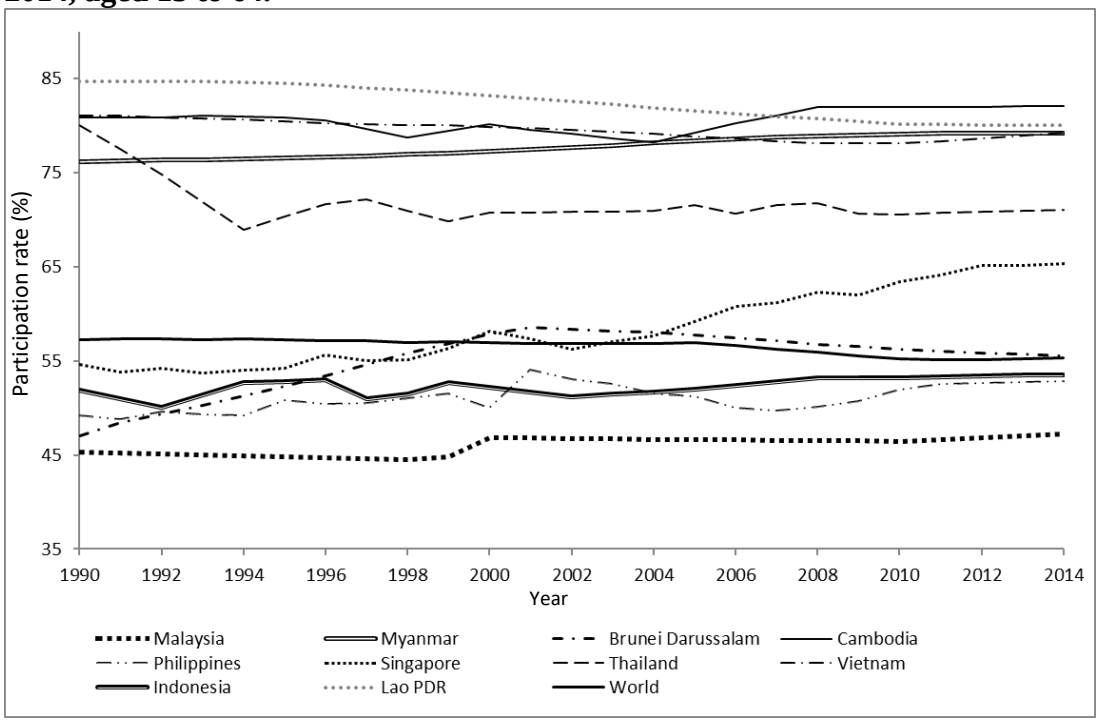
Source: Department of Statistics Malaysia 2016.

The female labour force participation rate is historically lower than the male participation rate. According to data from the Population and Housing Census,[4] the female labour force participation rate increased significantly from 37.2% to 44.5% between 1970 and 1980. Meanwhile, as shown in Figure 2.4, the female labour force participation rate in Malaysia was 44.5% in 1982. The rate showed a modest change from 40% to 49% from 1982 to 2012. In 2013, the female labour force participation rate surpassed the 50% mark for the first time and it remains at 54.1% in 2015. On the other hand, the male labour force participation rate was 85.3% in 1982 and this has decreased over the decades to 79.7% in 2011. The male labour force participation rate then increased slightly to 80.5% in 2012 and remains at 80.6% in 2015. The gender gap in labour force participation has narrowed between 1982 and 2015 from 40.8% to 26.5%. Although this is a positive indicator for women's development, it should be noted that the closing of the gender gap is partly attributed to the decline in male labour force participation.

[4] Apart from the official labour force statistics collected from the Labour Force Survey, the decennial Population and Housing Census of Malaysia, first collected in 1970, provided data on labour force participation.

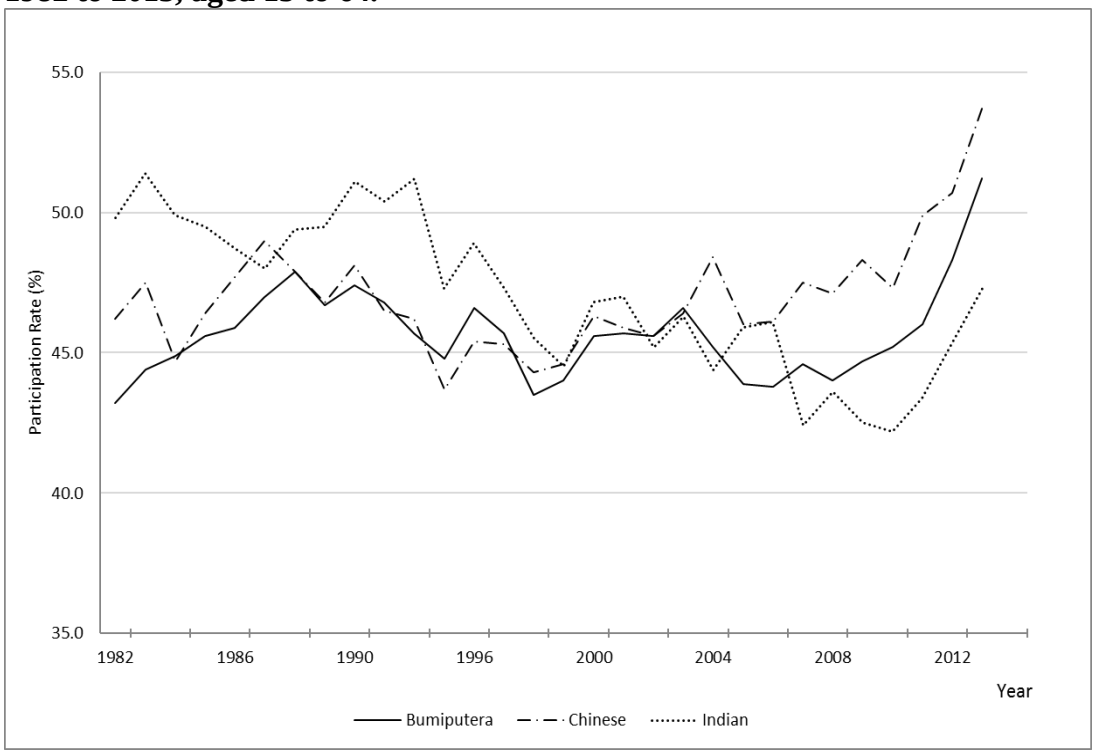
In the context of the ASEAN region, the female labour force participation rate in Malaysia has been the lowest from 1990 to 2014 (as shown in Figure 2.5). This is of particular concern given the country's immediate policy targeting. In the Eleventh Malaysia Plan (2016-2020), the Government has targeted an increase in the female labour force participation rate to 57% by the year 2020 (EPU 2015). The effort to increase female labour force participation in Malaysia therefore continues to be one of the key focus areas for the country. Figure 2.6 shows the female labour force participation rate in Malaysia by ethnic group. The rates fluctuated between 42% and 52% from 1982 to 2013. The rates of female labour force participation for the Bumiputera and Chinese women were similar from 1982 to 2003. Nevertheless, from 2004 onwards, the female labour force participation rate for Chinese women was 2 to 3 percentage points higher. The female labour force participation rate for Indian women had declined since 1990 but started to increase from 2010. In 2013, the female labour force participation rate of Chinese women was the highest, followed by the Bumiputera and Indian women. The differences in female labour force participation by ethnic groups will be discussed further in Chapter 7.

Figure 2.5: Female labour force participation rate in ASEAN countries, 1990 to 2014, aged 15 to 64.



Source: World Development Indicators, World Bank 2016.

Figure 2.6: Female labour force participation rate in Malaysia by ethnicity, 1982 to 2013, aged 15 to 64.



Source: Department of Statistics Malaysia 2016.

2.5.1 Female advancement in the economy

The role and contribution of women in Malaysia to the country's development has been increasingly recognised. Although women had lower status and their contributions to the development process were undervalued in the early years after independence, their improving health and education enabled them to advance beyond the traditional role of performing household duties and in the primary role of childbearing and child caring in the post-independence era (Leete 2007). Additionally, Leete (2007) noted that the increased participation of women in modern urban-based employment increased their income and enabled them to enjoy greater independence and increased status within the household where bargaining power is usually unequally distributed between male and female members.

The Malaysian economic development plan gave priority to the need for overall economic growth post-independence, which brought about significant structural changes in the economy that affected the pattern of female labour force participation (Ariffin 1992). Ariffin (1992, p. 33) highlighted three main factors that contributed to the changing trend in Malaysian women's economic participation in the early years

after independence. First, the rapid expansion of the country's education system in the 1960s enabled women to obtain more education and this changed their attitude towards paid employment as well as increasing their skills and thus increased their employability and earnings capacity. Second, the rapid economic development and industrialisation as well as expansion of the urban economy created new job opportunities for women. Third, the implementation of the NEP, aimed at restructuring Malaysian society, facilitated greater social and spatial mobility with transformation of rural to urban activities from unpaid to paid employment.

The level of women's involvement in the economy has changed gradually according to the country's economic structure. The favourable economic situation post-independence was partly attributed to the country's position as the leading natural rubber and tin ore producer plus the later process of industrialisation (Hirschman & Aghajanian 1980). Malaysia underwent major structural changes in the economy from the 1970s where the manufacturing sector became the main engine of growth for the Malaysian economy (Ariffin 1992; Loh-Ludher 2009; Yahaya 2009). In general, there was a shift in the nature of work for women as the economy shifted from agricultural to industrial and services sectors. Although there was an increase in the share of women both in agricultural and non-agricultural work between 1957 and 1980, the proportion of women employed in the agricultural sector fell significantly from 39% in 1980 to 25% in 2005 while employment in non-agricultural sectors (especially industry and services) increased from 30% to 37% (Leete 2007).

The growth of manufacturing plants in urban areas and free trade zones near cities encouraged a massive flow of migration of rural men and women to urban areas (Ariffin 1992; Loh-Ludher 2009; Yahaya 2009). The creation of job opportunities, especially with the growth in manufacturing sectors, affected the female workers' composition where, prior to 1970, more males had been employed than females (Ariffin 1982). In 1983, around 70% of the workforce in the textiles and garments industry were women, while 90% of electronics factory workers were women (Jomo & Wee 2014).

The expansion of export-oriented industry and the intensity of foreign direct investment inflow to the country in the electronics, garment and other light consumer-oriented industries provided employment opportunities for single, young and relatively educated women (those who had at least completed primary school) (Ariffin 1982; Leete 2007). These factories provided many young women with their first opportunity for paid employment, allowing them to move away from the extreme poverty of rural areas and to achieve a degree of financial independence (Leete 2007). Additionally, these women began to play important roles in supporting their families financially (Jomo & Wee 2014). Female workers were considered suitable for manufacturing work. Young women aged 15 to 24 years old were often seen as a cheap and docile labour force, as well as having keen eyesight, manual dexterity, discipline and the ability to sit for long hours (Ariffin 1992; Leete 2007; Yahaya 2009). In the electronics industry for example, they were able to perform intricate work with diligence, patience and speed (Ariffin 1982, p. 414).

According to Ariffin (1982), many general incentives were introduced by the Government to attract multinational establishments to invest in the country. Apart from the export-processing trade zones and pioneer status treatment, other legislative regulations were relaxed to promote the interest of foreign investors. For example, regulations prohibiting night-shift work for women workers were relaxed. In the early 1970s, the formation of trade unions was also deliberately curbed by the Government to ensure a docile and efficient industrial workforce.

Apart from the manufacturing sector, women also gained employment in the services sector which included wholesale and retail trade, restaurant and hotel services, and social and personal services. Between 1970 and 2005, the composition of females in the wholesale and retail trade and restaurant and hotel services sectors, and the social and personal services sector increased from 18% to 39% and from 29% to 45%, respectively (Yahaya 2009, p. 38). The positive growth of female employment in the services sector suggested that the sector was deemed suitable for women due to their domesticity and feminine nature (Yahaya 2009, p. 39).

The favourable growth in the Malaysian economy in the 1980s, attributed to the growth in GDP, structural change and government policy, continued to fuel the participation of female workers in the economy (Ariffin 1992; Loh-Ludher 2009; Yahaya 2009). However, it is also noted that women were commonly found in informal employment including as street vendors, petty traders, child minders and seamstresses. Women were traditionally confined to low wage jobs due to a lack of access to education. Parents were reluctant to invest in daughters' education because girls earned less due to job and wage discrimination (Jomo & Wee 2014). Additionally, Malay daughters, for example, were expected to help with household work including looking after their younger siblings (Hirschman 2016, p. 42). Moreover, the domestic role of women fitted the cultural norms across all ethnicities. There was also a general preference to send sons to school over daughters as any gains of education would accrue to the daughter's in-laws after the daughter married (Jomo & Wee 2014). Although female access to education has improved tremendously over the years, sexual stereotyping in the education system persisted with young girls and boys encouraged into jobs stereotyped as feminine or masculine (Jomo & Wee 2014). While education increased women's opportunities to do paid work, the education process also reinforced the sexual division of labour which was then reflected in job and wage discrimination (Jomo & Wee 2014).

Women work for many economic and social reasons. In many households, a single income is no longer sufficient for the household. In the 1990s, Malaysian women from poor households entered paid employment to supplement family income (Ariffin 1994; Stivens 2000, p. 27). In a similar vein, a proportion of the wages of young, unmarried daughters working in urban areas were used to support many rural households (Stivens 2000, p. 27). Wage employment provides women with regular income and offers them independence. At work, females enjoy benefits required by labour law, such as mandatory holidays, worker's compensation and paid maternity leave (Leete 2007).

While rural women worked to supplement household income, urban middle-class women struggled to juggle the dual role of home and work as they faced increasingly higher opportunity costs of working outside the home as a result of the limited

childcare support system (Ariffin 1994; Stivens 2000). In addition, not all Malaysian women could expect an equal sharing of household responsibilities between husbands and wives (Yacob & Noor 1993). Malaysian households, like those in many non-Western countries, presume more traditional gender roles (Westman 2005). Although flexible work arrangements are becoming more common in recent years, the structure of employment in Malaysia is highly formal with limited availability of part-time and casual work (Aziz 2011, p. 11). Nonetheless, as the Malaysian Government continues to view females as an important pillar for economic growth and sustainability, various policies have been implemented to motivate women into participating in the labour force. This will be discussed further in section 2.8. As noted most profoundly by Ahmad (1998, p. xviii), increasing women's participation in the development is both an opportunity and challenge for Malaysia.

2.6 Female educational attainment in Malaysia

Female educational attainment in Malaysia has increased substantially in the post-independence era. Female adult literacy (among population aged 15 years and older) increased from 61.25% in 1980 to 90.75% in 2010 (UNESCO-UIS 2016). By 1990, universal primary education was almost achieved, when the net enrolment ratio rose to 94% (United Nations Development Programme 2005). According to data from UNESCO-UIS (2016), between 1970 and 2010, the net enrolment rate at primary level for girls rose from 79.7% to 96.7% in Malaysia. Meanwhile at the secondary level, net enrolment rate increased from 26.6% to 69% in the same period. The gross enrolment ratio at tertiary level for female increased from 3.07% in 1980 to 43.16% in 2010. By 2010, the percentage of females enrolled in Malaysian public universities was 60.1% (Ministry of Women, Family and Community Development 2014).

The education system in Malaysia is constantly being revised to keep up with the country's structural change, especially to meet the demand for skilled and knowledgeable workers. In the early post-independence years, the Government increased allocations for educational expenditure to create a Malay middle class as well as to develop human capital for the rapidly growing and increasingly modern Malaysian economy (Jomo & Wee 2014). Specifically, Karim (2009, p. 161)

emphasises that educational policies prior to 1970 were based on economic needs, fuelled by the urgency to replace foreign expatriates at managerial, administrative and professional levels. However, she notes that the focus of the education policy in the country changed after the 1969 racial riot where national unity was given greater emphasis, with efforts to increase equal participation in education regardless of ethnicity, location and social class, and to improve educational opportunities for young people from disadvantaged groups including females.

Several important reforms took place in the Malaysian educational system which led to increased equality and equity in education opportunities. In 1970, a significant reform took place in the education system where the Malay language was introduced as the official medium of instruction in all Government schools. The change was implemented at the tertiary level in the mid-1980s.[5] This reform was seen as an important tool to integrate the multiracial society as well as to eradicate the poverty addressed in the NEP. The reform increased access to education especially for rural Malays whose native tongue was the Malay language (Ismail 2007). In the 1990s, the mounting demand for local tertiary education in the 1990s eventually led to a reform of the tertiary education system in Malaysia which included the privatisation of tertiary education institutions. The higher education reform saw the establishment of many new higher education institutions, which increased the opportunities for tertiary education.

In general, the expansion of educational opportunities since the 1960s has provided females with greater access to education and opportunities for training (Karim 2009, p. 161). According to Karim (2009), enrolment in primary education increased, including for girls, which may reflect a greater appreciation by parents of the value of education for their daughters. Additionally, between 1975 and 2003, female enrolment in the upper secondary and post-secondary levels has increased remarkably while male enrolment has declined. The enrolment of female students in tertiary institutions surpassed males from 1996 onwards (Karim 2009). Nevertheless, "until the 1960s, there was a common belief in the society in general that women are

[5] Due to the internationalisation in higher education from the 1990s, English is commonly used as the medium of instruction at present.

ideally better off as housewives and when educated should be channelled into teaching, nursing or other feminine occupations" (Ariffin 1992, p. 55). The gender segregation as a result of gender stereotyping, which affected the student's choice of courses, is still prevalent even at the tertiary education level where female students are more concentrated in the arts stream than the science streams (Karim 2009). However, this pattern is slowly changing as the Government encourages girls to take up more science-based studies.

The role of women in the Malaysian economy continues to concern the Government considering the significant increase in female educational attainment over the same period. The theory of human capital postulates that increased years of education are often associated with positive earnings. In Malaysia, the average private returns to education are highest at the secondary school level; 27.2% for females versus 16.5% for males. Meanwhile the returns to university education are 16.1% for females and 15.5% for males. Additional schooling yields a higher return for females than males (Kenayathulla 2013). The returns to university education can be lower than secondary education as a result of overeducation, where a graduate works in employment not commensurate with her qualification such as clerk and factory operators (Lim 2013, p.93). Finally, more education often reflects the changing tastes and preferences of females for labour market work. Yet, despite the higher educational attainment by Malaysian women, the labour force participation rate remains low. This might indicate that alternative uses of time for females, such as caring for their family, are considered by them as more valuable. The effect of increased education on female labour force participation will be discussed further in Chapter 6.

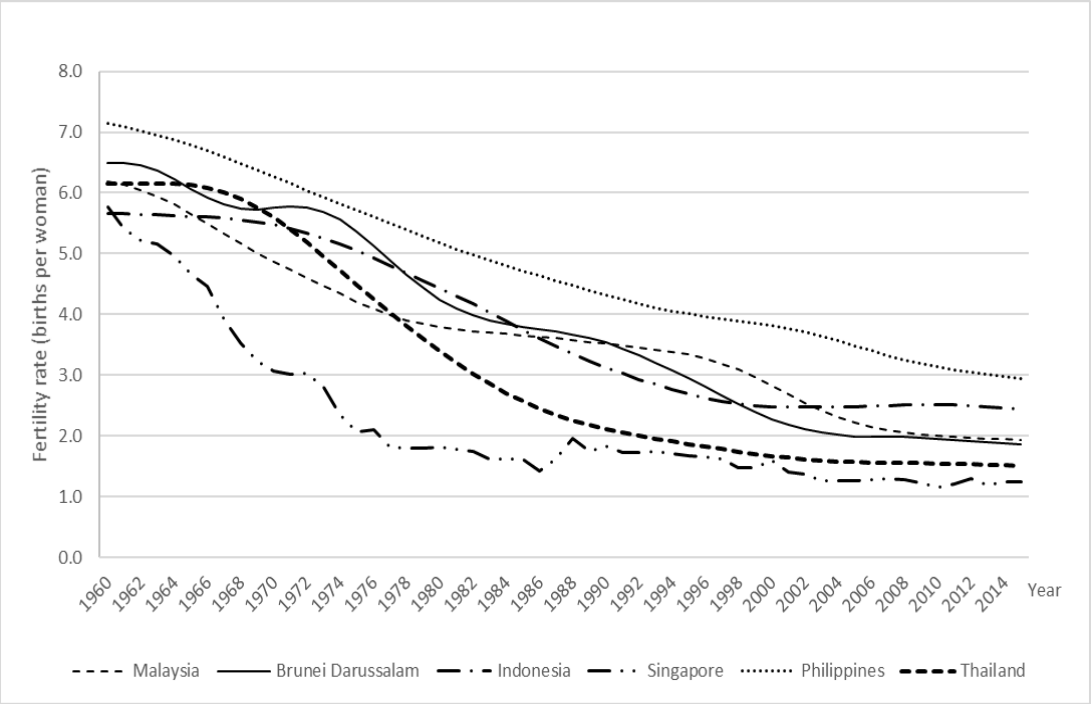
2.7 Fertility trends in Malaysia

Malaysia is an intermediate-fertility country with total fertility dropping from 5 to 2.1 children per woman in the period between 1995 and 2000. It is anticipated "that by 2050 fertility in the intermediate-fertility countries will fall below the level required for long-term population replacement" (United Nations 2002). As shown in Figure 2.7, the fertility rate in Malaysia decreased from 6.19 in 1960 to 1.93 in 2015. In general, this trend has also been observed in other ASEAN countries over the last five decades. The dominant reason for the decline in fertility rates in Asia, including

Malaysia, has been the increase in contraceptive prevalence. At the same time, contraceptive efficiency has generally increased (Sanderson and Tan 1996).

In Malaysia, the population policy shifted from anti-natalist to pro-natalist in the 1980s. In the 1950s, the Government had introduced and provided family planning services in the country. A national population control programme was introduced in the First Malaysia Plan 1966-70 due to the need to reduce population growth as continuous population growth (which was then at 3% per annum) would affect the country's economy in the long term when income would be used for consumption rather than productive investment (Saw 2015, p. 144). The crude birth rate reduced from 37.3 per 1,000 persons in 1966 to 30.3 in 1980 (Saw 2015, p. 147). Family planning programmes were generally well received, as evidenced by the falling crude birth rate.

Figure 2.7: Total fertility rates in selected ASEAN countries, 1960 to 2015.



Source: World Development Indicators, World Bank 2016.

However, in 1982, the Prime Minister envisioned the need for a larger population base in order to expend the country's economic advantage, including the provision of a large domestic market to support future industries in the country (Saw 205, p. 148).

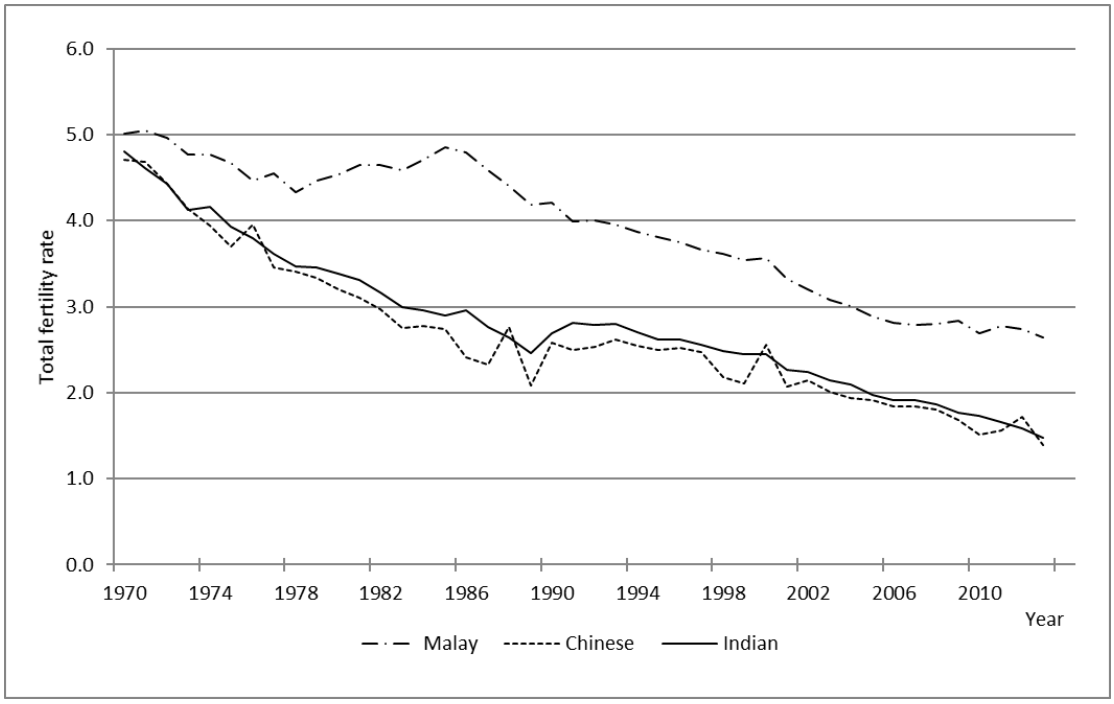
The New Population Policy (NPP) was announced by the Prime Minister with the target of increasing the population fivefold to 70 million by the year 2100. Following that, several measures were introduced to encourage large family sizes including the extension of paid maternity leave from the first three children to the first five children in June 1984 and child relief allowances for tax purposes revised in the 1985 budget to allow deductions up to the fifth child (Govindasamy & DaVanzo 1992; Saw 2015). The 70 million population target was abolished in 2004 due to the difficulty of achieving the target and the rapid decline in fertility (Saw 2007, p. 159). However, the benefits introduced earlier are still in place.

Previous studies indicate that both the NEP and NPP affected the fertility trend in Malaysia (Govindasamy & DaVanzo 1992; Hirschman 1986; Jones 1990; Pong 1994). According to these studies, the rate of contraceptive prevalence before the policy change rose from 25.9% (1970-1974) to 45% (1980-1984). The policy change saw the rate fall to 41.5% in 1987. Although the total fertility trend in Malaysia is declining in general, there is a variation in total fertility rates by ethnic group, where the fertility rate has been highest for the Malays since 1970 and lowest for the Chinese as shown in Figure 2.8. There was a small spike in the total fertility for the Bumiputera group (primarily Malay) between 1983 and 1985 which coincided with the introduction of the NPP. On the other hand, the fertility rates for the Chinese group show a declining trend with small peaks in 1976, 1988 and 2000 (believed to be the auspicious years of the dragon according to the Chinese zodiac).

Though the NPP was not ethnic-specific, the more rural Malays, who prefer larger family sizes, were more receptive to the political message (Govindasamy & DaVanzo 1992). Although the new tax relief for additional children increased an individual's disposable income, the benefit should be weighed against the overall cost of raising children. In this regard, the increased educational opportunities and civil service employment under the NEP reduced the cost of children for Malays, leading to increases in the desired family size. Additionally, the NEP, which favoured the Malays, created greater barriers to upward mobility for the Chinese and Indians which potentially could have led to lower fertility among these ethnic groups (Govindasamy & DaVanzo 1992). The increase in Malay fertility during the NEP

period was then seen to reverse in later years when Malay women started to acquire more education and eventually enjoyed greater opportunities in the labour market. Furthermore, although the Government's policy has impacted on the changing trend of fertility, rapid socio-economic development in the country has also contributed to the change. The rising age of marriage, the increased use of contraceptive methods, urbanisation, increased education, increased female labour force participation and the breakdown of the extended family system have all resulted in smaller family sizes (Tey 2009, p. 304).

Figure 2.8: Total fertility rate per woman by ethnic group in Peninsular Malaysia, 1970 to 2013.



Source: Department of Statistics Malaysia 2016.

The changes in population structure and fertility are closely related to the trend in marriage and the marital status of the population. The proportion of females (aged 15 years and above) who never married increased from 26.0% to 32.2% between 1970 and 2010 while the mean age at first marriage increased from 21.6 to 25.7 years between 1970 and 2010 (DOSM 2011b; Mahari 2011). Therefore, it can be concluded that there is a rising trend of non-marriage and a rise in the mean age at first marriage. Postponement of marriage has enabled more women to enter and remain in the workforce, thus reducing the span of active reproductive life. The

effect of fertility on female labour force participation will be discussed further in Chapter 7. The next section deals with government policies and initiatives to encourage female labour force participation in Malaysia.

2.8 Policies to encourage female labour force participation in Malaysia

The history of formal development in Malaysia to improve the status of women can be traced to the 1970s when the country recognised the United Nation's Women's Decade from 1975 to 1985 as shown in Table 2.1. Various agencies and units were established to spearhead the implementation of various policies and agendas to improve the status of women in social, economic and political realms. In 1989, the National Policy on Women was formulated with the aim to integrate women into all sectors of development as well as to ensure equitable sharing of resources and development opportunities between men and women.

The increasing commitment by the Government to women's development in the country took a major turning point when a full chapter on women and their development was included in the Sixth Malaysia Plan 1991-1995. The Malaysia Plan, first introduced in 1965, is a comprehensive outline of the country's development policies and strategies over a 5-year period. The Sixth Malaysia Plan addressed gender issues in various areas and stressed the need to increase women's access to new opportunities in education, training and labour markets. The succeeding Malaysia Plans continued to incorporate policies and plans to integrate further the role of women into the mainstream development process of the country.

Over the years, the Government has continued to increase women's access to the labour market, eradicate poverty amongst female-headed households, provide childcare facilities and support for working mothers, and address work and family conflicts as well as sexual harassment in the workplace. In recent decades, the Government has aimed to increase the representation of women in politics and decision-making positions (EPU 2006, p. 293).

Table 2.1: National policies and agendas to increase female labour force participation in Malaysia.

Year	Policies/Agendas	Aims/Highlights of policy
1975 to 1985	Malaysia recognised the United Nations' Women's Decade	To instil the need to value the role of women and upgrade the status of women in society.
1975	National Advisory Council on the Integration of Women In Development (NACIWID) set up	To advise the Government on female-related matters in development.
1982	The Women Affairs' Secretariat in the Prime Minister's Department set up	To administer affairs relating to women.
December 1989	National Policy on Women	(a) To ensure equitable sharing of resources and development opportunities between men and women. (b) To integrate women into all sectors of development.
1992	National Plan of Action for the Advancement of Women	(a) To strengthen national machineries for the advancement of women. (b) To redress problems of discrimination and promote affirmative action for the advancement of women in various fields.
September 1995	Beijing Declaration and the Platform for Action	Commitment to strengthen the implementation of the National Policy for women.
1995	Ratified the Convention on the Elimination of all forms of Discrimination Against Women (CEDAW)	(a) Provision of national legislation to ban discrimination. (b) Recommended actions to modify social and cultural patterns that perpetuate discrimination.
1997	Revision of National Plan of Action for the Advancement of Women	(a) To strengthen national machineries for the advancement of women. (b) To redress problems of discrimination and promote affirmative action for the advancement of women in various fields.
2001	Ministry of Women, Family and Community Development	To mainstream women into national development and to strengthen the family system.

(continued)

Table 2.1: (continued)

Year	Policies/Agendas	Aims/Highlights of policy
2004	At Least 30% of Women in Decision-Making Positions in Public Sector Policy	Ensure at least 30% participation of women in decision-making positions at all levels in the public sector.
2009	Review of the National Plan of Action for the Advancement of Women and the National Policy on Women 2009	To integrate women in all sectors of national development and promote equality as well as to empower women.
2011	At Least 30% of Women in Decision-Making Positions in the Corporate Sector Policy	(a) Increase female composition to 30% in public and private sector decision-making positions. (b) For monitoring purposes, companies required to include a gender index in their annual report.

Source: Compiled by author.

Despite the Government's effort to increase women's economic opportunities, Malaysian women were still underrepresented in the job market enforcing the need to introduce social policies or family friendly policies to address barriers to women's labour force participation. This is crucial considering for example, a survey conducted by the National Population and Family Development Board (2016) indicated that 42.4% of female respondents who had decided to withdraw from the labour force cited family responsibilities and the difficulty to balance career and family life as some of the main reasons affecting their decisions.

The Government introduced various legislation to encourage women to enter the labour market such as parental leave, provision of child care, tax system reform and flexible working arrangements (see Table 2.2). The private sector was encouraged to facilitate women's entry into the labour market through flexible working hours, career breaks, family-friendly workplace practices and new working arrangements such as teleworking, part-time work and job-sharing.

The Government also provides generous maternity leave benefits to women. Female civil servants are entitled to a total of 300 days paid maternity leave for the entire duration of service with the flexibility of 60 to 90 days leave per child delivery (Public Service Department of Malaysia 2010). Employees from the private sector are entitled to a minimum of 60 days paid maternity leave with the exception of clerical workers in the banking industry (with influential trade unions) who enjoy 90 days leave. Beginning in 2007, civil servants also enjoy up to a total of 1825 days of unpaid leave entitlement (for the entire service duration) for childcare following a new birth (Public Service Department of Malaysia 2007).

In 2007, the Government implemented flexi work time in the public sector with three staggered work times. Although part of the reason was to reduce traffic congestion, the move was well-received as employees with family commitments could choose their working time to suit family commitments. In 2015, the Ministry of Women and Family Development took the initiative to introduce three flexible working modes in 2015 including: (1) working from home; (2) flexi-working hours; and (3) modified-compressed workweek. In the private sectors, such arrangements are limited and are usually practised by foreign owned multinational corporations, educational institutions and a few small firms (Subramaniam & Selvaratnam 2010).

One of the barriers restricting flexible work arrangements such as part-time work is the complexity of implementation, for example, the employer contributions to employee provident funds are calculated on a monthly basis based on full-time work hours. The article in the *New Straits Times* (30 September 2010) reported the Human Resource Minister, Datuk S Subramaniam, explaining the need to introduce the Work Regulation for Part-Time Work which defined the minimum standards for part-time employment in terms of hours of work, holidays, annual leave, sick leave and rest days. The implementation of the part-time work regulation in 2010 is expected to benefit 6.5 million latent workers in Malaysia who are willing to work part-time, including housewives, single mothers, retirees, people with disabilities and students. According to the new regulation, part-time workers would be given salaries and other relevant benefits and entitlements on a *pro rata* basis. At the same time, the new regulation would help lessen the country's dependence on foreign workers.

Table 2.2: Laws and regulations related to women's employment in Malaysia.

Year	Law and regulations	Aims / Highlights
1955	Employment Act 1955	Prohibition against night work for females between 10pm to 5am. Paid maternity leave of 42 days for the public sector and 60 days for the private sector.
1975	Income Tax Act 1967 Amendment 1975, (also amended 1978, 1991)	Option to allow married working women to submit separate tax assessments from their husbands.
1984	Maternity leave	Extended from the first three children to the first five children for public sector employees.
1985	Budget 1985 child relief allowances	Child relief allowance deductions for tax purposes up to the fifth child.
1998	Employment Act 1955 - Amendment 1998	Paid maternity leave for a period of not less than 60 days, for a maximum of up to five deliveries in the public sector. Ability to extend maternity leave up to three months as unpaid leave. Paternity leave of up to three days in the public sector. Provision for flexible work hours *inter alia* part-time work.
2007	Service Circular 2 Year 2007 (Implementation of flexi-work time in the public sector)	Staggering work times in the public sector with three different start times: 7.30 am; 8.00 am; and 8.30 am.
2007	Service Circular 4 Year 2007 (Childcare subsidy in public sector workplaces)	Provision of childcare subsidies up to RM180[6] per child for public sector employees with a total household income up to RM3000.

(continued)

[6] RM represents the Malaysian currency, Ringgit Malaysia. On the 15th of July 2016, 1USD=3.9585RM.

Table 2.2: (continued)

Year	Law and regulations	Aims / Highlights
2007	Service Circular 15 Year 2007 (Childcare benefit)	A total of 1825 days of unpaid leave entitlement (for the entire service duration) for child care following a new birth for employees in the public sector.
2010	Service Circular 14 Year 2010 (Public service employee maternity leaves benefit)	A total of 300 days paid maternity leave for the entire duration of service with flexibility of 60 to 90 days leave per child delivery for the public sector.
2010	Introduced Work Regulation for Part-time Workers	Set minimum standard for part-time employment in terms of hours of work, holidays, annual leave, sick leave and rest days.
July 2012	Minimum Wage Order	Minimum wage of RM900 in Peninsular Malaysia and RM800 in East Malaysia.
2013	Circular Service 38 Year 2013 (Childcare subsidy in public sector workplaces)	Provision of childcare subsidies up to RM180 per child for public sector employees with a total household income up to RM5000.
October 2015	Revision of minimum wage	Minimum wage set to RM1,000 in Peninsular Malaysia and RM920 in East Malaysia.

Source: Compiled by author.

Other initiatives including programs such as 1Malaysia Support for Housewives program, and the Housewives Enhancement And Reactivate Talent Scheme (HEARTS) were also implemented to attract housewives, especially those with tertiary educations, to participate in the labour market.

In summary, the Government's key focus area for the labour market in the period between 2000 and 2015 included childcare, flexible work arrangements and minimum wage regulations. From 2008, the female labour force participation rate in Malaysia has increased gradually from 45.7%, surpassing the 50% mark in 2013. The female labour force participation rate was 54.1% in 2015, very close to the initial target of 55% (DOSM 2016; EPU 2010b).

2.9 Conclusion

The discussion in this chapter suggested that the rapid economic growth in Malaysia, followed by its changing economic structure, has shaped the pattern of female labour force participation in the country. The employment of females shifted from agriculture to manufacturing and then to the service sector. In addition, the level of education among females has increased substantially while fertility declined. At the same time, the Government has implemented various policies to encourage work-family balance, as evidenced by the provision of various childbearing and child caring benefits. More recently, the emphasis on flexible work arrangements, including the introduction of formal legislation on part-time work, aims to attract more women, especially housewives with tertiary education, to the labour force. Against this backdrop, the modest growth in female labour force participation rate appears puzzling. The female labour force participation rate in Malaysia has been persistently low as compared to other ASEAN countries.

In conclusion, the discussion in this chapter suggests that fertility and education are linked to female labour force participation decisions in Malaysia. Hence, this study aims to provide a better understanding of how fertility and education may affect female labour force participation in Malaysia. The next chapter presents the theoretical model to initiate the investigation into this question.

CHAPTER 3 THEORETICAL MODEL

3.1 Introduction

This chapter seeks to explain the underpinning theories for the empirical analysis in subsequent chapters which focus on the effects of tertiary education and fertility on female labour force participation. The female labour force participation decision in this study can be explained by two complementary theories - the neoclassical model of labour supply and the human capital theory. In the neoclassical model of labour supply, a woman's decision to participate in the labour force depends on the value of paid labour market work and the value of time spent at home which can be affected by the presence of children. Meanwhile, according to the human capital theory, an individual's decision to invest in tertiary education is undertaken by weighing the cost and benefit of such investment. The effect of government policies on female labour force participation is also considered in this chapter.

Following this introduction, section 3.2 discusses the theory of labour supply. The extensions to the neoclassical model of individual labour supply are presented to incorporate the child variable. Section 3.3 presents a discussion on the human capital model and section 3.4 concludes.

3.2 Theory of labour supply

The traditional neoclassical model of individual labour supply can be used to analyse decisions by females for labour force participation (Pencavel 1986). According to the model, an individual's labour supply decision can be made by considering the allocation of time between paid work and leisure. Paid work includes labour market activity that generates income to the individual allowing her to purchase consumer goods, while leisure refers to non-market activities that are assumed to provide utility to the individual.

The labour supply decision is made when the individual maximises utility by choosing the optimal combination of work and leisure subject to fixed time and budget constraints (Pencavel 1986).

The utility function of an individual is given by:

$$U = U(x, h; A, \varepsilon) \quad (3.1)$$

subject to the budget constraint:

$$px = wh + y \quad (3.2)$$

The utility of an individual, *U*, is defined by the consumption of commodities, *x*, which are assumed to be normal goods and the hours of work, h. The combination of commodities x and the hours of work h varies according to the personal characteristics of the individual, given by A. The observed characteristics can include age or race, while ε represents the unobserved characteristics of individuals which include taste and preferences for work and leisure. The amount of commodity consumed (the product of prices and quantity of commodities, *px*) is constrained by the resources that the individual possesses. The budget constraint is derived from the wage earned from paid labour market work, *wh*, and non-wage income, *y*. The individual is assumed to maximise utility subject to the constraints she faces. In other words, the individual chooses values of $x > 0$ and $h \geq 0$ subject to their budget constraints.

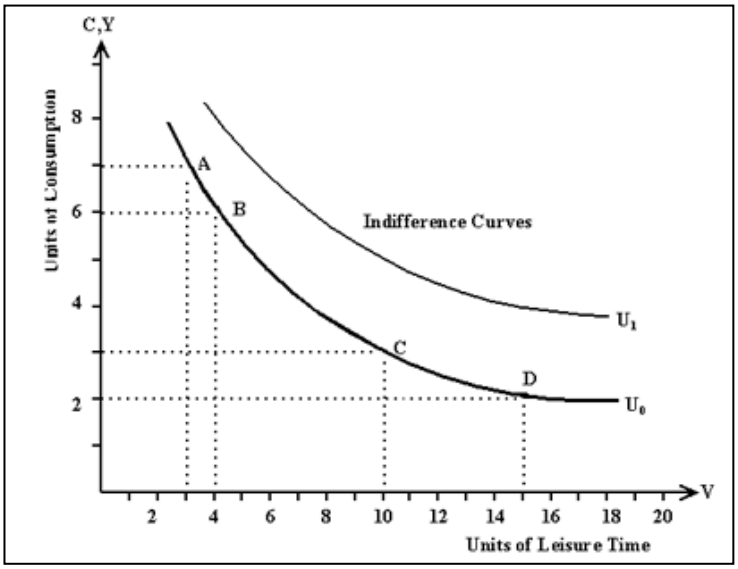
3.2.1 Indifference curve and marginal rate of substitution

Combinations of work and leisure that yield some specific level of utility or satisfaction to the individual can be shown using an indifference curve (McConnell, Brue & Macpherson 2010). In Figure 3.1, daily income or consumption is measured on the vertical axis while the hours of leisure are measured from left to right on the horizontal axis. Points A, B, C and D represent bundles of commodities and leisure hours that yield the same level of utility U_0 to the individual.

The indifference curve has several properties (McConnell, Brue & Macpherson 2010). First, the indifference curve is downward sloping because the additional utility associated with more leisure must be offset by less income so that total utility remains unchanged. In moving down the curve from left to right, there is a trade-off of real income or commodities (C) for the acquisition of more leisure (V) for total utility to remain constant. Second, the indifference curve is convex to the origin where the absolute value of the slope diminishes when it moves down the curve from left to right. This implies that an individual becomes more reluctant to surrender any good as it becomes increasingly scarce. The slope of the indifference curve is

measured by the diminishing marginal rate of substitution of leisure for income. The marginal rate of substitution diminishes following the assumption of diminishing marginal utility where the additional utility gained from consuming one more unit of V decreases as the amount of V in the bundle increases.

Figure 3.1: Indifference curve.



Source: McConnell, Brue and Macpherson 2010, p.16.

Third, the set of non-intersecting indifference curves for each individual, which represent different levels of utility, is known as the indifference map. Combinations of C and V will provide a higher level of utility at a higher indifference curve, U_1, when compared to U_0. Fourth, the shape of the indifference curve of an individual depends on the individual's preferences for work and leisure. A typical workaholic who places a low value on leisure and a high value on work will have a relatively flat indifference curve. A leisure lover puts a high value on leisure and a low value on work and so their indifference curve is usually steep. Apart from tastes or preferences, an individual's circumstances may affect the shape of the curve. In the context of this study, for example, a mother with young children may have a steep indifference curve because leisure (or non-market) time is valuable for childcare.

3.2.2 The corner solution vs interior solution

The primary outcome of interest in this study is the labour force participation status of females. While the decision of an individual on how many hours to work

(intensive margin) can be modelled in the static framework of work-leisure choice, the model can be extended to show an individual's decision of whether or not to participate in the labour market (extensive margin).

The interior and corner solution to the constrained maximisation problem can be distinguished (Pencavel 1986). Recall that an individual chooses $x > 0$ and $h \geq 0$ to maximise utility subject to a given budget constraint, $px = wh + y$. With regard to the hours of work, an interior solution occurs when the individual selects a positive number of hours to supply to the labour market, $h > 0$, while a corner solution suggest that the hours of work are zero (or no labour is supplied), $h = 0$. When $h > 0$, the first-order condition for a constrained maximum requires that the combination of x and h results in a negative value of the marginal rate of substitution (m) of working hours for commodities equals the real wage (w/p), given by:

$$\frac{w}{p} = -m(x, h; A, \varepsilon) \quad (3.3)$$

The interior solution for hours of work can be expressed using the concept of the individual's reservation wage, w^*. The real reservation wage, w^*/p, is the slope of the indifference curve between commodity consumption and hours at work evaluated at $h=0$. The reservation wage varies from one indifference curve to another, and depends on x and y for any given A and ε. The reservation wage is the lowest wage rate at which an individual would choose to participate in the labour market. It is the implicit value of her time at the margin between participating and not participating in the labour market. An individual will participate in the labour market and supply positive work hours if $w > w^*$. This can be written as:

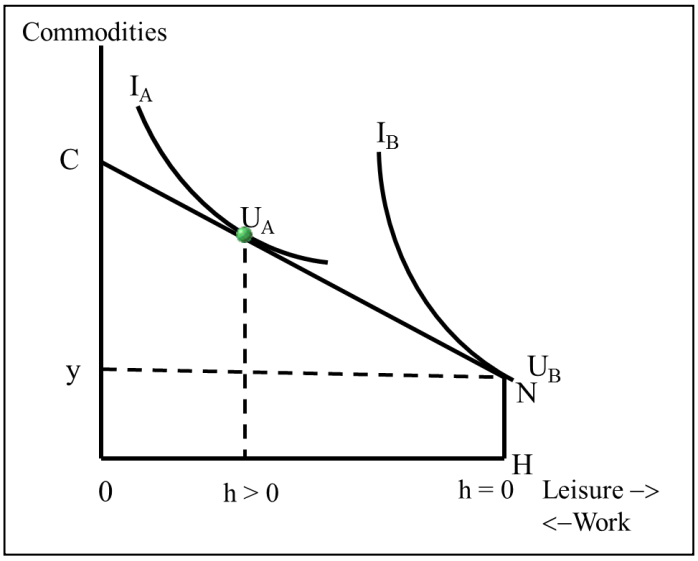
$$\text{if } w > w^*, \text{ then } h = h(p, w, y; A, \varepsilon) > 0 \quad (3.4)$$

However, if, at the margin, the individual places a greater value on time so that $w^* > w$, no work will be supplied and the solution to the constrained maximisation problem will be a corner solution where $h=0$, where if $w < w^*$, then $h = 0$.

The interior and corner solutions can be depicted graphically by considering two individuals, A and B, with different labour force statuses. In Figure 3.2, a linear budget constraint is given by the line NC. The vertical line HN represents non-wage income, y, and is independent of the working decision. Non-wage income can be in

the form of income from a spouse, bonuses or dividends. The slope of NC represents the real wage offered, *w/p*. The utility function for individual A is represented by the indifference curve, I_A. Individual A places a low value on leisure and a high value on work. The interior solution for individual A is at point U_A where the indifference curve is at a tangent to the budget constraint NC. At this level, individual A is willing to supply a positive number of hours to the labour market (h > 0). The rate at which individual A is willing to substitute work for leisure is equal to the real wage offered in the market. On the other hand, individual B has a steep indifference curve indicating that leisure is valued highly relative to income. The marginal rate of substitution of leisure for income are high. At $h = 0$, the rate at which individual B is willing to substitute labour for leisure is not equal to the real wage rate. Individual B therefore works zero hours as shown at point U_B. The optimal outcome at N is not a tangency point but a corner solution. Individual B values non-market time more highly than market time.

Figure 3.2: Interior and corner solutions to labour force participation.



Source: Author's own work.

In general, an individual will be induced to work if the market wage offered is higher than the reservation wage. An individual who decides not to participate in the labour market places a higher value on leisure time and has a higher reservation wage. The reservation wage can be influenced by a woman's tastes and preferences, non-labour income, and personal characteristics such as race, age, marital status, and the ages

and number of children (Sprague 1994). For example, a woman who has a high desire to care for her young children may attach greater marginal utility to non-market time and therefore choose not to participate in the labour force (McConnell, Brue & Macpherson 2010). Consequently, when two individuals face the same potential wage in the labour market, the individual with the higher reservation wage will be less likely to participate in the labour market. In general, women with children have a higher reservation wage as childcare is associated with monetary costs, such as formal childcare, which will increase the cost of working and the reservation wage (Ehrenberg & Smith 2006, pp. 206-211). *Ceteris paribus*, women with children therefore will have a lower probability of labour force participation when compared to women without children. The discussion in this section indicates that the change in wage, *w*, has an effect on the supply of hours of work, *h*. The Slutsky equation can be used to decompose this effect into both the substitution and income effect (Pencavel 1986). Nevertheless, the outcome of interest in this study is limited to the labour force participation status. Thus, the effect of a change in wage on the hours of work supplied will not be discussed in this study.

3.2.3 Model of allocation of time

In the simple static model of labour supply, a woman's individual labour supply decision can be made independent of the labour supply decision of other individuals. However, in a household unit, Becker (1965) argued that a woman's decision to work may depend on the work status of other household members such as her spouse. Family membership and its obligations affect the levels and trends in female labour supply (Pencavel 1986, p. 126). Therefore, the decision can be viewed as a joint household decision. Additionally, Becker (1965) expanded the neoclassical labour supply theory to include multiple uses of time and to show how this perspective can affect the labour supply decision. In Becker's model of allocation of time, the household is viewed as an economic unit that produces utility-yielding commodities (McConnell, Brue & Macpherson 2010). Thus, rather than deriving utility from income and leisure, Becker (1965) suggests that a household can use the time available to maximise the household's total utility by allocating time for: (1) labour market time; (2) household production time; and (3) consumption time. A household produces commodities by combining goods with time to maximise utility.

These commodities may include children, prestige and esteem, and health and altruism (Becker 1981).

The allocation of time model by Becker (1965) is potentially useful to analyse the relationship of fertility and the female labour force participation decision in this thesis. However, Mincer (1962) pointed out that the distinction between work at home and leisure was omitted from Becker's model. This point is important in the case of analysing female labour supply. Gronau (1977) extended the model to consider how individuals make their labour force participation decision by allocating time between labour market work and home production. In Gronau's model, an individual's utility is derived from leisure and consumer goods. Consumer goods are either purchased in the market or produced at home. In the household production function, there is a trade-off between leisure and home-produced consumer goods. Thus, individuals who wish to consume a large quantity of home-produced consumer goods must forgo leisure time. By including both home-produced and market-produced consumer goods, the individual maximises utility subject to their time and budget constraints and the production function (Gronau 1986). In the simple static model of labour supply, an individual's time is allocated between market work and leisure. In Gronau's model, time is allocated between leisure, home production and market work. In this model, an individual will choose to work in the labour market if the marginal value of leisure time is less than the market wage. Further, if the value of an individual's marginal productivity in home production is greater than the market wage, the individual will not work in the labour market and will only allocate time between home production and leisure.

The decision about labour force participation depends on a woman's reservation wage and the market wage. Thus, in the framework of a household production model, an increase in the market wage will result in a substitution between market and household work (Munoz 2007). Considering the substitution between market and household work, the purchase of more goods and services can compensate for fewer hours of household work. The purchase of a microwave, prepared food or formal childcare reduces time devoted to household chores such as cooking and child caring. Additionally, a higher wage will induce women to participate in the labour market,

shift away from time-intensive activities and increase consumption of consumer good-intensive activities.

3.2.4 Extensions of the basic labour supply model to incorporate children

An extension of the basic labour supply model to incorporate the presence of children can facilitate a woman's decision on whether to work or not (Becker 1965). Children can be viewed as consumption goods as they provide satisfaction or utility to parents. In some cases, children may generate income for parents and thus can be viewed as production goods. The demand for children is determined by various factors such as taste, quality of children, income, cost and supply (Becker 1981). According to Becker (1981), the utility function of each family can be written as:

$$U = U(n, q, Z_1, \dots, Z_m) \quad (3.5)$$

where the quantity of children is given by *n*, the expenditure on each child, called the quality of children, *q*, and $Z_1, \dots, Z_m$ are the various commodities consumed.

By ignoring the quality of children, various other commodities can be combined into a single aggregate commodity, Z, because there are no good substitutes for children. The utility function is thus given by:

$$U = U(n, Z) \quad (3.6)$$

Children are usually self-produced by each family, using market goods and services and the time of parents, especially mothers. The total cost of producing and rearing children varies by family but each family is assumed to be subjected to a budget constraint:

$$p_n n + \pi_z Z = I \quad (3.7)$$

where p_n is the cost of producing children, π_z is the cost of *Z*, and *I* is the family's full income. The optimal quantity of π and *Z* are therefore determined by the budget constraint and the marginal utility condition:

$$\frac{\frac{\partial U}{\partial n}}{\frac{\partial U}{\partial Z}} = \frac{MU_n}{MU_z} = \frac{P_n}{\pi_z} \quad (3.8)$$

The demand for children would depend on the relative price of children and the family's full income. An increase in the price of children relative to the price of commodities reduces the demand for children and increases the demand for other commodities, holding income constant.

Again, according to Becker (1981), the relative price of children is affected by many variables. The net cost of children is reduced if children perform household chores, work in the family business or in the marketplace. In these cases, the increase in the earning potential of children would increase the demand for children. This explains the difference between the quantities of children in families in developed versus developing countries, as well as urban versus rural. However, the contribution of farm children has declined as agriculture has become more mechanised and complex (Becker 1981).

The relative cost of children is affected by the changes in the value of the time of married women due to a mother's time being a major input to the cost of producing and rearing children (Becker 1981). The amount of time a woman allocates between home and market work depends on the price of her non-market work (Willis 1973; Becker 1965). The price of time in a woman's non-market work will increase if the family chooses a large amount of child services, including having many children.

The analysis between fertility and female labour force participation in this thesis is focused on the impact of having additional children for families who already have children. The theoretical framework is adopted from Angrist and Evans (1996) who considered two sources of exogenous variation in the number of children, namely multiple births and the sex mix of children. Their framework incorporates features from Becker and Lewis (1973) and Becker and Tomes (1976) into Gronau's (1977) model of home production. The family is treated as an economic unit, obtaining utility from leisure and children, with an option to buy or produce an input that increases utility from children (Angrist & Evans 1996).

Angrist and Evans (1996, p. 4) presented a model that describes the choices facing parents who already had some children (n_x) but may decide to have additional children (n_c). Assuming additively separable family preferences for leisure, the utility from child services scaled by parental inputs and a pure child component, the utility function for a family is given by:

$$u_l(l_1, l_2) + \beta \ln(n - \gamma) + u_q(nq) \quad (3.9)$$

where l_1 and l_2 are the father's and mother's leisure time, $n = n_x + n_c$ is the total number of children and q is a good that increases the utility parents receive from children. In Becker and Lewis (1973), the commodity q represents child quality. Browning (1992) suggested that the interaction between n and q be viewed as a restriction on preferences over two complementary goods.

Angrist and Evans (1996, p. 4) indicated that parents allocated time (T) between work in the market ($h_{mj;}\, j = 1,2$), work in home production of q ($h_{hj;}\, j = 1,2$) (including child care), and leisure (l_1, l_2).

The production technology for q can be written as:

$$q = f_1(h_{h1}) / n^{\alpha 1} + f_2(h_{h2}) / n^{\alpha 2} + q_m;\ 0 < \alpha_1 < 1, 0 < \alpha_2 \leq 1 \quad (3.10)$$

where q_m is purchased per-child inputs and $f_1(h_{h1})$ and $f_2(h_{h2})$ convert parental time spent on child care into an aggregate input. If $\alpha_1 = \alpha_2 = 1$, this aggregate input is simply divided among the children. There are likely to be economies of scale in the parental production of q, corresponding to α_1 and α_2 less than 1.

Assuming that q_m can be purchased at fixed prices, p_q, but that $f_1\ (h_{h1})$ and $f_2(h_{h2})$ exhibit diminishing returns (Gronau 1977), the family budget constraint is:

$$p_n n + p_q n q_m = w_1\ (T - h_{h1} - l_1) + w_2\ (T - h_{h2} - l_2) + y \quad (3.11)$$

where y is non-labour income and p_n is a fixed per-child cost. The marginal cost of a child depends on parental inputs, q, while the marginal cost of per-child inputs depends on the number of children as noted in Becker and Lewis (1973).

Angrist and Evans (1996) considered the birth of twins and sex preferences as sources of exogenous variation in the number of children that might affect leisure time and work effort. The birth of twins can be viewed as a shock to the existing number of children; therefore, families with multiple births on average have more children than other families. On the other hand, children's sex mix is seen to determine quality in a quantity-quality model (Ben-Porath & Welch 1976). The model however did not put a price of commodity q nor did it allow for home production so that sex mix becomes simply a change in utility for inframarginal children based on their characteristics.

The fertility and labour supply choice generated in Angrist and Evans (1996) indicate that by choosing $(l_1, l_2, n_c, q_m, h_{h1}$ and $h_{h2})$ to maximise equation 3.09 subject to equation 3.10 and equation 3.11, the relationship between home production and the number of children can be determined. The time spent in home production is affected by real wages, marginal productivity at home and the number of children. Home time may be zero when wages are high enough or day care is cheap enough. When the number of children increases, home production also increases. The model implies that changes in labour supply occur because of changes in home time and leisure time. Any shock to the number of children affects home time and hence, labour supply. Additionally, the separability between leisure and other goods indicates that the effect of the number of children on leisure operates through the marginal utility of income. If the husband and wife's leisure time are substitutes, changes in the marginal utility of income on leisure can operate in different directions for husband and wife. The model implies that the change in labour supply as a result of an exogenous increase in fertility is similar regardless of the source of the variation. Nonetheless, due to the differences in individual wages, home production technology and preferences, the labour supply behaviour can be heterogeneous.

3.2.5 Limitations of Angrist and Evans' (1996) theoretical model

Apart from the model discussed in Angrist and Evans (1996) in the previous section, many studies have utilised the instrumental variables method by using the occurrence of twins at first birth (Rosenzweig & Wolpin 1980; Bronars & Grogger 1994; Jacobsen, Pearce & Rosenbloom 1999) to estimate the effect of fertility on female labour supply. These studies imposed the restriction that the occurrence of natural experiments such as twins and same-sex children do not directly affect labour supply except through the effect of having an additional birth and place strong restrictions on preferences and household technology (Rosenzweig and Wolpin 2000, p.864). However, the structure of child costs, such as the effect of sex-sameness on child cost, was not addressed. For example, Angrist and Evans (1996) assumed that child cost is not affected by the sex of the children. However, fertility has an impact on labour supply as a result of changes in child costs. Rosenzweig and Wolpin (2000), nonetheless, suggested that sex-sameness potentially affects child costs.

Angrist and Evans (1996) assumed that the sex composition of children and multiple births do not affect labour supply decision if the sex composition and leisure are separable in the utility function or when consumption and leisure are strongly separable. Similar to previous studies, Rosenzweig and Wolpin (2000) include parental preferences and child-rearing costs in their model to examine whether child-cost are affected by the sex composition of children.

According to Rosenzweig and Wolpin (2000), parental preferences for children of a specific sex could be affected by cost differentials of children by sex. In India, for example, sons are preferred to daughters because a dowry must be paid when daughters are married (Rosenzweig & Wolpin 2000). Therefore, fertility can be affected by the first two births as a result of cost differential, assuming parents prefer to have mixed-sex children. Additionally, the sex composition of children also matters, for example, if parents prefer to invest more in a boy's education when compared to a girl. In countries where there are no cost differentials between children by sex, such preference might still arise purely from taste.

Furthermore, other expenditures such as expenditure on clothing might also differ if parents invest more on children of a specific sex. However, if these costs are non-trivial in the household budget, there should be no cost differentials between children of different sexes. Nonetheless, child-rearing costs can be minimised when all children are of the same sex which can be attributed to the savings from sex-specific hand-me-downs such as clothing. While savings on clothing cost for the first child might reflect preferences, the birth of a second or third child for example could matter for child cost where the expenditure will be lower for children with same-sex older sibling. If sex-sameness affects child-rearing costs, the instrumental variable estimates of fertility on labour supply using same-sex children as an instrument will be confounded because the sex composition of children might affect labour supply through channels other than fertility. In the event that child costs were not important to sex composition, such as in the context of a developed country, strong assumptions have to be made about preferences when the child sex-mix is an instrument to identify the effect of fertility on labour supply. The limitations highlighted by Rosenzweig and Wolpin (2000) suggest that further research in this

area can provide better understanding of the relationship between fertility and labour supply.

3.3 Human capital model

Apart from the child variable, education also affects the labour supply decision. The stock of knowledge and skills acquired through education and training embodied in an individual is known as human capital. Thus, the labour supply decision of an individual can be explained within a framework that incorporates the investment of human capital which is able to raise the market opportunities of individuals through increased productivity.

The static model of labour force participation can be extended to incorporate the human capital model where labour market investment behaviour is viewed from a lifetime perspective. According to Ghez and Becker (1975, p.19), each individual is assumed to embody a stock of human capital, H_t, at the beginning of time *t* where the real wage $(w/p)_t$ is assumed to be proportional to H_t and can be written as:

$$(w/p)_t = e_t H_t \quad (3.13)$$

where the factor of proportionality, e_t, measures the service yield per unit of capital for each hour spent at work at time *t*. Human capital can be produced using a combination of time and educational goods. The production function of human capital at time *t* can be given by:

$$h_t = h(N_t', X_t') \quad (3.14)$$

where N_t' is the time input and X_t' is the educational goods used in the production of h_t.

Human capital investment refers to activities that influence real income through the embedding of resources in people which include schooling, on-the-job training, medical care, vitamin consumption and acquisition of information about the economic system. Though the effects on earnings and consumption differ, all improve the physical and mental abilities of people and thereby raise real income prospects (Becker 1962, p.9). Thus, labour force participation outcomes can be determined by general skills acquired through investments in education and on-the-job training (Altonji & Blank 1999; Mincer 1974). Ghez and Becker (1975) highlight that the size of the stock of human capital is assumed to affect efficiency in

consumption and market production where the optimal allocation of time between work and leisure is determined simultaneously with the optimal accumulation of human capital. By considering efficiency in consumption, gender differences in human capital investment decisions can be explained.

Basically, the division of labour market work and household production is allocated between household members based on the principle of comparative advantage (Becker 1965). Historically, women have developed a comparative advantage in household production such as childcare through the process of socialisation or preference while men have comparative advantage in the labour market. Therefore, wives tend to engage in more non-market work in the household while husbands engage more in market work (McConnell, Brue & Macpherson 2010). This explains why traditionally women invest in human capital that raises household efficiency while men invest in human capital that raises market efficiency (Becker 1981). More importantly, this hypothesis could potentially explain the differences in human capital investment decisions between married and single women. A woman with more traditional values is less likely to invest in education (Munoz 2007). Furthermore, the traditional role of childbearing and child caring might force women to exit the labour market temporarily. If a woman foresees the interruption to her labour force participation, the time to recoup her human capital investment decision is shorter and therefore the investment is not as profitable (Munoz 2007) which will result in a lower investment in education.

Although females have traditionally tended to invest less in education, in the US, female human capital acquisition, especially at the tertiary level, has been on the increase since the late 1960s, so that by 1980, the gender gap in university enrolment had disappeared (Goldin, Katz & Kuziemko 2006). The rise in female education however has occurred much later in developing countries as has been widely observed. Goldin, Katz and Kuziemko (2006) offer several explanations for the increase of female tertiary education attainment in the US. There was a gradual change in the role of women from the perception of young women beginning from the late 1960s. Women envisioned higher levels of labour force participation as compared to being married and staying at home with the family. These rising

expectations of future employment encouraged young women to acquire more tertiary education. A change in the demographic occurred in the late 1960s where the age of first marriage among female university graduates increased. This change was attributed to the increased access to reliable contraception through birth control pills which allowed flexibility in family planning therefore increasing women's university attendance and graduation, post-college education, opportunities for professional careers, labour force participation and age at first birth (Goldin & Katz 2002).

Female human capital investment in tertiary education can be explained using the human capital model. Theoretically, individuals maximise utility and take a lifetime perspective when making choices about human capital investment. Viewed from a lifetime perspective, the human capital model explains the relationship between the returns on human capital investment and the time a person expects to work during her life. A rational decision involves weighing the costs against the benefits of a tertiary education. The costs of attending university include directly outlaid costs such as tuition fees, potential financing constraints and the effort costs of university attendance, while the benefits include labour market returns which depend on expected employment probabilities for university education versus secondary school education, while other benefits include the positive influence of education on health and parenting skills and the role of tertiary education in the marriage market (Goldin, Katz & Kuziemko 2006). An individual will invest in human capital if the present value of future benefits from the investment exceeds the costs of investment.

The human capital model offers several explanations for a woman's human capital investment decisions. Individuals planning to participate in the labour market as full-time workers will be likely to invest more in education (Altonji & Blank 1999). Additionally, a change in the cost or benefit of education is also likely to affect human capital investment. The reform in higher education, including the expansion of tertiary education and provision of student loans discussed at the beginning of this thesis, is likely to affect the cost of tertiary education. For simplicity, the provision of education by both public and private[7] tertiary institutions as well as student loan provision as a result of education expansion is assumed to contribute to the increase

[7] Students at private higher education institutions usually incur higher costs per student.

of social goals which include private returns to society (in terms of higher income) as well as other social benefits or externalities to society. Education reform can therefore be treated as an exogenous decrease in the price of human capital investment. Based on the human capital model, the decrease in the cost of investment will lead to greater human capital acquisition and consequently higher employment due to the positive relationship between wages and educational attainment. Thus, women with more education are more likely to be in the labour force (Bowen & Finegan 1969).

3.4 Conclusion

The various theoretical explanations presented in this chapter emphasise how women make their labour force participation decisions. The static model of labour supply provides the basic explanation of how the labour force participation decision is a result of an optimal combination between work and leisure. Although the model provides the basis for an individual's labour supply decision, the decision is usually viewed from a household perspective. This is important especially when discussing female labour force participation decisions. For example, a married woman's labour force participation decision most likely depends on the participation status of her spouse. Women traditionally play a more important role in the household. By incorporating multiple uses of time in the neoclassical labour supply model, the decision of a woman about female labour force participation is a result of the optimal allocation of time for market work, consumption and household production. A household produces commodities by combining goods with time to maximise utility and these commodities include children. In general, the presence of children influences female labour force participation.

Apart from fertility, investment in human capital or education is predicted to affect female labour force participation. Greater investment in education increases the economic opportunities for women and therefore women are more likely to participate in the labour market. Over the century, female labour force participation has increased tremendously. The theories discussed here, which focus on education and fertility, provide a foundation to explain the varying levels of female labour force participation over time and across countries according to a country's level of development as well as labour market institutions. This is the essence that will be

explored in subsequent empirical analysis. Before beginning the empirical analyses, the next chapter provides an empirical literature review in this area of study.

CHAPTER 4 LITERATURE REVIEW

4.1 Introduction

The purpose of this chapter is to establish a basic understanding of the key determinants that affect the trends of female labour force participation. In particular, the discussion in this chapter will focus on the empirical evidence of the relationships between education and fertility on female labour force participation. By looking at the changing impacts of education and fertility on female labour force participation, this chapter provides the background to this study which aims to quantitatively explain the stagnant trend in female labour force participation in an emerging economy.

As highlighted at the beginning of this present study, the level of female labour force participation varies according to the level of economic development of a country (Mammen & Paxson 2000; Psacharapoulous & Tzannatos 1989). Differences across countries can often be attributed to variations in demographic, economic, cultural and institutional factors. At this juncture, it is worth reiterating that female labour force participation has increased tremendously in most advanced economies since the 1960s (see Killingsworth & Heckman 1986). A similar trend can also be observed in developing countries in later decades. The role of trade liberalisation induced structural change in emerging economics resulting in a shift in sectoral labour allocations between men and women (Gaddis & Pieters 2017).

The advancement in biotechnology with the breakthrough in birth control pills in the 1960s provided women with greater control over the timing of childbearing decisions which subsequently affected their labour force participation decisions (Goldin 1995; Goldin & Katz 2002). Having fewer children decreases time for child caring and leaves more time to participate in the labour market. The neoclassical work-leisure model describes a trade-off between paid labour market work and leisure activities such child caring. This flexibility has allowed women to have greater freedom over their time and thus more time to engage in paid labour market work (Goldin 1995). Additionally, the introduction of labour-saving household appliances and the

decrease in the relative price of home appliances are seen as the engines of liberation, liberating women from household works to greater labour force participation (Greenwood, Seshadri & Yorukoglu 2005; Cavalcanti & Tavares 2008).

Furthermore, females have had access to more and more schooling opportunities over time. In the human capital theory, female labour force participation is positively related to level of education. Education increases the taste and preference for work and enhances potential wages (Becker 1975). The changing trends in fertility and education have drawn significantly more women into the labour force.

Following this introduction, section 4.2 discusses the determinants of female labour force participation. While they are various determinants of female labour force participation, as discussed in the preceding paragraphs, this thesis focuses on the effects of education and fertility on female labour force participation for which the measures on both variables are available in the Malaysian census data. The following section also provides a review of various other determinants affecting female labour force participation including: (1) ethnicity; (2) marital status; (3) spouse labour force participation status; (4) age; (5) type of household; and (6) living strata. Section 4.3 provides a summary of the chapter.

4.2 Determinants of female labour force participation

The determinants of female labour market participation and its related topics have been widely researched. An individual's labour supply decisions depend on the individual's preferences for work and leisure. This preference can be influenced by many determinants which may include the individual's traits, human capital endowment, family background and demographic characteristics as well as institutional and government policies. The impact of these factors may be different between developed and developing countries. The discussion in this section focuses on the effects of education and fertility on female labour force participation. Other determinants of female labour force participation, which include ethnicity, marital status, spouse labour force participation status, age, type of household and living strata, are also reviewed in this section.

4.2.1 Education

In this section, the effect of education on female labour force participation is reviewed. Education is by far one of the most important determinants to explain growth in female labour force participation. It is therefore imperative to understand the link between female education and labour market behaviours. In theory, female education can increase the productivity of women both at home (Becker 1975) and at work (Schultz 1961). If education results in greater productivity at home, increased educational attainment may in fact cause a reduction in female labour force participation. Alternatively, if education increases labour market opportunities for women, education investments contribute to positive economic growth (Lincove 2008, pp. 45-46).

Most studies have shown that education has a positive effect on female labour force participation (see for example Contreras, Puentes & Bravo 2005; Ntuli & Wittenberg 2013; Olowa & Adeoti 2014). In Australia, women's participation increased tremendously in the 1980s and 1990s as a result of rising educational attainment and falling fertility (Evans & Kelley 2008). A rise in educational levels increases female labour supply in Europe (Vlasblom & Schippers 2004). In developing countries like Chile and South Africa, education also has positive effects on female labour force participation (Contreras, Puentes & Bravo 2005; Ntuli & Wittenberg 2013).

In contrast, other studies have documented a negative relationship between education and female labour force participation (Das & Desai 2003; Dasgupta & Goldar 2006). Lam and Duryea (1999) find that Brazilian women with primary education and lower birth rates than uneducated women have low participation rates despite increasing wages. Female education attainment also increased significantly during the Green Revolution in India while returns to human capital show no increase (Behrman 1999). In these cases, it is argued that the aim of female schooling is improved home production. Lam and Duryea (1999) argue that families enjoy greater benefit from the production of high-quality children than from women's wages with the initial increase in levels of female education. With secondary schooling, women's wages exceed the value of home production, and women enter the labour market. This explanation suggests that the relationship between education and female labour force

participation is U-shaped. This is observed in developing countries. Some studies indicate that primary education of mothers improves child health, but secondary education creates labour market opportunities (Gille 1985; Mason 1993).

The benefits of educating girls are not limited to a more positive outcome in the labour market. The indirect or social benefits from education are immense. Increased education delays the age of marriage and lowers completed fertility. A decline in fertility reduces child caring activities enabling women to work more and, with a raise in permanent income, there is a subsequent increase in the investment in each child's health and education (Becker & Lewis 1973; Bloom et al. 2009; Willis 1973; Wolfe & Haveman 2002). In addition, in India for example, the expansion in the supply of education and the rising marriage market returns to women's education drives women to pursue more education. In the absence of labour market returns, women's education can contribute to husbands' social status (Eswaran, Ramaswami & Wadhwa 2013). These findings are important, especially for women in developing countries given that their labour force participation is lower than their counterparts in developed nations. If the return of schooling is not expended in the labour market, the larger gain in social welfare should still provide sufficient basis for a country to focus on investment in female education as one of its main development agenda items.

In terms of income, the labour force participation of poorly educated women may be driven by a financial burden where women work to support themselves and their families. On the other hand, attractive and highly paid jobs attract better educated women to work. Nonetheless, in some cases, as it is observed in India, it is found that the absence of the need to work (the income effect) reduces the rate of female labour force participation (Klasen & Pieters 2015, p. 5).

In countries where there is social stigma associated with women working outside of the home, especially in low-skilled or menial jobs, the stigma attached to taking up white-collar jobs can be less or does not exist and therefore there may be less stigma for better educated women (Klasen & Pieters 2015, pp. 4-5). An increase in education and the growth of white-collar employment could be expected to attract

more females to participate in the labour force (Blau & Kahn 2007a; Goldin 1995; Mammen & Paxson 2000). The presence of social stigmas varies in society. In India, social stigma is still associated with menial jobs which could be an impediment to female labour force participation (Klasen & Pieters 2015, p. 5).

The preceding discussion implies that the relationship between education and female labour force participation is not straightforward and cannot be ascertained *a priori* even in a country where the education level is rapidly rising. Several studies are worth mentioning at this point. In establishing the determinants affecting changes in six European countries (France, West Germany, Italy, the Netherlands, Spain and the United Kingdom) from 1992 to 1999, Vlasblom and Schippers (2004, p. 390) find that the difference between labour force participation rates between highly and lowly educated women has diminished. Educational level has become less important as a predictor for labour supply as having a job becomes increasingly more common.

In countries where the trend of female labour force participation has been stagnant and declining in recent years, it is found that the effect of education has weakened (Hotchkiss 2006; Klasen & Pieters 2015). The impact of education on female labour force participation changes over time. In the US, the growth of female labour force participation was stagnant at the beginning of 1997 and has declined since 2000 (Hotchkiss 2006). According to Hotchkiss (2006), the result from the maximum likelihood probit model indicates that although college education attainment for women in 2005 has increased when compared to 2000, it is less of a pull factor into the labour market in 2005 and this has put downward pressure on labour force participation. The recent decline in the female labour force participation rate in the US is attributed to a decline in labour force participation among highly educated married women with young children (Bradbury & Katz 2005). Bradbury and Katz (2005, pp. 66-67) provide several explanations to this trend including changes in: (i) women's wages and labour market opportunities; (ii) other family income; (iii) preferences and cultural norms; (iv) characteristics of potential entrants; and (v) labour market attachment and the timing of breaks.

In India, while educational attainment has increased, the effect of education on female labour force participation has decreased between 1987 and 2011 (Klasen & Pieters 2015). The estimates of the average marginal effects indicate that labour force participation declines with the rise of education up to primary levels. On the other hand, the positive effects of higher education could reflect positive selection effects due to endogenous selection where girls with a stronger labour market orientation select to go into higher education. This explains the decline in the positive effects of secondary and tertiary education over time in India. Furthermore, if the increase in educational attainment has been driven by the increased supply of education, positive selection among highly educated women is greater in 1987 than in 2011 (Klasen & Pieters 2015, pp. 14-15). However, this hypothesis is not tested by Klasen and Pieters (2015) due to a lack of instrument for educational attainment.

In Turkey, where female labour force participation is the lowest among the OECD countries, Dayioglu and Kirdar (2011) observe that as higher education became more accessible, individuals might have become less selective, hence lowering labour force participation. Women participate less in the labour market despite increasing educational attainment and falling fertility rates. The female urban workforce is highly selective on education. By using a synthetic cohort analysis, the probability of female labour force participation for women with primary education born before and after 1960 shows no significant variation. However, the participation rate for women with high school education and higher education is lower for younger cohorts. This can be explained by the expansion of higher education which may have compromised the quality of education programs offered.

In countries where universal education includes both primary and secondary level education, educating individuals at the tertiary level has become the new focus. The declining effect of education, especially higher education, explains the modest growth in female labour force participation but raises the question to what extent should policymakers promote higher education as a means to achieve greater female labour force participation growth. In developed countries, higher educational levels increase the cost of non-participation and stimulate more modern norms on the combination of paid labour and unpaid care (Vlasblom & Schippers 2004). On a

different note, the issue of self-selection in education suggests that there is a possible causal link between educational attainment and labour force participation. This issue is addressed in the next section.

4.2.1.1 The endogeneity of education

This section gives an overview of the literature on the endogeneity of the education variable with female labour force participation. It begins by discussing some instruments commonly used in previous studies to examine the causal impact of education on various economic outcomes.

In general, women with greater ability and a stronger preference for work are more likely to have higher education. Therefore, education and female labour force participation decisions could be jointly determined. Instrumenting the exogenous change in education can help eliminate the bias in estimation and thus provide a more accurate view of the impact of education on female labour force participation. Many studies have examined the impact of education on various economic outcomes. To correct for the bias in estimation, Angrist and Krueger (1991) explore the link between student birthdays, school start-age cut off policies and compulsory schooling laws in determining the impact of education on earnings. Some other instruments used to analyse this relationship include the proximity of colleges (Card 1993) and school construction (Duflo 2001).

The impact of education on fertility is also widely studied. León (2004) exploits the change in state compulsory schooling laws as a source of exogenous variation in education. He finds that women in the US with three to four years of additional schooling have on average one less child. The instrumental variable estimate is larger than the ordinary least squares (OLS) estimate suggesting a measurement error in schooling. Black, Devereux and Salvanes (2008) find that increased compulsory schooling reduces the incidence of teenage childbearing in both the US and Norway. On the other hand, Monstad, Propper and Salvanes (2008) find no significant relationship between additional schooling years and the number of children or the probability of never having children. However, mandatory education reduces teen birth and delays the age of first birth.

McCrary and Royer (2011) use age-at-school-entry policies and find no differences in fertility behaviours for individuals born just before and after the cut-off dates. In the United Kingdom, a change in the minimum school leaving age causes a moderate increase in fertility. Most of the effects on fertility can be observed among women who are employed while there are no changes for unemployed women. When women work, household income increases which subsequently increases the number of children in a household. In developing countries, Breirova and Duflo (2004) use a massive school construction program in Indonesia to instrument for education while Osili and Long (2008) use the introduction of universal primary education in Nigeria to examine the impact of education on fertility and child mortality. In Kenya, Duflo, Dupas and Kremer (2015) use the variation in the cost of education while Chicoine (2012) exploits a policy change which lengthened schooling years to assess the causal impact of education on fertility. All studies find negative causal impacts of education on early age fertility. Following a change in travel restrictions which allowed better access to education, Lavy and Zablotsky (2011) find a strong negative relationship between education and fertility for Arab women in Israel, a place where female labour force participation is low.

In terms of children's educational outcomes, there are no effects for children whose mothers were affected by the schooling reform (Braakmann 2011). In Norway, Black, Devereux and Salvanes (2008) conclude that there is a small but significant causal effect between a mother's education and a son's education but no causal relationship is found between a mother's and a daughter's education. The authors conclude that the high correlations between parents' and children's education may be affected by family characteristics and inherited ability. There is no spillover effect from parents' education to children's education.

Next, the causal impact of education on female labour force participation is examined. Female labour force participation and childcare is jointly determined for women with young children. In Argentina, the large expansion of pre-primary school facilities induces a large increase in preschool attendance for children aged 3 to 5 and this has a positive effect on female labour force participation. A similar result is also seen in the US where public-school enrolment increases the likelihood of female

labour force participation by 5 percentage points (Gelbach 2002a). In addition, the childcare subsidy introduced with the education expansion program in Argentina also increase female labour force participation (Berlinski & Galiani 2007). Berlinski and Galiani (2007) note that the issue of education expansion at the pre-school level is of policy interest especially in developing countries where female labour force participation rates are substantially lower than in developed countries. The support of childcare as such is important especially because the age of children is positively linked to female labour force participation. This will be discussed further in section 4.2.2.

Apart from the availability of childcare and pre-school education which affects maternal employment, education at the tertiary level potentially affects female labour force participation decisions. In 1999, China's higher education experienced a major expansion (Li & Xing 2010). Following the expansion, individuals taking college exams before and after the expansion policy have different probabilities of being admitted to college. The expansion increased the probability of going to college tremendously. The sample in this study includes both males and females with data obtained from the Population Census 2005. Due to the limited evidence in this area, the result in Li and Xing (2010) is discussed further to provide insights into the education expansion effect. In the short term, labour force participation for individuals who had taken exams after the education expansion are found to be lower than for earlier cohorts. However, this could likely be due to both policy and age effects. There was a large share of individuals who were unemployed immediately after graduation which could be due to an excess supply of college graduates. However, these effects are regarded as short-term. In the long run, it is expected that more individuals will enter the labour market as their college education makes them better off. Due to limitations in the available data, only the short-term effect is examined in Li and Xing (2010).

A more recent study in Senegal exploits a variation in education - a large-scale education reform at the tertiary level in 2001 - to identify short-term effects of education on labour market outcomes of highly skilled workers (Boccanfuso, Larouche & Trandafir 2015). In a sample of highly skilled workers, male and female

combined, the study finds that improvements in the quality of higher education increase the employment rate of cohorts affected by the reform by 12 percentage points in the short term. Younger workers are better able to find jobs in the services sector and the public sector.

Although it is not possible to identify the impact of higher education reform on female labour force participation in both studies due to the sample used, both studies attempt to identify the causal impact of education on labour market participation. In Li and Xing (2010), education expansion does not increase labour force participation in the short run. On the other hand, Boccanfuso, Larouche and Trandafir (2015) find that an improvement in the quality of education increases labour force participation outcomes. With reference to the argument in the earlier section that the effect of education on female labour force participation has declined despite the increasing educational attainment among females in developing countries, the findings in Boccanfuso, Larouche and Trandafir (2015) lend support to Dayioglu and Kirdar's (2011) explanation that the expansion of higher education, which may have compromised the quality of education programs offered, can result in lower female labour force participation. In addition, the findings in Li and Xing (2010) imply that an increase in highly educated individuals puts pressure on the labour market and results in graduate unemployment. In a separate study utilising the population censuses in 2000 and 2005, Li, Whalley and Xing (2014) indicate that education expansion increases female unemployment rate by 7 percentage points. However, the share of the population working informally at home (which was dropped from the estimates) increased sharply from 22% to 45% between 2000 and 2005 for individuals aged 22 to 35, and this consisted mainly of females. This raises interesting questions for further research, especially in the context of a country with low or stagnant female labour force participation. Although educational attainment has increased, young female graduates might have withdrawn from the labour market due to the lack of job opportunities as a result of increased competition between peers with higher education qualifications.

The ambiguity of the effect of education expansion on female labour force participation raised in this section can be examined using the case of Malaysia where

higher education reform was implemented in the 1990s. Apart from education, one other key determinant of female labour force participation is fertility. The next section reviews the role of fertility on female labour force participation.

4.2.2 Fertility

This sub-section reviews the empirical findings in both developed and developing countries with a focus on studies that have attempted to disentangle the causal effects between fertility and female labour force participation. Besides education, female labour force participation behaviour is affected by familial events such as marriage and fertility (Blundell & MaCurdy 1999). A large number of studies have investigated the relationship between fertility and female labour force participation (Angrist & Evans 1998; Karbownik & Myck 2016; Maurin & Moschion 2009; Moschion 2013). These studies indicate that the impact of fertility on female labour force participation can be overestimated or underestimated when taking into account the issue of endogeneity.

According to Becker's (1981) model of specialisation, in societies where "men tend to have higher incomes than women, the arrival of children leads to a reduction in women's paid work as they take over the bulk of unpaid work". When compared to men, the labour force participation of women is largely entwined with the decisions of household and children.

The theory of female labour supply suggests that there is a strong negative correlation between the presence of children in a household and female labour supply. This relationship has been observed in many countries (Del Boca, Pasqua & Pronzato 2005; Francesconi 2002; Mincer 1962; Moffitt 1984; Nakamura & Nakamura 1994; Klasen & Pieters 2015). This relationship is robust even when fertility is treated as endogenous with respect to female labour force participation (Angrist & Evans 1998; Karbownik & Myck 2016; Maurin & Moschion 2009; Moschion 2013). This indicates that the presence of children is a key determinant in female labour force participation decisions. Additionally, the negative trade-off between fertility and female labour force participation in developing countries are determined by various socio-economic factors including living arrangements (Mason & Palan 1981; Wong & Levine 1992) which will be discussed in section 4.2.8.

A negative relationship between fertility and female labour force participation was observed in several OECD countries in the 1970s but the correlation between fertility and female labour force participation becomes positive in the late 1980s (Del Boca & Locatelli 2006). This change was attributed to changes in work-family policies such as the introduction of parental paid leave and affordable childcare. However, it it observed that Southern European countries with low fertility still have low levels of female labour force participation while Nordic countries with high fertility have higher levels of female labour force participation. This indicates that some societies are more successful in mitigating the role incompatibility of work and motherhood than others (Gornick, Meyers & Ross 1997). Del Boca and Locatelli (2006) stress that the availability of flexible work arrangements such as part-time work and generous childcare related benefits can reduce the incompatibility of motherhood penalty. However, while part-time opportunities are, in general, widespread in the Nordic countries, this type of employment is not common in Southern European countries, resulting in low employment rates among mothers with children (Del Boca & Locatelli 2006).

Flexible work arrangements facilitate female participation in the labour market, especially for those with young children. For example, between 1989 and 1998, both married and cohabiting Dutch women participate more but work fewer hours in the labour market, reflecting the growing importance of women working part-time. The growth in female labour force participation in the Netherlands is attributed to the growth in part-time work. A policy to encourage individualised working-time arrangements introduced by the Dutch Government was successful and there is growing social acceptance of mothers working for pay (Henkens, Grift & Siegers 2002). Conversely, in countries where there is lack of policies that reconcile work and family, there seems to be only modest growth in female labour force participation.

Between 1992 and 1999, the increase in female labour force participation in Europe (France, West Germany, Italy, the Netherlands, Spain and the United Kingdom), could not be explained by either compositional changes in educational levels nor in the number and timing of children. Female labour force participation increases at all

educational levels for women with or without children. The rise in the female labour force participation rate is driven by changes in behaviour attributed to generational effects where younger generations have higher participation levels. At the same time, there is also a shift in fertility patterns which resulted in an increase in female labour supply. In terms of family formation, European women tend to postpone the first child, have children at shorter intervals and have smaller completed family sizes. Thus, the increase in female labour force participation is not necessarily because the combination of work and family becomes easier but because women make changes in their family choices as the choice of having a paid job became preferable (Vlasblom & Schipper 2004).

As it is widely argued, having an additional child increases the time for childcare activities in the household and the marginal value of time at home. This increases the probability for some mothers to withdraw from the labour force while others may reduce the intensive margin of labour supply by shifting to flexible work arrangements or occupations that are less demanding (Jacobsen, Pearce & Rosenbloom 1999). Women in East German households have smaller family sizes and fewer children. This increased the differences between East and West female participation rates. Although childcare facilities increase female labour force participation in East Germany, the provision of childcare has no significant impact on the participation rate in West Germany. The pure availability of childcare is important but the effect of full-time care seems to have more impact on women's work decision (Grundig 2008).

Besides the negative link between fertility and female labour force participation, some studies offer mixed evidence on the relationship between fertility and female labour force participation in particular when fertility is modelled as an endogenous variable (Aguero & Marks 2008; Aguero & Marks 2011; Cruces & Galiani 2007; Priebe 2010). At the household level, the varying functions of families in developed and developing countries may result in differences in family behaviour including fertility and household time allocation (Schultz 1990a). The effects of children are ambiguous for developing countries where households struggle to fulfil basic necessities (Priebe 2010). The economic demands of a larger family may induce

females to enter the labour market in developing countries (Adair et al. 2002). In Indonesia, for example, children are relatively more expensive for poorer households, inducing women to work more outside the home to finance the cost of children (Priebe 2010). There could be a positive relationship between female labour force participation and family size for example, even without the presence of adequate family-friendly policies.

Women with more children participate in the labour market due to greater financial needs. Participation can be driven by poverty and women in developing countries will join the workforce as a coping mechanism in response to shocks (Verick 2014). This is evidenced in Indonesia (Priebe 2010). In Indonesia, a decline in fertility does not increase female labour force participation. Rather it is the high direct cost of having children that increased labour force participation among the poorer and less educated women living in the rural areas between 1993 and 2008. This is in contrast to the typical theoretical explanation that high childcare costs tend to lower female labour force participation. The effect was more pronounced in the economic crisis period when real household incomes declined, suggesting that female labour force participation in Indonesia is counter-cyclical. The effect of an added worker is present where women enter the labour force as a result of men losing their jobs such as during the 1997-1998 economic crisis (Priebe 2010). On the one hand, women may find it easier to participate in the labour market with fewer children. However, others might not need to engage in the labour market due to the relaxation of their budget constraint. The offsetting effects of children explain why female labour force participation in Indonesia stagnated despite declining fertility (Priebe 2010). A lack of policies to diminish the potential opportunity costs of children, such as subsidised childcare, parental leave and child benefits, in developing countries increases the pressure for women to work when they are facing a high direct cost of children.

Female labour supply is also found to be positively correlated with the age of children present in the household (Browning 1992, p.1450). In general, infants require more attention and therefore the time spent with infants is more exhausting than with an older child. Mothers might also want to have infants with them at home out of pure preference. As children age, the costs of supervision and care fall and the

effect of an extra hour spent with a child decreases the marginal utility of leisure (Browning 1992, p.1458). In the US, female labour force participation increases rapidly with the age of the children in the 1970s, but shows only a modest rise in the late 1980s (Leibowitz, Klerman & Waite 1992). A recent study in the US notes a decline in female labour force participation between 2000 and 2005 which can be attributed to a rise in the number of children under six (Hotchkiss 2006). In Chile, the effect of children under the age of 5 has a small but not significantly negative effect on female participation, while children aged 6 to 10 have a significantly negative effect (Contreras, Puentes & Bravo 2005). Meanwhile, Mlatsheni and Leibbrandt (2001) observe that the presence of children under 5 has no significant effect on women's work participation in South Africa. These findings potentially suggest that the presence of young children deters female labour force participation in developed countries but not in developing countries.

In short, the impact of fertility on female labour force participation across countries might be different due to the varying costs of having children, and the availability of family-friendly policies might also affect work decisions. Heterogeneity between women's education levels, living strata or mothers' ages may also affect female labour force participation decisions. This relationship is further complicated because decisions on work participation and fertility are jointly determined. More recently, various studies have been carried out to identify the causal effect of fertility on female labour force participation in both developed and developing countries. The examination of the causal impact of fertility on female labour force participation generate mixed results due to the factors explained earlier. The next section reviews the endogeneity problem in the link between fertility and female labour force participation and the potential instruments used in addressing this issue.

4.2.2.1 The endogeneity of fertility and female labour force participation

The traditional neoclassical model of labour supply explains the decision to work as a choice between work and leisure. The allocation of time for both activities allows for an optimal combination of work and leisure which maximises utility. For a married woman, leisure activities include childcare. The opportunity cost of leisure (childcare) is forgone earnings. In general, most studies treating fertility as an exogenous variable find a negative correlation between fertility and female labour

force participation. While declining fertility is assumed to increase female labour force participation, Browning (1992) argues that if fertility is taken as endogenous, either no effect or a positive effect can also be found on labour supply because fertility and labour supply are jointly determined (Nakamura & Nakamura 1992; Rosenzweig & Wolpin 1980). Mothers with strong labour force attachments may be more likely to have fewer children when compared to mothers with lower earnings potential. The explanatory variable, childbearing, may be correlated with the error term which will result in biased standard OLS estimates (Angrist & Pischke 2009).

If fertility and labour supply are jointly determined, Browning (1992) cautions on the limitation of drawing credible inferences from the correlations. The effect of fertility on female labour force participation is sensitive to the treatment of the fertility variable, especially in developing countries (Aguero & Marks 2008; Aguero & Marks 2011; Priebe 2010). A possible solution to the endogeneity problem of fertility and labour supply is to instrument the child status variable (fertility) (Nakamura & Nakamura 1992). This requires finding an instrument that affects family size but does not influence female participation. The effect of fertility on female labour force participation was investigated for different birth order parities using different instrumental variables.

4.2.2.2 Twinning as an instrumental variable

One of the pioneering studies in this area examined the effect of a second child on female labour force participation. Notably, Rosenzweig and Wolpin (1980) use twins at first birth to instrument for the exogenous change in family size. The occurrence of twin births is random and unplanned. By examining the birth of twins at higher parity, the effect of the number of children on female employment can be examined for third or higher-order children (Cáceres-Delpiano 2012).

Rosenzweig and Wolpin (1980) use 87 sets of twins in a sample of 12,605 women with at least one birth as an instrument for exogenous fertility. They conclude that the impact of exogenous changes in fertility on the female labour supply was understated. A potential concern is the rarity of multiple births in the dataset (Nakamura & Nakamura 1992). Consequently, Bronars and Grogger (1994) test the twins-first methodology by using census data where a larger sample of women

experiencing twin births could be obtained. By using the 1970 and 1980 US census data, Bronars and Grogger (1994) examine the causal impact of fertility shocks on female labour force participation for unwed mothers and find that unwed mothers experience short-run decreases in labour force participation after an unplanned birth. Jacobsen, Pearce and Rosenbloom (1999) use the same instrument on labour supply of married women. Their findings indicate that fertility has a strong causal impact on labour supply and earnings in the short run but the impact is modest in the long run. The women's response to fertility explain only a small fraction of the changes in labour supply and earnings in 1970 and 1980.

More recently, Cáceres-Delpiano (2012) surveys 40 developing countries, with an average of two years' sample and finds a negative impact of fertility on female labour force participation when using twinning as an instrumental variable. Cáceres-Delpiano (2012) highlights three types of heterogeneity: (1) the magnitude of the impact depends on the birth at which the increased fertility takes place; (2) the jobs affected are informal jobs, for example, self-employment and unpaid jobs; and (3) the change is stronger for more educated mothers in urban areas.

4.2.2.3 Mixed sibling-sex composition as an instrumental variable

One other phenomenon likely to affect family size is the sex mix of children. From the 1970 US census data, 56% of families with either two boys or two girls had a third child while only 51% of families with one boy and one girl had a third child. Observation on parental preference for a mixed sibling-sex composition motivated Angrist and Evans (1998) to use sibling-sex composition as instrumental variables. If a woman has two children of the same sex, this can be used as an instrument to estimate if she will have a third child. The instrumental variable estimates for women are significant but smaller than the OLS estimates. In 1980, the two-stage least squares (2SLS) estimate is -0.12 while the OLS is -0.167. In 1990, the estimates are -0.104 and -0.147, respectively. Angrist and Evans (1998) highlight that the 2SLS estimates, though smaller than the OLS estimates, are still negative, precise and of plausible magnitude. The same-sex instrument is reliable for generating the causal effect of fertility and female labour supply.

The same sex instrumental variable generates much interest, and subsequent studies in both developed and developing countries followed. In the United Kingdom, Iacovou (2001) reports that OLS estimates indicate that fertility has a negative effect on female labour force participation (between 12 and 15 percentage points). In contrast, the 2SLS estimates report a positive effect (between 7 and 13 percentage points) between fertility and female labour force participation. The coefficients are all positive (unlike those reported in Angrist and Evans (1998) though none is significantly different from zero). The marginal effect of a third child on increasing labour market participation may be a result of the income effect outweighing the substitution effect. Iacovou (2001) suggests that this might be due to differences between the welfare systems, maternity leave provisions and the availability of part-time work in the United Kingdom and the US.

Similar studies examining the causal effect of fertility on female labour force participation are found in many other countries. In France, using the sex composition of the two eldest children as the instrumental variable, results show that fertility has a negative effect on female labour force participation and the impact is greater than in the US (Maurin & Moschion 2009). In Greece, having more than two children lowers employment opportunities for married mothers (Daouli, Demoussis & Giannakopoulos 2009). Family size is found to reduce mothers' employment up to the second child in Poland. The causal effect is not present for higher parities of children (Karbownik & Myck 2016). By using the sibling-sex instrument, Moschion (2013) shows that having more than two children causes a reduction in labour market participation by 19.7 percentage points in Australia. The larger effect might reflect limitations in public child care and the lack of national paid parental leave before 2011. This has an important policy implication. Understanding the relationship between fertility and mothers' labour force participation can assist in the design of policies that help balance work and family.

The endogeneity of fertility and female labour force participation is also widely studied in developing countries. In a study of two middle-income developing countries, Argentina and Mexico, the empirical evidence indicates that having more than two children reduces a mother's labour supply. This is similar to the US where a

mixed-sex sibling preference is also present (Cruces & Galiani 2007). There is a less negative effect of children on female labour force participation in Mexico despite a lack of childcare institutions which Moschion (2013) implied could be due to the overall low participation of females in the country. Therefore, the impact of fertility on female labour force participation must be interpreted with care.

Studies in two Asian countries using the sibling-sex instrumental variable find a mixed relationship between fertility and female labour force participation. In Vietnam, Le (2009) finds that having an additional child reduces the probability of female labour force participation by 26.4 precentage points. The effect is more negative (29.3%) in rural areas. Meanwhile there is a positive effect of additional children on fathers' labour supply. This suggests that there is a specialisation effect in Vietnamese households. In Indonesia, a positive causal effect is found (Priebe 2010). An increase of one child increases the female labour supply by 4 percentage points. The effect is more positive (9 percentage points) during the economic crisis from 1998 to 2000. There is a negative effect of fertility on a mother's labour supply in urban areas but not in rural areas. This indicates that children are more expensive for poorer households. If the direct costs of children are high, women are more likely to work (Priebe 2010). The impact of an economic crisis may present a temporary or a permanent effect on female labour force participation decisions.

Moschion (2013) attributes the differences in the results from various countries to institutional differences, especially national family policies. A lack of family-friendly policies may result in a negative effect between fertility and a mother's labour market participation. Policies designed to reconcile both work and family in some developed countries, for instance, may result in a positive relationship between childbearing and female labour force participation in some countries (Craig & Siminski 2010).

4.2.2.4 Son preference as an instrumental variable

While there is evidence of parental preferences for sibling sex-mix compositions in some developed countries, evidence indicates that Asian households display a strong son preference which is deeply rooted in feudalism. By using the first child's sex as an instrumental variable for fertility in Korea, the results indicate that Korean women

with a son as their first child are less likely to have additional children. Chun and Oh (2002) reiterates that Korean households have a strong son preference, citing old-age support from mature sons as the main factor. In a sample of women aged between 20 to 39 years with at least one child, Chun and Oh (2002) find that Korean parents with a first-born son are 15.4 percentage points less likely to have a second child. Using the sex of the first child as the instrumental variable, an additional child is estimated to reduce the probability of married women's labour force participation by 27.5 percentage points. In Taiwan where there is also a strong son preference, a similar negative effect is found (Ebenstein 2009). More recently, Angrist, Lavy and Schlosser (2010) use a boy at third birth instrument with mixed-sex older siblings for more traditional Israeli households with a son preference in a population with high fertility to examine child quantity and quality trade-off. A boy at third birth reduces fertility for families with mixed-sex first and second born children.

Although the sex of the first child instrument in Chun and Oh (2002) leads to the identification of son preference, the sample selected only included households with two or more children, limiting the comparison of their results with Angrist and Evans' (1998) and Iacovou's (2001) studies which use the sex composition of the first two children as instrumental variables. Nam (2010) highlights this issue and extends the son preference analysis for a sample of women with two or more children by using the number of daughters as an instrument. The OLS estimates indicates a positive effect of fertility on female labour force participation while the 2SLS shows a significantly negative effect. In this case the OLS estimates might underestimate the negative correlations in a developing country like Korea. Nam (2010) offers a possible explanation. There might be a strong inverse relationship between fertility and female labour force participation where working women have economic income and therefore can afford to have more children in a developing country like Korea. Karbownik and Myck (2016) find a similar positive bias of OLS estimates (although both OLS and 2SLS are negative) for mothers with a higher level of education in the cohort born after 1977, suggesting that women who have a greater labour market attachment have more children in general.

Wong (2010) uses the preference for sons in Chinese families and finds a negative causal effect of childbearing on female labour supply in Hong Kong. The instrumental variable estimates are substantially higher than the OLS estimates. More importantly, Wong (2010, p. 12) stresses an important issue when investigating the causal effect of fertility on female labour force participation in high fertility groups (for example in developing countries) where the labour supply could be insensitive to increased fertility. In a high-fertility country, the impact of fertility for women with more than two children may include women with three, four, or even five children, causing the interpretation of the estimated coefficients to be unclear as it also incorporates those with more children.

As highlighted in the introduction chapter, the rising trend in the U-shaped curve can be attributed to a decline in fertility. The discussion presented in this section shows that there is mixed evidence for the effect of fertility on female labour force participation. In this study, the relationship between fertility and female labour force participation will be further examined by taking into account the possibility of cultural influences in the context of a developing country. The next section examines female labour force participation by ethnicity.

4.2.3 Ethnicity

Studies in the field of economics have begun to incorporate the effect of culture in various economic outcomes. Culture can be defined as those customary beliefs and values that ethnic, religious and social groups transmit fairly unchanged from generation to generation (Guiso, Sapienza & Zingales 2006). According to Becker (1996), individuals cannot alter their ethnicity, race or family history. The role of culture has a direct impact on expectations and preferences, which then affect economic preferences such as fertility and labour force participation. For example, studies found that the work and fertility choices of second-generation American women are influenced by the female labour force participation and fertility rates of their ancestors' country of origin (Fernández & Fogli 2009; Fernández, Fogli & Olivetti 2004).

The effort to combine work and family differs according to ethnicity as each ethnic group has different values, beliefs, norms and culture. In the case of Malaysia, the

Malays are often seen as possessing more collectivist values than the Chinese. They are also more inclined to have a more traditional attitude towards gender role division within society as demonstrated by different child-rearing practices and attitudes towards women's employment (Aziz 2011, p. 12). Meanwhile, the Malaysian Chinese inherited the Confucian ideology which impacts on women's economic roles through: (1) the nature of familial relationships and family expectations placed on women; and (2) societal investment in education (Brinton 2002, p. 20). The Confucian ideology emphasises the importance of education as being key to upward mobility (Brinton 2002, p.21). The Confucian patriarchal ideology regulating the hierarchical relationships between men and women has a clear division of labour between husband and wife, where the primary responsibility of the wife is the household (Kim 1997). The influence of religious teachings affects perceptions of life and social roles which, among other things, influences the perceptions towards the role of men and women in both society and households (Aziz 2011, pp.12-13). This view suggests that the traditional perspective on the importance of women's roles in household activities for both Malay and Chinese women is similar.

The traditional gender roles perspective is still prevalent in Malaysian society (Noor 1999) which is predominantly Muslim. There is however no difference between the Malay and Chinese perception on the importance of fulfilling role obligations in the domestic household in balancing work and family (Aziz 2011, p.161). The working preference for Malay and Chinese women is not significantly different (Aziz 2011, p.162). Fontaine and Richardson (2005) suggest that ethnic groups residing under the same system while maintaining their identities might share some similarities.

The results however are in contrast to an earlier finding by Noor (1999) who concludes that the Chinese have a greater preference for working outside the home in full-time employment than the Malay. Although Aziz (2011) suggests that this differential could be due to more diverse marital statuses in their female samples, the differences could also possibly be impacted by changes in role perception over time. An analysis of the changing trend in the behaviour or response of women to labour

force participation decisions covering a longer period of time, such as this present study, can therefore add evidence to this proposition.

Amin (2004) studies the impact of the NEP and the NPP on the employment pattern of married women under 50 years from three ethnic groups in Malaysia using panel data from the Malaysian Family Life Surveys for two waves in 1976-1977 and 1988. The estimation using logistic regression indicates that there is a difference in labour market behaviours for the different ethnic groups with the percentage of working women always lower for Malays than non-Malays. The NEP is found to decrease the work probability of Malay women by 9 percentage points. Meanwhile, the work probability of the Chinese women increases by 13 percentage points. The combined effect of the NEP and NPP however, do not have significantly different impacts on married women's employment decisions across the three major ethnic groups in Malaysia. Amin (2004, p.303) suggests that married women's employment and fertility decisions could therefore depend on women's tastes and preferences, social values and culture.

Apart from women's own preferences and family decisions, participation behaviour is also influenced by restrictions, both at an individual and an institutional level. The institutional context can provide push or pull forces for female labour force participation. Higher levels of child care, for example, will increase female labour force participation as combining work and family becomes easier. Other regulations such as anti-discrimination legislation, equal opportunities and affirmative action also affect female labour force participation (Vlasblom & Schippers 2004).

In Malaysia, the practice of affirmative action, in the form of preferential programmes favour the ethnic majority, or the Bumiputera group, has been in place since independence to facilitate the mobility of the economically disadvantaged Bumiputeras, mainly in education and public-sector employment (Lee 2012). With the introduction of the NEP in 1971, the affirmative action programmes were intensified. In the two decades of this policy, "the affirmative action programmes in education and employment made substantial gains toward the goal of increasing Bumiputera representation in tertiary institutions and upper-level occupations" (Lee

2012, p. 231). By including the ethnicity variable in this study, this thesis examines to what extent the Bumiputera female labour force participation decisions differ to their non-Bumiputera counterparts.

4.2.4 Marital status

The dramatic increase of married women's participation in the labour force in the 20th century has been widely attributed to the industrialisation process that has taken place across different countries, regions and cultures at different points in time (Brinton 2002). The discussion in the theoretical chapter suggests that the probability of an individual participating in the labour force depends on both the value of market and non-market time. Based on this premise, the labour force participation of a married or a single woman can be different as a result of the variation in household characteristics which affect the value of market and non-market time.

According to Mincer and Polachek (1974, p. S81):

> The labour force participation of married women, especially mothers, varies over the life cycle, depending on the demand of time in the household as well as their skills and preferences relative to other family members.

In general, being married is negatively related to female labour force participation (Euwals, Knoef & Van Vuuren 2011). Marital status also reflects in part the availability and level of alternative sources of income (Blau, Ferber & Winkler 2014, p. 101). Thus, a higher source of non-labour income is expected to exert a negative effect on women's labour force participation.

Nevertheless, after World War II, the labour force participation of married women increases rapidly in the US (Blau & Kahn 2007a; Goldin 1989). In the 1990s, the composition of working females shifts to single mothers with young children (Blau & Kahn 2007a). The composition of working women according to marital status has changed in developed countries, it is interesting to explore if similar shifts occur in developing countries.

While marriage is not a key obstacle for female labour force participation for women in the US, marriage is a major obstacle to a young female's labour force participation

in South Korea, where an average married woman is 40 to 60 percentage points less likely to participate in the labour force when compared to a single woman in urban South Korea (Lee, Jang & Sarkar 2008). The lower female labour force participation rate among young married women in South Korea can be attributed to limited access to low-cost public childcare services and the reluctance of employers to continue employing married women, even those with higher education. Work interruptions due to childbearing and child-rearing activities are deemed costly for employers (Lee, Jang & Sarkar 2008, p. 152).

Although the labour force participation of a woman is always linked to her marital status, a study in Australia found that the labour force participation of married women without children do not differ systematically from non-married women (Evans & Kelley 2008). In Mexico, the participation rate of single women is high while that of married women depends on the presence of young children (Cunningham 2001). It can therefore be assumed that it is the impact of marriage and children combined that drives the differences between the labour force participation of single versus married women.

4.2.5 Spouse labour force participation status

The availability of income from sources other than the individual's own work efforts affects the value of non-market time (Blau, Ferber & Winkler 2014). Non-labour income can be in the form of labour income of a spouse or income from other assets (Heim 2007). The status of spouse labour force participation can therefore affect the work decision of women through the income effect. An increase in non-labour income is expected to reduce the labour supply of an individual.

In general, a wife's decision on whether to work or not is often conditional on her husband's choices. Dessing (2002) finds that negative wage elasticities are particularly strong for secondary earners. In her argument, primary earners are always fully employed and the secondary earner, usually the married woman, adjusts their hours of work as necessary to maintain a subsistence level of household income. When there is a fall in wages, women increase their hours of work. In contrast, when wages rise, secondary earners reduce their work hours. The dominant effect is particularly strong at income levels that are near subsistence. This is usually

found in low-income countries such as the Philippines, Thailand, India, Mexico and Peru (Dessing 2002; Licona 2000; Schultz 1990a; Sharif 1991; Yamada 2008). In India, despite the fact that the increase in women's education levels and declining numbers of children increas the participation rate, the offsetting effect of rising male incomes results in a decline in female labour force participation (Klasen & Pieters 2015). The effect of a decrease in household income is hypothesised to increase female labour force participation more in developing countries because these countries often lack income and unemployment support programs especially when economies are hit by adverse conditions (Licona 2002).

On the other hand, the income effect is small in some developed countries. Highly educated women who are more likely to work tend to marry prosperous men. Their husband's wealth only reduces their work effort minimally. In Australia, husband's employment increases women's workforce engagement (Evans & Kelley 2008). In the US, the participation of married women with high-earning husbands in paid employment experienced significant gains in the 1970s and 1980s. However, since the mid-1990s, the participation of college-educated women with high-earning husbands declines sharply which can be partly explained by a greater increase in other sources of family income such as husbands' earnings and the stock market (Bradbury & Katz 2005, p.62). In summary, the effect of spouse labour force participation on female labour force participation varies according to a woman's tastes and preferences for work, as well as the cultural context in which the women live. This thesis can provide additional evidence to this debate by examining the case of Malaysia, which is a multicultural country.

4.2.6 Age

The age variable is often included in studies of labour force participation for males or females to capture the role of life-cycle effects on labour supply and to act as a proxy for labour market experience. The life course trajectories of women in general are more heterogeneous than men. The timing of life cycles is different in various parts of the world, but women in general go through stages of schooling, transition to adulthood, motherhood and grand-motherhood (Besamusca et al. 2015). Female labour force participation can be related to the lifecycle where it is commonly hypothesised that women first enter the labour market upon completion of schooling.

Then, their participation is expected to be interrupted by childbearing or child-rearing activities in their early years of motherhood. Finally, women typically re-enter the labour market once the children start to attend school and continue to work until retirement. This pattern can be portrayed by an M-shaped participation curve.

Although the M-shaped participation curve is commonly observed, there can be a divergence across countries. In comparing women's work participation across their life cycle between East Asian countries and Western countries, for example, Brinton (2002) finds that the M-shaped curve was distinct in Japan and South Korea in 1995. Taiwan, however, shows a more continuous curve of female labour force participation across their life cycle, similar to North America and most European countries (in recent years) where female labour force participation is uninterrupted throughout the childbearing and child-rearing years (Brinton 2002). The transition into a single-peaked or uni-modal curve can be potentially influenced by the childcare support system in a country or the flexibility in women's work arrangements.

In the case of Malaysia, the M-shaped or bimodal female labour force participation trend is observed (Ariffin 1992, p. 34). In 1957, a low first peak is observed for the 20 to 24 years age group, while a second higher peak occurs for the 45 to 49 years age group. The older women in the labour force are involved in the agricultural sector. In 1980, there is a sharp peak for the 20 to 24 years age group, and a second lower peak is observed for the 40 to 44 years age group. In general, however, there is a significant increase in female labour force participation. Observations from 1980 to 2000 indicates a similar pattern (Yahaya 2009). The first peak consists of young, single women who migrate from rural to urban areas to work in the manufacturing industry while the second peak consists of married women who re-enter the services industry (Yahaya 2009, p. 28). In 2000, the participation rate peaks for the 20 to 24 years age group. The bi-modal pattern prior to 2000 has changed to a uni-modal pattern or the 'one-phase' working life after the year 2000 suggesting that the characteristics of working females have changed over the years (Abu Bakar 2007).

The age profiles of female participants in the labour market have also evolved over time. The increased access to education in many countries tends to lower the female labour force participation rate, especially for the schooling age group as a result of their delayed entry into the labour market. This is not necessarily a cause for concern because in the long run education has a positive effect on female labour force participation. Studies in developing countries show that females aged 15 to 19 are more likely to have a higher participation rate (Schultz 1990a; Tansel 2002). However, in countries where access to education has increased, female labour force participation for the 15 to 19 age group has decreased due to these girls staying longer in school (Lee, Jang & Sarkar 2008). This can affect the age profile of female labour force participation via two mechanisms. First, women's entry into the labour market is postponed, resulting in the decline in participation for the younger age group but there is a relatively higher participation rate among prime-age working women as a result of increased educational attainment (Dayioglu & Kirdar 2011). Second, by staying longer in school, women delay marriages and reduce fertility which may also affect labour force participation decisions. The shift in this pattern implies that the decisions that a woman makes early in life regarding human capital investments, such as schooling and consequently marriage and fertility, will shape the value of her market and non-market time in subsequent periods (Juhn & Potter 2006). Variations in the age distribution of the population of a country therefore can affect the level of female labour force participation in that country.

Additionally, the participation rate by age group over time differs due to cohort effects. Different cohorts behave differently to other generations. In some European countries (France, West Germany, Italy, the Netherlands, Spain and the United Kingdom), the increase in the female labour force participation rate between 1992 and 1999 can be explained by neither compositional change in educational level nor the number and timing of children. It increases at all educational levels for women with or without children. The rise in the female labour force participation rate is driven by changes in behaviour attributed to generational effects where younger generations showed a higher level of participation reflecting the difference between generations in norms and values (Vlasblom & Schippers 2004).

A similar change is observed in developing countries, for example, in Chile, where a rise in the female labour force participation rate from 28% in 1980 to 35% in 1995 is primarily driven by the change in the female age composition where younger generations are more likely to participate in the labour market (Contreras, Puentes & Bravo 2005). In South Africa, the changing composition and coefficients of age from a decomposition analysis indicates that in 2004 black women of the same age are more likely to participate in the labour market than they were in 1995 (Ntuli & Wittenberg 2013).

4.2.7 Type of household

Living arrangements have an impact on household family decisions including female labour force participation decisions. Co-residence with one's parents or in-laws can exert a positive effect on the likelihood and availability of women to participate in the labour market (Kolodinsky & Shirey 2000; Ogawa & Ermisch 1996; Shen, Zhang & Yan 2012). Living with extended families, particularly including other female relatives, may also have similar effect. Co-residence reduces the burden of household work and allows women to participate in the labour market (Hill 1984; Ogawa & Emirsch 1996; Sasaki 2002).

In contrast, the labour supply of women can then be reduced if women have to spend time taking care of their parents or in-laws. Living with elderly who were sick and require care decreases female labour force participation (Pezzin & Schone 1999). In some cases, adult women have to shoulder the burden of all household chores, therefore decreasing their labour force participation (Yang, Fu & Li 2016).

In other cases, co-residence with elderly parents can have different effects on female labour force participation depending on their marital status (Lee, Jang & Sarkar 2008). Co-residence increases the labour force participation of married women but not unmarried women. As co-residence is a common living arrangement in many developing countries, and especially in Asian countries including Malaysia, the effect of co-residence on female labour force participation in Malaysia will be examined.

4.2.8 Living strata

Changes in work opportunities for women are related to the process of urbanisation which is closely related to changes in economic structures (Chaudhary & Verick 2014). At a lower level of industrial development, women work to a great extent either as paid or unpaid workers in the agricultural sector. At this stage, fertility rates are high but women can combine economic activity with child-rearing as they work in farm or household enterprises (Gaddis & Klasen 2014). As industrialisation begins, a country's economy is characterised by two transitions, the movement of workers from agriculture to manufacturing (and eventually into service sectors) and the migration from rural to urban areas. This transition has been seen in both East and Southeast Asia recently (Verick 2014). At this stage, countries experience a decline in the agriculture sector and therefore a decline in the demand for female workers in the sector. In urban areas, female labour force participation declines as a result of restricted work opportunities, especially work that allows women to combine work and child caring. At the same time, the income effect from the rise in men's income reduces the pressure on women to work (Goldin 1995; Psacharopoulos & Tzannatos 1989). At a more advanced stage of economic development, female labour force participation rates increase as a result of increased growth in the white-collar sector and increased urbanisation. Women have more education and increased access to the white-collar sector. Furthermore, a decline in fertility and greater access to childcare facilities enables women to combine work and child-rearing (Goldin 1995).

In countries where there is a difference in the level of development in urban and rural areas, the living stratum is therefore a variable of interest in the study of labour market outcomes. The literature on labour markets in developing countries is often segmented between (1) agriculture, industry and the service sectors (Lewis 1954), and (2) rural and urban areas (Todaro 1969). The different levels of development in urban and rural areas can affect the work and life realms of women. A number of studies find that women living in urban areas have greater opportunities to enter the labour force as compared to women living in rural areas (Contreras, Mello & Puentes 2011; Evans & Kelley 2008; Ntuli & Wittenberg 2013). Mohd Nor and Said (2014, p. 1464) suggest that this is a result of the persistence of unequal region progression

in the face of free mobility where skilled labour is more inclined to migrate to regions that provide better employment.

In contrast, other studies found that women in rural areas are more likely to work than their urban counterparts (Faridi, Chaudhry and Anwar 2009; Priebe 2010). Indonesian women from poorer rural households are more likely to work in order to finance the direct cost of children (Priebe 2010). This is a country where the incidence of poverty is higher in rural areas than urban areas. In Pakistan, Faridi, Chaudhry and Anwar (2009) note that women in rural areas participate in the labour market to cope with financial burdens as a result of a high level of poverty, low household income and high inflation. This point suggests that the push factor for female labour force participation in rural areas is closely tied to poverty levels.

The urban-rural difference in the female labour force participation rate is closely related to demand side factors such as the changing economic structure of a country. A study using an Indian and Thai dataset in the 1980s and 1990s indicates that female labour force participation is lower for urban women suggesting that there are fewer work opportunities in the urban areas (Mammen & Paxson 2000). In Turkey, the share of female employment in the agriculture sector has declined over time, resulting in women's migration from rural to urban areas. However, with limited jobs available in urban areas, this move then results in a decline in the rate of female labour force participation (Dayioglu & Kirdar 2011). Similarly, in urban India, the growth in the manufacturing and white-collar industries has not provided sufficient job opportunities for female workers. Employment growth in India is concentrated in construction and low-skilled services which favour male workers (Klasen & Pieters 2015, p. 25). In a similar vein, the shift from agriculture to manufacturing and service sectors results in a decline in job opportunities in rural areas. Female labour force participation in rural India therefore declined substantially between 1987 and 2011. A caution in interpreting this number lies in the fact that women's work in the agricultural sector is often underreported in developing countries (Klasen & Pieters 2015).

In Malaysia, however, the urbanisation process has often been cited as one of the main factors driving the growth of female labour force participation especially in the 1970s and 1980s due to the increase in employment opportunities in the manufacturing sector. The transformation of economic structure from agriculture to the manufacturing and services sectors in Malaysia attracted individuals from rural areas to work in urban areas where there are better job opportunities and higher wage offers. Mohd Nor and Said (2014), using data from the Malaysian Labour Force Surveys from 2000, 2005 and 2010, indicate that the probability of labour force participation (in a sample of male and females combined) is higher in urban areas, citing greater opportunities and higher salaries in these areas. The result is driven by the higher participation of individuals from the 25 to 34 years age group. The changing differences in characteristics and behaviour of female labour force participation in Malaysia can be examined in greater detail to provide a better understanding of the modest growth of female labour force participation in Malaysia over the past decades.

4.3 Conclusion

The objective of this chapter is to explore the impacts of the determinants of female labour force participation on the female labour market outcome. In general, the literature shows that individual characteristics of females, such as education and fertility, in a country changes over time and these have different impacts on female labour force participation. The question of interest is whether the slow growth in female labour force participation as witnessed in increasingly more countries in recent decades is related to a change in women's behaviour in response to education and fertility over time.

With the increasingly higher educational attainment of females, most countries aim to increase female participation in paid work as an educated workforce is a valuable resource for a country. As discussed in section 4.2.1, the impact of education on female labour force participation in a particular country may change over time. More importantly, in the few countries where the female labour force participation trend has stagnated, the pull of education has weakened over time. Many possible explanations have been put forward. In the case of a developed country, this could possibly be due to changes in female characteristics and behaviours as well as

changes in labour market conditions. The explanations in developing countries however focus on the increasing supply of education in recent decades. The positive effect of higher education observed in earlier decades could be due to self-selection where females with stronger labour market orientation selected into higher education. With the expansion of higher education in developing countries in the late 20th century, the positive effect of higher education has declined over time. Female educational attainment and labour force participation decisions could be jointly determined. However, due to a lack of suitable instruments, there are a limited number of studies which attempt to disentangle the causal effect of education and female labour force participation in economies with a stagnant female labour force participation trend. This thesis aims to fill this gap by exploring the impact of higher education reform on female labour force participation in a developing country, namely Malaysia.

Apart from education, fertility is also a key determinant of female labour force participation. The literature provides evidence on the causal effect of fertility on female labour force participation when fertility is instrumented using various instruments. In developing countries, the relationship between fertility and female labour force participation is ambiguous. The fertility behaviour of women is related to their cultural and ethnic backgrounds. The comparison of ethnic groups across countries should be interpreted with caution due to different institutional factors and macro environments across the countries. The findings from previous research on the causal effect of fertility on female labour force participation, especially in developing countries, have provided mixed evidence. The unique features of the distinct heterogeneous sub-population in Malaysia allow the impact of ethnicity, the cultural variable, to be examined. Thus, exploring the impact of fertility on female labour force participation by choosing Malaysia as a case study plausibly advances the literature in this area. In summary, the discussion in section 4.2 shows that the impact of education on female labour force participation has weakened over time. However, the changing impact of fertility on female labour force participation over time is less known. Thus, the effects of education and fertility on female labour force participation will be formally investigated in the subsequent empirical chapters.

CHAPTER 5 DECOMPOSITION ANALYSIS

5.1 Introduction

The Malaysian economy recorded rapid growth in the 1970s, following the introduction of the export-oriented industrialisation policies. This results in a growing demand for female workers, especially to work in the manufacturing sector. At the same time, female education attainment has increased and fertility declines and this potentially pushes more females into the labour market. Nevertheless, female labour force participation rate experienced only moderate growth between 1970 and 2000. Therefore, the purpose of this chapter is to investigate why female labour force participation stagnated in Malaysia for the past decades.

This chapter attempts to address the research question highlighted in Chapter 1, namely what are the main determinants of female labour force participation between 1970 and 2000 in Peninsular Malaysia and to what extent do these determinants affect female labour force participation. First, the marginal effects of the various determinants of female labour force participation is examined using a logistic regression. Second, the gap in female labour force participation between 1970 and 2000 is examined using Fairlie (1999; 2005) decomposition, an extension of the Blinder-Oaxaca (1973) decomposition model. The Blinder-Oaxaca (1973) decomposition is useful for identifying and quantifying the contribution of group differences in measurable characteristics, such as education, marital status to racial and gender gaps outcome (Fairlie 2005, p. 305-306). In the case of this study, this method allows the observed gap in the female labour force participation rate between two time periods to be quantified into changes in characteristics or changes in coefficients.

Decomposition analysis can provide insights into question like what factors are behind the trend in female labour force participation in Malaysia over the years examined. While this analysis can explain the change in female labour force participation between 1970 and 2000 in a statistical sense, it cannot identify the determinants of this change in an economic sense. Nevertheless, the results from this analysis can provide useful insights into the correlates of female labour force

participation in Malaysia.

The results from this study can be compared to other, albeit limited, studies of this kind in both developed and developing countries to allow further understanding of the changing impact of education and fertility, in particular, on the trend of female labour force participation over the past decades. Several other developed countries and developing countries such as the US (Lee 2014), Indonesia (Priebe 2010), India (Kapsos, Silberman & Bourmpoula 2014; Klasen & Pieters 2015), Turkey (Karaoglan & Okten 2015) and Sri Lanka (Gunatilaka 2013; Gunawardena 2015), have experienced a stagnant female labour force participation trend in recent years similar to Malaysia. In some cases, it was observed that the pull of education has weakened over time. Additionally, the negative effect of fertility on female labour force participation has increased over time. In general, there is still limited evidence on this issue. Thus, the analysis in this chapter aims to provide necessary evidence by using data from the Malaysian Population and Housing Census in 1970, 1980, 1991 and 2000, with a focus on Peninsular Malaysia. The main results from Fairlie (1999; 2005) decomposition show that education and fertility are the major contributors to the change in female labour force participation rate in Peninsular Malaysia between 1970 and 2000.

Following this section, the data used in the analysis is described in section 5.2. Section 5.3 discusses the Fairlie (1999; 2005) decomposition model, which is extended from the Blinder-Oaxaca (1973) decomposition. The logit model used is specified in section 5.4. The empirical results are presented in section 5.5. Section 5.6 provides a discussion of the findings and concludes.

5.2 Source of data

This study utilises data from the Malaysian Household and Population Census for the years 1970, 1980, 1991 and 2000, viewed from the IPUMS-International database (Minnesota Population Center 2015). The census is administered by the Department of Statistics Malaysia. The census covers a large representative sample of the population. The data are cross-sectional in nature and provide individual unit records. A total of 2% from the sample for each census year is accessible. The censuses for 1970 and 1980 include observations for Peninsular Malaysia only, while in 1991 and

2000 two other East Malaysian states were included. In order to allow for comparability for all census years, only observations from Peninsular Malaysia were included. As Peninsular Malaysia is more densely populated and comprises 75% of the population (Ong 2013), this choice of sample for this study will still provide a good overview of the female labour force participation trend in Malaysia.

The final dataset used for this analysis is constructed from women aged 20 to 54 years old who are considered the prime working age group. Observations for male individuals are dropped. Women aged 20 are more likely to have completed schooling and be in the labour market. The census contains rich demographic information including labour market status, age, ethnicity, marital status, level of education, living strata and household type. Information for both spouse and children can also be obtained by linking the person number in the household using the relationship code given in the database. However, the dataset does not contain information on household income, wages or non-wage income. Therefore, this chapter does not attempt to estimate a standard labour supply equation. The use of the education variable can reasonably provide a proxy for wage and income. Those observations with missing labour force participation and educational attainment information are not included as these are key variables in this analysis. The final samples from the respective census years are as follows: 32,406 (1970); 37,900 (1980); 62,598 (1991); and 79,001 (2000). The construction of the dataset is given in Table 5.1.

Table 5.1: Details of samples.

	1970	**1980**	**1991**	**2000**
A. Total observations from census	175,997	182,601	347,892	435,300
B. Total female observations	87,489	91,595	172,569	214,786
C. Observations dropped (non-Peninsular Malaysia states)	-	-	14,218	18,898
D. Total female observations (20 to 54 years old)	32,636	38,415	62,598	81,859
E. Observations dropped (missing information on labour force participation status)	230 0.7% of (D)	515 1.34% of (D)	-	-
F. Observations dropped (missing information on education)	-	-	-	2,858 3.5% of (D)
G. Total observations used in the analysis	32,406	37,900	62,598	79,001

Source: Population and Housing Census 1970, 1980, 1991 and 2000.

5.2.1 Descriptive statistics

The descriptive statistics for the sample are presented in Table 5.2. The summary provides some clues on how the changes in characteristics affects female labour force participation decisions between 1970 and 2000. In general, the female labour force participation rate in Peninsular Malaysia shows an increasing trend. There is a 5 percentage point increase from 1970 to 1980. This change can be attributed to growth in the manufacturing sector in the 1970s which provided employment opportunities for females, especially in urban areas. Over a period of 30 years, the female labour force participation rate has increased by 8.42 percentage points.

In terms of age, the mean age of women in the sample from 1970 to 1991 remains constant at about 33 years. In 2000, the mean age is slightly older at 35 years. The breakdown by age group indicates that, in general, between 1970 and 2000, the proportion of females in the selected sample in the 20 to 24 age group has decreased. Due to the increased access to education and increased educational attainment among females, it can be expected that this is the result of delayed entry among women into the labour market. The proportions of females in all other age groups either increased slightly or remained constant. The data in Table 5.2 also shows a slight change in the ethnic composition in Peninsular Malaysia between 1970 and 2000. The proportion of Bumiputera women has increased over the years, while the proportion of non-Bumiputera women has decreased over the years.

As discussed in section 2.7, the fertility rate in the country has declined since independence. Although an overall decline in the fertility rate is observed, the fertility rate of the non-Bumiputera groups shows a sharp decline when compared to the Bumiputera group. Additionally, from the late 1970s to the early 1980s, there is a slight increase in the fertility rate among Bumiputera women partly due to the introduction of the NPP in the early 1980s. These changes affect the composition of the population.

As indicated in Table 5.2, the proportion of married women in the labour force has decreased slightly between 1970 and 2000. A similar trend exists for women who were separated, divorced or widowed at the time of the census. In contrast, the

proportion of single women has increased. The changing composition in marital status is mainly due to the delay in age of marriage among females as a consequence of increased educational attainment as entry into lower secondary education increases the mean age at first marriage by two to three years (Von Elm & Hirschman 1979). More educated females also have higher career aspirations which also leads to delays in the age of marriage.

Other factors that contribute to this change include the ethnic variable - the Chinese tend to marry later as compared to Indian and Malay women, as well as family socio-economic status - daughters of white-collar workers also tend to marry later (Von Elm & Hirschman 1979). The age of first marriage predictably affects the fertility trend. Between 1970 and 2000, the mean number of children has decreased from 2.67 to 1.93. For married women, their spouse labour force participation rate is constant between 1970 and 1991 but it increases slightly in 2000. The proportion of families living in extended households increases from 1970 to 1991 before declining to 0.30. The proportion of urban-rural population also shows a notable change. The proportion of urban dwellers in the sample increases from 0.432 to 0.735 between 1970 and 2000.

The educational attainment for females increases significantly over the period studied. The proportion of females with no schooling decreases dramatically so that by 2000, only 0.06 women have no schooling. By 2000, approximately 70% of the total females in the sample have at least secondary level schooling or beyond. The mean of women with tertiary education has increased from 0.008 in 1970 to 11.8 in 2000. The improvement in educational attainment can be attributed to the Government's continuous investment in education infrastructure as well as the various reforms in the education system and policies implemented since independence.

Table 5.2: Summary of descriptive statistics.

	1970		1980		1991		2000	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
FLFP	0.402	0.490	0.455	0.498	0.465	0.499	0.486	0.500
Age	33.533	9.777	33.011	9.662	33.856	9.403	35.010	9.520
Age20_24	0.239	0.426	0.241	0.428	0.194	0.395	0.169	0.375
Age25_29	0.168	0.374	0.203	0.402	0.189	0.392	0.170	0.375
Age30_34	0.166	0.372	0.158	0.365	0.181	0.385	0.162	0.368
Age35_39	0.133	0.340	0.122	0.327	0.152	0.359	0.160	0.366
Age40_44	0.114	0.318	0.115	0.319	0.121	0.326	0.141	0.348
Age45_49	0.097	0.296	0.087	0.281	0.083	0.276	0.113	0.316
Age50_54	0.083	0.276	0.075	0.264	0.081	0.273	0.087	0.281
Single	0.148	0.355	0.209	0.406	0.223	0.416	0.218	0.413
Married	0.770	0.421	0.731	0.444	0.733	0.442	0.740	0.439
Widowed/divorced/ separated	0.082	0.274	0.061	0.239	0.044	0.205	0.042	0.201
Bumiputera	0.537	0.499	0.549	0.498	0.555	0.497	0.572	0.495
Non-Bumiputera	0.463	0.499	0.451	0.498	0.445	0.497	0.428	0.495
Extended household	0.298	0.457	0.455	0.498	0.383	0.486	0.301	0.459
Spouse work	0.610	0.488	0.614	0.487	0.618	0.486	0.648	0.478
Urban	0.432	0.495	0.488	0.500	0.632	0.482	0.735	0.441
Rural	0.568	0.495	0.512	0.500	0.368	0.482	0.265	0.441
No schooling	0.472	0.499	0.281	0.450	0.130	0.336	0.063	0.243
Primary	0.415	0.493	0.444	0.497	0.343	0.475	0.238	0.426
Lower secondary	0.050	0.217	0.122	0.328	0.193	0.395	0.211	0.408
Upper secondary	0.057	0.231	0.143	0.350	0.279	0.448	0.370	0.483
Tertiary	0.008	0.088	0.010	0.099	0.055	0.228	0.118	0.323
Total children	2.670	2.422	2.267	2.175	2.012	1.961	1.928	1.861
Total children under 6 years	0.915	1.092	0.698	0.948	0.633	0.912	0.536	0.833
Total children 6 years and over	1.754	2.035	1.569	1.959	1.379	1.689	1.392	1.672
Child<6 years_0 child	0.496	0.500	0.571	0.495	0.604	0.489	0.647	0.478
Child<6_1 child	0.215	0.411	0.226	0.418	0.213	0.409	0.206	0.404
Child<6_2+ children	0.289	0.453	0.203	0.402	0.183	0.387	0.147	0.354
Child 6 years_0 child	0.419	0.493	0.471	0.499	0.475	0.499	0.465	0.499
Child 6 years_1 child	0.145	0.352	0.128	0.334	0.136	0.343	0.135	0.342
Child 6 years_2+ children	0.437	0.496	0.401	0.490	0.389	0.487	0.400	0.490
Number of observations	32,406		37,900		62,598		79,001	

Note: SD represents standard deviations, FLFP is female labour force participation.

5.3 Blinder-Oaxaca decomposition model

The Blinder-Oaxaca (1973) decomposition technique is useful for identifying and quantifying the separate contributions of group differences in measurable characteristics and coefficients. The decomposition technique was first used to decompose mean differences in log wages based on a regression in a counterfactual manner to explain the differences between two comparison groups. Using this technique, the separate contributions of group differences in measurable characteristics, such as education, marital status and fertility, can be quantified. The decomposition method has been used to identify differences in labour markets, education, health and other outcomes (García-Altés, Pinilla & Ortún 2011; Sen 2014).

The Blinder-Oaxaca (1973) decomposition generalised by Newmark (1988) and Oaxaca and Ransom (1998, 1994) can be used to explain the differences between two comparison groups. The Blinder-Oaxaca decomposition was first used to decompose mean differences in log wages based on regression in a counterfactual manner. The difference in wages between gender and race can be explained by distinguishing the gap into explained and unexplained components. Apart from identifying gender and race differentials, the Blinder-Oaxaca (1973) decomposition has also been used to decompose changes over time to address issues such as changes in labour force participation rates over time.

The Blinder-Oaxaca (1973) framework is outlined here as illustrated in Sinning, Hahn and Bauer (2008, p. 481). By considering a linear model for two separate groups, $g = (A, B)$, the linear regression model can be written as:

$$Y_{ig} = X_{ig}\beta_g + \varepsilon_{ig} \quad (5.1)$$

where $i = 1, \dots, N_g$ and $\sum_g N_g = N$.

The regression can be decomposed according to Blinder-Oaxaca (1973) so that:

$$\bar{Y}^A - \bar{Y}^B = \left[(\bar{X}^A - \bar{X}^B)\hat{\beta}^A\right] + \left[\bar{X}^B\left(\hat{\beta}^A - \hat{\beta}^B\right)\right] \quad (5.2)$$

where $\bar{Y}^g = N_g^{-1}\sum_{i=1}^{Ng} Y_{ig}$ and $\bar{X}^g = N_g^{-1}\sum_{i=1}^{Ng} X_{ig}$.

In equation 5.2, the first term on the right-hand side represents the explained component of the difference in mean outcomes as a result of the differences in observable characteristics. The second term represents the unexplained component of the difference in mean outcomes which is due to differences in coefficient estimates.

The contribution of the differences in characteristics and coefficients of individual variables or detailed composition obtained from the Blinder-Oaxaca (1973) decomposition method is useful to answer many relevant economic questions. For example, in the case of female labour force participation, the methodology can identify to what extent the change in educational attainment explains the differences in the female labour force participation rate between two time periods. The differences between two comparison groups can be explained by differences in educational attainment (characteristic effect) and behavioural responses associated with educational attainment (coefficient effect) (Yun 2004, p. 276).

Hotchkiss (2006, p. 4) summarises three potential sources affecting changes in labour force participation rates that can be identified using this methodology. First, a change in characteristics, for example, women who have more children might have a higher reservation wage or the acquisition of more education raises a woman's expected market wage. Second, a change in behaviour where the changes in a woman's characteristics translate into her observed labour market participation decision. For example, if discrimination against women declines, their return to tertiary education might increase and therefore the marginal utility of participating in the labour market increases. The third source is the force of the unobservable which includes factors like changes in women's tastes and preferences or changes in the labour market structure or institutions that affect the value of human capital characteristics and market wages. This change can be reflected in the intercept of the decomposition results.

While the contribution of the differences in characteristics and coefficients of individual variables can be easily calculated in linear equations, this is not the case when using non-linear equations (Barsky et al. 2002; Yun 2004). The coefficient

estimates from logit or probit models cannot be used directly in the standard Blinder-Oaxaca decomposition equations when the outcome is binary (Fairlie 2005), as is the case with female labour force participation in this study. The standard Blinder-Oaxaca (1973) strategy may not provide consistent estimates of the decomposition if the relationship of interest is non-linear. In such cases, the conditional expectation of the outcome for one sample is not an accurate representation for the conditional expectation of the outcome for the other sample (Hotchkiss & Rios-Avila 2013).

Several methods have been used to decompose non-linear models. The Even and Macpherson's (EM) (1993) decomposition technique was used to decompose the respective gaps in South African female labour force participation into two components, being the differences in observable characteristics and disparities in behaviour or coefficients in response to these characteristics for the years 1995 and 2004. The method is similar to the Blinder-Oaxaca (1973) decomposition technique. While the Blinder-Oaxaca technique applies to linear models, the EM method is used for non-linear (binary probability) models. The method however does not include the analysis of specific factor contributions to the unexplained portion of the gap or the detailed decomposition. In contrast, Nielsen (1998) proposes a detailed decomposition of the coefficient effects but not the characteristics effects. The detailed decomposition, while useful to provide information on the contribution of the characteristic and coefficient effects, is not invariant to the choice of the omitted group when categorical covariates are used (Jones 1983; Oaxaca & Ransom 1999). This is known as identification problem in the literature (Oaxaca & Ransom 1999; Yun 2005).

Yun (2005) suggests that this problem can be solved by averaging both the characteristic and coefficient effects in the decomposition equation with varying reference groups. This can be estimated using a normalised regression where the result is a decomposition equation that can identify the characteristic and coefficient effects for each category including the reference group and therefore avoid having omitted reference groups. Nevertheless, Gelbach (2002b) points out that there is no identification problem because the parameters of interest are all identified. Therefore, Fortin, Lemieux and Firpo (2011, p.10) stress that it is misleading to provide a

general "solution" to the identification problem. In cases where the omitted group has a particular economic meaning, the elements of the detailed decomposition are more interpretable as they correspond to interesting counterfactual exercise. However, in other cases, the elements of the detailed decomposition are not economically interpretable (Fortin, Lemieux & Firpo 2011, p. 10). The Oaxaca decomposition constructed from normalised regressions (Yun 2005) may complicate the interpretation of the decomposition results, which still depend on the choice of reference groups.

The female labour force participation decision in this study is modelled with logit regression as the outcome of interest is represented by a dichotomous variable which takes the value of 0 and 1. The logistic regression can then be decomposed using the Fairlie (1999; 2005) decomposition method. The non-linear decomposition approach developed by Fairlie (2005) allows the estimated coefficient of the logistic regression to be used directly in the decomposition determination. The non-linear decomposition technique has been used extensively to analyse differences over time, geographies and school types (Fairlie 2005).

Following closely the approach by Fairlie (1999; 2005, p. 306-307), the decomposition analysis in this study for a non-linear equation, $Y = F(X\hat{\beta})$ can be written as:

$$\bar{Y}^{2000} - \bar{Y}^{1970} = \left[\sum_{i=1}^{N^{2000}} \frac{F\left(X_i^{2000}\hat{\beta}^{2000}\right)}{N^{2000}} - \sum_{i=1}^{N^{1970}} \frac{F\left(X_i^{1970}\hat{\beta}^{2000}\right)}{N^{1970}}\right] + \left[\sum_{i=1}^{N^{1970}} \frac{F\left(X_i^{1970}\hat{\beta}^{2000}\right)}{N^{1970}} - \sum_{i=1}^{N^{1970}} \frac{F\left(X_i^{1970}\hat{\beta}^{1970}\right)}{N^{1970}}\right] \quad (5.3)$$

where $N^j$is the sample size for year *j*. This alternative expression for the decomposition is used for the decomposition because $\bar{Y}$ does not necessarily equal $F\left(X\hat{\beta}\right)$.

The first term in brackets in both equation (1) and (2) represents the part of the gap in female labour force participation that is due to group distributions of the X, also

called the endowment effect (or explained effect) while the second term represents the part due to differences in the group processes determining levels of Y. The second term also captures the portion of the gap due to group differences in unmeasurable or unobserved endowments, also known as the coefficients effect (or unexplained effect).

In order to calculate the decomposition, $\bar{Y}^j$ can be defined as the average probability of the binary outcome of interest for year j and F as the cumulative distribution function from the logistic distribution. For a probit model, F would be defined as the cumulative distribution function from the standard normal distribution.

The decomposition can be expressed as:

$$\bar{Y}^{2000} - \bar{Y}^{1970} = \left[\sum_{i=1}^{N^{2000}} \frac{F\left(X_i^{2000}\hat{\beta}^{1970}\right)}{N^{2000}} - \sum_{i=1}^{N^{1970}} \frac{F\left(X_i^{1970}\hat{\beta}^{1970}\right)}{N^{1970}}\right] + \left[\sum_{i=1}^{N^{2000}} \frac{F\left(X_i^{2000}\hat{\beta}^{2000}\right)}{N^{2000}} - \sum_{i=1}^{N^{2000}} \frac{F\left(X_i^{2000}\hat{\beta}^{1970}\right)}{N^{2000}}\right] \quad (5.4)$$

The 1970 coefficient estimates, $\hat{\beta}^{1970}$ are used as weights or the first term in the decomposition and the 2000 distribution of the independent variables, $\bar{X}^{2000}$ are used as weights for the second term. This alternative method often provides different estimates, which is the familiar problem with the Blinder-Oaxaca approach (Fairlie, 2005, p. 307). Oaxaca and Ransom (1994) suggest weighting the first term of the decomposition expression using coefficients estimated from a pooled sample of the two groups.

The estimation of total contribution can be obtained calculating two sets of predicted probabilities and take the difference between the average values of the two. Identifying the contribution of group differences in specific variable is not straightforward. To simplify, assume that $N_{1970} = N_{2000}$ and there ia a natural one-to-one matching of 1970 and 2000 observations.

Using coefficient estimates from a logit regression for a pooled sample, $\widehat{\beta^*}$, the independent contribution of $X_1$to the participation gap can be expressed as:

$$\frac{1}{N^{1970}} \sum_{i=1}^{N^{1970}} F\left(\hat{\alpha}^* + X_{1i}^{2000}\hat{\beta}_1^* + X_{2i}^{2000}\hat{\beta}_2^*\right) - \left(\hat{\alpha}^* + X_{1i}^{1970}\hat{\beta}_1^* + X_{2i}^{2000}\hat{\beta}_2^*\right) \quad (5.5)$$

The contribution of X_2can be expressed as:

$$\frac{1}{N^{1970}} \sum_{i=1}^{N^{1970}} F\left(\hat{\alpha}^* + X_{1i}^{1970}\hat{\beta}_1^* + X_{2i}^{2000}\hat{\beta}_2^*\right) - \left(\hat{\alpha}^* + X_{1i}^{1970}\hat{\beta}_1^* + X_{2i}^{1970}\hat{\beta}_2^*\right) \quad (5.6)$$

The contribution of each variable to the gap is equal to the change in the average predicted probability from replacing the 1970 distribution with the 2000 distribution of that variable while holding the distribution of the other variable constant. The sum of the contributions from individual variables will be equal to the total contribution from all the variables evaluated with the full sample (Fairlie 2005, p. 308).

The sample sizes of the two groups are rarely the same. Therefore, a one-to-one matching of observations is needed to calculate equations (5.3) and (5.4). This is done by drawing a 2000 subsample of size equal to the 1970 sample, matching women on their predicted probability of working (based on a pooled logit estimation) and assigning women in the 2000 subsample the value of X_1 observed for their 1970 match (Klasen & Pieters 2015, p. 467). The results reported in this chapter are based on 1,000 random subsamples. Furthermore, a potential issue in this approach is the effect of ordering of variable in the decomposition. This is due to the nonlinearity of the decomposition equation (Fairlie 2015, p. 313). Thus, the order of variables is randomised.

5.4 Logit model

The empirical analysis in this chapter is divided into two main parts. In the first part, the effect of the variables determining the female labour force participation rate is examined using a logit model. In the second part, the contributions of each variable

in terms of the explained and unexplained components were analysed using the Fairlie (1999; 2005), extension of the Blinder-Oaxaca (1973) decomposition.

The model in this study includes variables usually found in a standard labour supply equation. The logit model of female labour force participation can be estimated as follows:

$$\Pr(FLFP = 1|X) = F(\omega_0 + \sum_{j=1}^{5} \omega_{1j}\, Age_j + \sum_{j=1}^{2} \omega_{2j}\, Married_j + \omega_3 Bumiputera +$$

$$\omega_4 Extended\_household + \omega_5 Spouse\_LFP + \omega_6 Urban + \sum_{j=1}^{4} \omega_{7j}\, Education_j +$$

$$\sum_{j=1}^{2} \omega_{8j}\, Child_j + \sum_{j=1}^{2} \omega_{9j}\, Child6_j) + \xi_1 \qquad (5.7)$$

where *FLFP* is a dummy variable which is equal to 1 if an individual is in the labour force and 0 otherwise, j is the index for dummy variables and X is a vector of explanatory variables including age, marital status, ethnicity, type of household, spouse labour force participation, living strata, education level and fertility as measured by the child variables. The child dummy indicates child less than 6 years, while child6 indicates child 6 years or above.

The detailed set of dummy variables in the model is given in Table 5.3. The age group in the sample is between 20 and 54, and the age categories examined are divided into 5 year intervals commencing from 20 years. The 35-39 age group has been chosen as the reference group as this age group forms the prime working age group. As highlighted in the literature review, the age variable is often present in empirical models analysing female labour force participation as age captures life course trajectories of women such as adulthood and motherhood that influence labour force participation decisions (Brinton 2002). Furthermore, the changing levels of education affect the age composition of women in the labour force (Dayioglu & Kirdar 2011; Lee, Jang & Sarkar 2008).

The ethnic variable is also included in the model. In the context of Malaysia, the unique feature of the population, namely ethnic heterogeneity, can be used to identify cultural differences that affect female labour force participation in the same labour

market institutions. As noted in the literature, the taste and preference for work is influenced by women's ethnic backgrounds (Aziz 2011; Noor 1999). The Bumiputera form the largest share of the population in Malaysia. By using the non-Bumiputera group as the omitted group, the labour force participation of Bumiputera women can be compared with non-Bumiputera women.

The decision to work differs according to marital status (Evans & Kelley 2008; Lee, Jang & Sarkar 2008). Therefore, the marital status of females is included in the model. The reference group in this category is married women. This allows the labour force participation of the currently single, widowed, divorced or separated group to be compared with women who are married. In addition, for married women, it is important to control for their spouse labour force participation as the status of spouse labour force participation affects married women's labour force participation decisions through their joint-labour force participation decisions along with the availability of non-labour income such as the husband's income (Dessing 2002; Licona 2000; Klasen & Pieters 2015; Schultz 1990b; Sharif 1991; Yamada 2008). Although the income or wage variable is important as well as non-labour income, these variables are not included in this study as this information is not available from the census data. Thus, the status of the spouse labour force participation is included in the model to serve as a proxy for non-labour income.

As discussed in the theoretical chapter earlier, one of the most important determinants of female labour force participation is human capital (Becker 1962; Mincer 1962), which in this study will be represented by the level of education. A higher level of education is expected to have a positive effect on female labour force participation (Mincer 1962). In this study, the level of educational attainment is divided into several categories: no schooling; primary; lower secondary; upper secondary; and tertiary. The 1970, 1980 and 1991 censuses contain more details on educational attainment where some individuals were reported to have some primary school or have completed primary school. However, in the 2000 census, information on 'some primary completed' only is given. Therefore, the primary category used in this analysis comprises individuals who have either some primary school or have completed primary school. The primary education category is the omitted category.

Meanwhile, the discussion in the literature review in Chapter 4 highlighted that child status variables are responsible for the largest share of the explained variation in most female labour supply studies (Nakamura & Nakamura 1994, p. 133). The presence of pre-school children especially affects the female participation decision (Cleveland, Gunderson & Hyatt 1996, p. 133). Therefore, child variables are included in this study. They are divided into two categories - whether women have children younger than 6 years and/or have children 6 years or older as the presence of younger and older children may affect female labour force participation differently due to the difference in care required. The effect of female labour force participation for women with children can be examined with respect to women with no children. The omitted category for children aged 6 and above is women without children aged 6 and above.

The variable for the type of household or living arrangements is included in the model as co-residence is common in many Asian countries including Malaysia. Living arrangements have different impacts on female labour force participation depending on whether a female relative is present or not in the household to help with household and/or child-caring work (Kolodinsky & Shirey 2000; Ogawa & Ermisch 1996; Shen, Zhang & Yan 2012). Additionally, the living strata, namely living in urban or rural areas, also impacts on female labour force participation as living strata affects work opportunities and other socio-economic characteristics such as the level of poverty (Contreras, Mello & Puentes 2011; Evans & Kelley 2008; Ntuli & Wittenberg 2013; Priebe 2010). Therefore, both the type of household and living strata variables are included in the model.

Table 5.3: Definition of explanatory variables.

Variable	Definition
FLFP (Female Labour Force Participation)	Binary variable. 1=the woman is in the labour force at the time of the survey; or 0=the woman is not in the labour force.
Age	Binary variable. 1=if the individual's age in years falls into one of the following categories: 20-24 years, 25-30 years, 31-34 years, 35-39 years, 40-44 years, 45-49 years, 50-54 years
Married	Binary variable. 1=if the individual's marital status falls into the following categories: Married, single, widowed/divorced/separated, or 0 otherwise.
Bumiputera	Binary variable. 1=if ethnic group is Bumiputera; or 0=if ethnic group is not Bumiputera.
Extended household	Binary variable. 1=if woman lives in an extended household; or 0=if not living in an extended household.
Spouse LFP	Binary variable. 1=if spouse participates in the labour force; or 0=if no spouse present or spouse not in the labour force.
Urban	Binary variable. 1=if woman lives in an urban area; or 0=if not living in an urban area.
Education	Binary variable. 1=if the individual's educational level falls into the following categories: No schooling, primary, lower secondary, upper secondary, tertiary, or 0 otherwise.
Child	Binary variable. 1=if the individual's child status falls into the following categories: No children under 6, 1 child under 6, 2 or more children under 6, or 0 otherwise.
Child6	Binary variable. 1=if the individual's child status falls into the following categories: No children aged 6 and above, 1 child aged 6 and above, 2 or more children aged 6 and above, or 0 otherwise.

Source: Author's own work.

5.5 Empirical results

This section reports the estimates for the determinants of the probability of female labour force participation in Peninsular Malaysia analysed using logit regression. Section 5.5.1 presents the results from the logistic regression coefficients and the average marginal effects estimated from the logit regression. Then, the findings from

the decomposition analysis to quantify the sources of changes in female labour force participation over time are reported in section 5.5.2.

5.5.1 Average marginal effects of logit estimations

This section reports on the estimates for the determinants of the probability of female labour force participation in Peninsular Malaysia. The coefficients estimated from the logit regressions and the average marginal effects estimated from the logit model on female labour force participation for 1970, 1980, 1991 and 2000 are given in Table 5.4. The average marginal effects show how the probability of female labour force participation changes as the dummy variable changes from 0 to 1, holding all other X equal. For categorical variables, the effects of discrete changes are computed. The results from the average marginal effects will be highlighted in this section.

From Table 5.4, the marginal effects for the various age categories indicate that, relative to the base category (35 to 39 years), the probability of participating in the labour force is low especially for 20 to 24 years and 50 to 54 years. Between 1970 and 2000, the negative effects decrease significantly especially for the 20-24 age group from -0.075 to -0.177. This is likely to be due to females staying longer in school including for the acquisition of tertiary education. At the other end of the spectrum, the older age group is most likely to have retired early from the labour market, with the probability of participation decreasing from -0.108 to -0.195. The negative effect for women aged 30 to 34 is close to zero - negative but not significant. The marginal effects for women from the 25 to 29, 40 to 44 and 45 to 49 age groups have decreased, especially in 1991 and 2000, suggesting that, together with the reference group, these women are the prime working age group in the labour force.

In terms of marital status, the estimates indicate that marriage reduces the probability of participating in the labour force. Single women are more likely to work than married women. However, the positive effect decreases significantly from 1991 to 2000 from 0.297 to 0.159. Likewise, women who are separated, divorced, or widowed are also more likely to work than married women. The average marginal effect for women in this category is 0.167 in 2000. In terms of ethnicity, the

probability of participation for Bumiputera women is slightly lower than non-Bumiputera women by 0.015.

Household types affect the probability of female labour force participation. A woman living in an extended household is more likely to work than a woman in a non-extended household. The effect is small in 1970 and 1980, but larger and significant in 1991 and 2000. The mean of extended household in 1970 and 2000 is about 30%. However, the average marginal effect of a woman (living in an extended household) participating in the labour market in 2000 is 10 times greater than in 1970 suggesting that having a family member or relative living in the household increases female labour force participation. Next, although the proportion of women living in urban areas have increased substantially between 1970 and 2000, the probability of women in urban areas participating in the labour market is only slightly more than women in rural areas (0.014).

The results from the marginal effects indicate that a woman who has a spouse currently working is less likely to participate in the labour market. Except for 1970 where there is a positive effect, the remaining years examined shows negative marginal effects. In 2000, a woman with a working spouse is 0.078 less likely to work than a woman with no spouse or no working spouse present. The effect is largest in the year 2000.

In general, the average marginal effects indicate that education has a positive effect on female labour force participation. However, the effect of education on female labour force participation has weakened over time. The effects of individuals with no schooling decreases from 1970 to 2000. In 2000, a woman with no schooling is less likely to participate in the labour market than a woman with primary education. However, the effect is not significant. From 1970 to 2000, the strength of the effects of education for upper secondary level has gradually weakened over time although the estimates are still positive. Similarly, the effects of lower secondary school on female labour force participation decisions have also weakened over time between 1970 and 2000.

Table 5.4: Logit model and average marginal effects.

	1970	1980	1991	2000	1970	1980	1991	2000
	Logistic regression coefficient				Average Marginal Effects			
Category: Age (Reference group: Age35-39)								
Age20_24	-0.341***	-0.230***	-0.868***	-0.870***	-0.075***	-0.049***	-0.170***	-0.177***
	(0.0508)	(0.0482)	(0.0401)	(0.0350)	(0.0112)	(0.0103)	(0.0078)	(0.0071)
Age25_29	-0.133**	-0.026	-0.303***	-0.094**	-0.029**	-0.006	-0.059***	-0.019**
	(0.0470)	(0.0443)	(0.0344)	(0.0300)	(0.0104)	(0.0095)	(0.0067)	(0.0061)
Age30_34	0.018	-0.049	-0.032	-0.035	0.004	-0.010	-0.006	-0.007
	(0.0437)	(0.0426)	(0.0311)	(0.0277)	(0.0096)	(0.0091)	(0.0061)	(0.0056)
Age40_44	-0.076	-0.148**	-0.208***	-0.049	-0.017	-0.032**	-0.041***	-0.010
	(0.0472)	(0.0451)	(0.0348)	(0.0285)	(0.0104)	(0.0096)	(0.0068)	(0.0058)
Age45_49	-0.153**	-0.300***	-0.411***	-0.338***	-0.034**	-0.064***	-0.081***	-0.069***
	(0.0512)	(0.0503)	(0.0404)	(0.0319)	(0.0113)	(0.0107)	(0.0079)	(0.0065)
Age50_54	-0.491***	-0.746***	-0.839***	-0.962***	-0.108***	-0.159***	-0.165***	-0.195***
	(0.0569)	(0.0553)	(0.0443)	(0.0385)	(0.0125)	(0.0117)	(0.0086)	(0.0077)
Category: Marital status (Reference group: Married)								
Single	1.130***	1.056***	1.513***	0.783***	0.249***	0.226***	0.297***	0.159***
	(0.0539)	(0.0465)	(0.0398)	(0.0359)	(0.0116)	(0.0097)	(0.0075)	(0.0072)
Widowed/divorced/	0.692***	0.701***	0.935***	0.820***	0.153***	0.150***	0.184***	0.167***
separated	(0.0517)	(0.0535)	(0.0476)	(0.0449)	(0.0113)	(0.0113)	(0.0092)	(0.0091)
Category: Ethnicity (Reference group: Non-Bumiputera)								
Bumiputera	-0.156***	-0.139***	-0.223***	-0.072***	-0.034***	-0.030***	-0.0439***	-0.015***
	(0.0269)	(0.0244)	(0.0197)	(0.0180)	(0.0059)	(0.0052)	(0.0039)	(0.0037)
Category: Household type (Reference group: Non-extended household)								
Extended household	0.019	-0.016	0.219***	0.241***	0.0041	-0.003	0.043***	0.049***
	(0.0266)	(0.0231)	(0.0189)	(0.0177)	(0.0059)	(0.0049)	(0.0037)	(0.0036)
Category: Spouse work (Reference group: No spouse, no working spouse)								
Spouse working	0.230***	-0.221***	-0.142***	-0.388***	0.051***	-0.047***	-0.028***	-0.079***
	(0.0349)	(0.0345)	(0.0289)	(0.0281)	(0.0077)	(0.0074)	(0.0057)	(0.0057)

(continued)

Table 5.4: (continued)

	1970	1980	1991	2000	1970	1980	1991	2000
	Logistic regression coefficient				Average marginal effects			
Category: Living strata (Reference group: Rural)								
Urban	-0.791***	-0.504***	-0.227***	0.068***	-0.175***	-0.108***	-0.0446***	0.014***
	(0.0280)	(0.0250)	(0.0205)	(0.0197)	(0.0059)	(0.0053)	(0.0040)	(0.0040)
Category: Education (Reference group: Primary)								
No schooling	0.333***	0.335***	0.043	-0.059	0.074***	0.072***	0.008	-0.012
	(0.0279)	(0.0286)	(0.0310)	(0.0379)	(0.0061)	(0.0061)	(0.0061)	(0.0077)
Lower secondary	0.184**	0.120***	0.101***	0.168***	0.041**	0.026***	0.020***	0.034***
	(0.0578)	(0.0362)	(0.0260)	(0.0240)	(0.0127)	(0.0077)	(0.0051)	(0.0049)
Upper secondary	1.363***	1.056***	1.021***	0.929***	0.301***	0.226***	0.201***	0.189***
	(0.0583)	(0.0385)	(0.0256)	(0.0229)	(0.0125)	(0.0079)	(0.0048)	(0.0045)
Tertiary	-0.474**	1.997***	0.762***	1.025***	-0.105**	0.427***	0.150***	0.208***
	(0.1650)	(0.1460)	(0.0516)	(0.0331)	(0.0364)	(0.0309)	(0.0100)	(0.0065)
Category: Child less than 6 years (Reference group: None)								
Child<6_1 child	-0.179***	-0.343***	-0.352***	-0.394***	-0.040***	-0.073***	-0.069***	-0.080***
	(0.0352)	(0.0314)	(0.0258)	(0.0226)	(0.0078)	(0.0067)	(0.0050)	(0.0046)
Child<6_2+ children	-0.277***	-0.570***	-0.762***	-0.765***	-0.061***	-0.122***	-0.150***	-0.156***
	(0.0357)	(0.0351)	(0.0294)	(0.0268)	(0.0079)	(0.0074)	(0.0057)	(0.0054)
Category: Child 6 years or more (Reference group: None)								
Child6+_1	-0.037	-0.066	-0.283***	-0.565***	-0.008	-0.014	-0.056***	-0.115***
	(0.0402)	(0.0390)	(0.0302)	(0.0268)	(0.0089)	(0.0083)	(0.0059)	(0.0054)
Child6+_2+	-0.122***	-0.009	-0.491***	-0.719***	-0.027***	-0.002	-0.096***	-0.146***
	(0.0348)	(0.0340)	(0.0268)	(0.0238)	(0.0077)	(0.0073)	(0.0052)	(0.0047)
Number of observations	32,406	37,900	62,598	79,001	32,406	37,900	62,598	79,001

Notes: Sample of women aged 20 to 54. Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.05 level, **0.01 level and ***0.001 level.

The effects of tertiary education fluctuated over time, peaking in 1980. It is interesting to note that the marginal effects of education on female labour force participation are lower in 1991 when compared to 1980 although still positive and significant. When compared to the average marginal effect in 1980 (0.427), the estimates in 2000 (0.208) indicate that tertiary education is less of a pull factor for female labour force participation in 2000.

Finally, as shown in Table 5.4, fertility affects female labour force participation. The presence of children (both under and over 6 years old) in a household reduces the probability of female labour force participation. The negative effects on female labour force participation of having children in either age group are larger over time indicating that it has become more challenging to combine work and family in recent decades than in previous decades. The results in this section will be discussed further in section 5.6.

5.5.2 Decomposition analysis

The contribution of explanatory variables to the observed gap in the female labour force participation rate between 1970 and 2000 can be quantified using Fairlie (1999; 2005) decomposition, which is extended from the Blinder-Oaxaca (1973) decomposition. First, separate logit regressions are estimated using three separate samples including the 1970 sample, 2000 sample and a pooled sample from 1970 and 2000. Then the changes are decomposed into changes in characteristics (explained components) or changes in coefficients (unexplained components) for each variable. Table 5.5 presents the results from the Fairlie (1999; 2005) decomposition analysis for the female labour force participation rate in Peninsular Malaysia between 1970 and 2000. Table 5.6 follows with the results of the detailed decomposition estimated using Yun (2005).

Between 1970 and 2000, the female labour force participation rate increases from 40.2% to 48.6%, by approximately 8.4%. Therefore, a positive value in the share of percentage change can be interpreted as contributing to the increase in the female labour force participation rate while a negative value in the share of percentage change contributes to a decline in the female labour force participation rate. Using the 1970 coefficients, a total of 46.9% in this gap is explained by changes in

characteristics while a total of 53.1% is explained by the changes in coefficients and other the unobservable factors. However, using the 2000 coefficients, a total of 138.3% of the gap in female labour force participation rate is explained by the change in characteristics. This is offset by a negative contribution in the change of coefficients and unobservable factors of 38.3%.

The reported estimates differ when using the 1970 and 2000 coefficients as the reference groups. If estimates from coefficients and covariates differ substantially, the measured contribution will vary and the true contribution of a variable will lie somewhere in between (Klasen & Pieters 2015). Therefore, in this analysis, a pooled regression is also estimated for the model where the mean from both groups is used as the reference group. In this model, the gap in female labour force participation is explained almost entirely by the change in characteristics, or the explained components, accounting for 102.92% while there is a negative effect of 2.92% in the change in coefficients or the unexplained components.

By using the pooled coefficients as a reference, it can be observed that the increase in female's education accounts for 77% of the change in female labour force participation. Between 1970 and 2000, the proportion of women with no schooling has decrease. The estimates confirm the positive link between education and female labour force participation. The estimates are statistically significant in all specifications.

Next, the effect of the child variables when combined is also one of the key variables contributing to the rise in female labour force participation. The declining number of children below 6 years have positive contribution to the gap in female labour force participation in Peninsular Malaysia. There is similar impact for children 6 years and above. The proportions of women with children 6 years and above between 1970 and 2000 experiences minimal change. However, the negative marginal effects of having children on female labour force participation have become larger over the years.

Table 5.5: Fairlie decomposition of female labour force participation rate, 1970-2000.

	(1)		(2)		(3)		(4)	
	At 1970 coefficients	% of gap	At 2000 coefficients	% of gap	Pooled coefficients	% of gap	Reverse order	% of gap
Overall								
Year 2000	0.4861***		0.4861***		0.4861***		0.4861***	
	(0.0018)		(0.0018)		(0.0018)		(0.0018)	
Year 1970	0.4019***		0.4019***		0.4019***		0.4019***	
	(0.0027)		(0.0027)		(0.0027)		(0.0027)	
Difference	0.0842***	100	0.0842***	100	0.0842***	100	0.0842***	100
	(0.0033)		(0.0033)		(0.0033)		(0.0033)	
EXPLAINED								
Age	0.00218	2.58	0.00378***	4.48	0.00378***	4.48	0.00637***	7.57
	(0.00034)		(0.00021)		(0.00031)		(0.00024)	
Marital status	0.00857***	10.17	0.01049***	12.45	0.01197***	14.21	0.01219***	14.48
	(0.00157)		(0.00040)		(0.00043)		(0.00040)	
Ethnicity	-0.00060***	-0.71	-0.00054***	-0.64	-0.00079***	-0.94	-0.00068***	-0.81
	(0.00011)		(0.00014)		(0.00012)		(0.00010)	
Extended household	0.00001	-0.01	-0.00010	-0.11	0.00017	0.2	-0.00003	-0.04
	(0.00002)		(0.00003)		(0.00011)		(0.00002)	
Spouse labour force participation	0.00168***	-2.00	-0.00310***	-3.68	-0.00128***	-1.52	-0.00117***	-1.39
	(0.00027)		(0.00024)		(0.00041)		(0.00017)	
Urban	-0.04799***	-56.99	0.00332***	3.94	-0.01341***	-15.93	-0.01285***	-15.26
	(0.00181)		(0.00097)		(0.00104)		(0.00090)	
Education	0.0675***	80.16	0.07769***	92.26	0.06509***	77.3	0.06572***	78.1
	(0.00506)		(0.00273)		(0.00243)		(0.00229)	

(continued)

Table 5.5: (continued)

	(1)		(2)		(3)		(4)	
	At 1970 coefficients	% of gap	At 2000 coefficients	% of gap	Pooled coefficients	% of gap	Reverse order	% of gap
Child less 6 years	0.00679***	8.06	0.01204***	14.29	0.01152***	13.68	0.01022***	12.14
	(0.00095)		(0.00059)		(0.00072)		(0.00047)	
Child 6 years or more	0.00138**	1.64	0.01296***	15.39	0.00964***	11.45	0.00686***	8.15
	(0.00045)		(0.00045)		(0.00034)		(0.00028)	
Total	0.03949	46.9	0.11653	138.3	0.08669	102.9	0.08666	102.9
	(0.00589)							
UNEXPLAINED								
Total	0.04474	53.1	-0.03233	-38.3	-0.00243	-2.9	-0.00243	-2.9
Number of observations	111,407		111,407		111,407		111,407	

Notes: Standard errors are in parentheses. Statistically significantly different from zero at the *0.10 level, **0.05 level and ***0.01 level.

The marital status of women contributes positively to the gap in female labour force participation. There is a rise in the proportion of single women between 1970 and 2000. Single women generally participate more than married women. Other variables including age and type of household exerts a small positive effect.

The urban characteristic puts downward pressure on the change in the female labour force participation rate. The urban variable's contribution to the change in female labour force participation is especially large when estimated using the 1970 coefficients at -56.9%. In the pooled coefficients specification, the negative contribution is smaller at 15.9%. The rate of urbanisation has changed dramatically from 1970 to 2000. By 2000, women living in the urban area are significantly more likely to work. Spouse labour force participation status and ethnicity have very small negative contributions to the gap.

Column (4) reports estimates in which the order of switching distributions of variables is reversed. The estimates are not substantially different from the main estimates. The child characteristic contribution decreased slightly. However, it is still one of the main contributors of the change in the explained components of the gap in female labour force participation. The unexplained part in the analysis represents part that cannot be explained by the differences in the observable characteristics which may include changing behaviour of women in response to observable characteristics, differences in labour market treatment between men and women as well as other demand-side factors.

The results from Fairlie (1999; 2005) decomposition is compared to the estimates from a standard Blinder-Oaxaca (1973) decomposition, shown in Table 5.6, using estimates from a linear probability model. By focusing on the pooled sample estimates in column (3), the result indicates that education and child characteristics contributes mainly to the rise in female labour force participation between 1970 and 2000. The largest difference is for the education contribution. Using Fairlie (1999; 2005) decomposition, education contributes 77.3% to the gap, while the Blinder-Oaxaca decomposition reports a contribution of 133.5%.

Table 5.6: Blinder-Oaxaca decomposition of female labour force participation rate, 1970-2000.

	At 1970 coefficients	% of gap	At 2000 coefficients	% of gap	Pooled coefficients	% of gap
Overall						
Year 2000	0.4861***		0.4861***		0.4861***	
	(0.0018)		(0.0018)		(0.0018)	
Year 1970	0.4019***		0.4019***		0.4019***	
	(0.0027)		(0.0027)		(0.0027)	
Difference	0.0842***	100	0.0842***	100	0.0842***	100
	(0.0033)		(0.0033)		(0.0033)	
EXPLAINED						
Age	-0.00021	-0.25	-0.00263***	-3.12	-0.00183***	-2.17
	(0.00055)		(0.00037)		(0.00031)	
Marital status	0.00605***	7.19	0.00116**	1.37	0.00396***	4.70
	(0.00079)		(0.00050)		(0.00043)	
Ethnicity	-0.00125***	-1.48	-0.00056***	-0.66	-0.00061***	-0.72
	(0.00024)		(0.00014)		(0.00012)	
Extended household	0.00006	0.07	0.00015	0.17	0.00011	0.13
	(0.00006)		(0.00015)		(0.00011)	
Spouse labour force participation	-0.00168***	-2.00	-0.0057***	-6.76	-0.00455***	-5.40
	(0.00027)		(0.00052)		(0.00041)	
Urban	-0.05194***	-61.67	0.00509***	6.03	-0.01428***	-16.96
	(0.00189)		(0.00123)		(0.00104)	
Education	0.04341***	51.56	0.12909***	153.3	0.11241***	133.50
	(0.00576)		(0.00268)		(0.00243)	
Child less than 6 years	0.01475***	17.52	0.02184***	25.93	0.01698***	20.16
	(0.00114)		(0.00088)		(0.00072)	
Child 6 years or more	0.00065**	0.77	0.00554***	6.57	0.00401***	4.76
	(0.00030)		(0.00045)		(0.00034)	
Total	0.00984*	11.7	0.15397***	182.8	0.1162***	138.0
	(0.00589)		(0.0031)		(0.00273)	
UNEXPLAINED						
Total	0.07439***	88.3	-0.06975***	-82.8	-0.03197***	-38.0
	(0.00663)		(0.00426)		(0.00397)	
Number of observations	111,407		111,407		111,407	

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.10 level, **0.05 level and ***0.01 level.

The total contribution of the child characteristics is similar in both analyses. However, the estimate is larger for children below 6 years in the Blinder-Oaxaca decomposition, which contributes 20.16% to the gap. In contrast, the estimates from Fairlie decomposition (1999; 2005) contributes 11.45% to the change.

The marital status contribution is smaller in the Blinder-Oaxaca decomposition at 4.7%, while the Fairlie (1999; 2005) decomposition returns a positive contribution of 14.4%. The contributions of other characteristics are very similar. In total, the change in explained components or characteristics explained 138% of the gap when estimated using the pooled coefficients in the Blinder-Oaxaca decomposition. In Fairlie (1999; 2005) decomposition analysis, the contribution of the explained components is lower at 102.9%. The unexplained component has a negative contribution of 38% in the Blinder-Oaxaca decomposition.

In summary, the gap in female labour force participation between 1970 and 2000 in Peninsular Malaysia is largely attributed to the positive contribution of changes in characteristics when analysed using Fairlie (1999; 2005) decomposition method. The changes in characteristics are explained mostly by the education and fertility variables. Other variables, including marital status and household type also contribute to the positive increase in female labour force participation. The remaining variables analysed which include living strata, spouse labour force participation rate and ethnicity found to reduce the gap in the female labour force participation rate.

5.6 Discussion and conclusions

The female labour force participation rate in Peninsular Malaysia has increased between 1970 and 2000. However, the rate of growth has been modest from the 1980s. Apart from the change in participation behaviour, the descriptive statistics indicate that there are notable changes in the characteristics of the population studied. In general, there is a shift towards higher educational attainment in the sample of women studied. A large proportion of women have attended at least secondary school. During this period, the fertility rate has declined. The proportion of women in the labour force living in urban areas has increased over the decades. All these changes contribute to the increase in female labour force participation. The purpose of this analysis is therefore to determine to what extent is the impact of each contributing factor on the trend in female labour force participation in Peninsular Malaysia between 1970 and 2000.

The estimates from the average marginal effects highlight several changes that affect the trend in female labour force participation between 1970 and 2000. Among the key changes is the lower labour force participation, especially among the younger age group, 20 to 24 years, due to individuals staying longer in school. The time required to achieve higher educational attainment has been found to delay female labour force participation in many countries (Dayioglu & Kirdar 2011; Lee, Jang & Sarkar 2008). In addition, older women in the 50 to 54 age group tend to work less and this can be attributed to early retirement.

In terms of marital status, the female labour force participation among single women in this study has decreased relative to married women between 1970 and 2000. While in general being married reduces labour force participation (Euwals, Knoef & Van Vuuren 2011; Lee, Jang & Sarkar 2008), the results also imply that the gap of work participation between never-married and married women has decreased over time, suggesting that the role of married women is no longer confined to the household. Living arrangements also affect female labour force participation, in that females living in extended households tend to participate more than females living in non-extended households. This finding is consistent with Kolodinsky and Shirey (2000), Ogawa and Ermisch (1996) and Shen, Zhang and Yan (2012) suggesting that in Peninsular Malaysia, co-residence increases female labour force participation.

A decomposition analysis is performed to gain more insight into the relative contribution of the changes in characteristics or the explained components on the female labour force participation rate. The results estimated using Fairlie (1999; 2005) decomposition suggest that the change in education explains most of the rise in female labour force participation between 1970 and 2000. Women in 2000 are more likely to have at least secondary level education than they were in 1970. Given that more education increases the returns to labour supply, the increase in education raises the probability of being in the labour force. This is intuitive and consistent with the human capital theory. Data from the Malaysian Income and Household Survey 1997 indicate that there are high and positive private returns to education in Malaysia, especially at the higher education level. For example, by moving from the upper secondary to the pre-university level, females receive an annual marginal gross

return of 23.3% (Chung 2003). Nevertheless, while educational attainment of females has generally increased over the decades, the pull of education might have been weaker implying that the probability of work participation for females with more education has decreased over the decades. This phenomenon is reported in Hotchkiss (2006) and Klasen and Pieters (2015). According to Hotchkiss (2006, p.13), the possibility of positive assortative mating, where highly educated women are more likely to marry highly educated men, results in a decline in female labour force participation as a result of the availability of non-labour income especially in the case where the husbands have high earning power. This potentially explains the case of the women in Peninsular Malaysia, where the rate of female labour force participation declines albeit higher educational attainment between 1970 and 2000.

Men in general continue to have a high participation rate regardless of their level of education as they are traditionally regarded the breadwinners for their families (Yahaya 2009). In the meantime, the findings in this study indicate that the participation rate for women is higher among more educated women. Increased opportunities in education have eroded the perception of women as homemakers and secondary earners; more educated women, especially those with at least a secondary level of education, are more likely to work. In contrast, women with no schooling tend to work less. This could be due to a lower market demand for women without education. Women with limited education face limited job opportunities and lower wage rates. The marginal gain from staying at home therefore potentially outweigh the gains of working in the labour market. As discussed in the theoretical model in Chapter 3, the reservation wage for women with limited education is lower than their educated counterparts.

Women with lower education levels may also find that the opportunity cost of staying at home is lower as compared to women with higher education. The impact is not necessarily negative when women do not work. There can be indirect impacts to the economy. Women not in the labour force still engage in household production, including child caring activities, which are not accounted for in the national income accounting. However, studies indicate that children of educated mothers are advantaged. For example, better maternal education improves infant health by

reducing the probability of smoking, one of the causes of low birth weights (Currie & Moretti 2003; Lightwood, Phibbs & Glantz 1999). Maternal education could also increase a mother's preference towards furthering her children's education (Andrabi, Das & Khwaja 2012) and therefore children of more educated mothers stay longer in school. Thus, although women do not work, the acquisition of greater levels of education is still an important priority to the Malaysian Government. In the process of becoming an advanced economy, Malaysia continues to invest in knowledgeable and skilled workers.

The estimates in the coefficient analysis show that the contribution of female participation among women whose husbands are working is significantly low. The access to non-labour income in the form of husbands' income reduces the probability labour force participation for women. The average marginal effect of spouse labour force participation on female labour force participation is positive in 1970 but not in the other years studied. This leads to the conclusion that there is household specialisation in the Malaysian family. In a traditional Malaysian family, women have a greater share of domestic activities, while men spend limited time on household chores.

The characteristics that have traditionally pushed women out of the labour market, such as the number of children, contribute to the rise in the female labour force participation rate. The change for the category of children below 6 years is larger than the change for children aged 6 years or more. The presence of younger children intuitively leads women to work less. In the case of Malaysia, the presence of younger children in the family decreases labour force participation. A woman might choose to stay at home as childcare costs can be high. This is especially true for women with lower education where the opportunity cost of work is low. On the other hand, a more highly educated woman is more likely to be able to afford childcare or domestic helpers in the household, allowing her to participate in the labour market.

In Malaysia, there is no re-entry mechanism for women who have left the labour market during their childbearing years. There are limited part-time or casual job opportunities. Once women leave the labour market in the childbearing and child-

rearing stage, the probability of returning to work when children are older is low. In general, the negative effect of fertility on female labour force participation rate has increased over time as evidenced in the marginal effects estimates. The estimates range between -0.081 to -0.156 for the various child categories examined. While a similar negative effect is also found in India for children aged 0 to 4, the estimate is considerably smaller at -0.039 in 2011 (Klasen & Pieters 2015). In Africa, the marginal effect of fertility is also small at -0.03 in 2004 for children under 7 years (Ntuli & Wittenberg 2013).

The average marginal effect indicates that non-Bumiputera women participate significantly more than Bumiputera women between 1970 and 2000. The expansion of education access in the 1960s increased schooling, especially for Bumiputera women. Their representation in both the tertiary institutions and upper-level occupations increased in the period of the NEP. However, beyond 1990s, the Bumiputera experienced greater difficulties in entering the labour market which could probably be attributed to greater competition among new graduates and the representation in upper-level occupations depends heavily on the public sector (Lee 2012).

In general, this chapter provide insights into the correlates of female labour force participation and the changing contributions of the observed characteristics to the trend in female labour force participation rate. However, Fortin, Lemieux and Firpo (2011, p. 2) emphasise that, although decompositions are useful for quantifying the contribution of various factors to a difference or change in outcomes in an accounting sense, it cannot identify the change in an economic sense inter alia the causal effect of the correlates and outcomes of interest. Nevertheless, the decomposition analysis indicates which factors are quantitatively important and thus provide indications for further exploration.

In this study, the findings indicate that the key determinants affecting the change in female labour force participation in Peninsular Malaysia between 1970 and 2000 are education and fertility. In terms of education, the average marginal effects indicate that women with tertiary education were more likely to work in the year 2000

relative to women with only primary education, and the effect is higher than relative to women with other education levels. This suggests that the Malaysian Government's investment in education has resulted in the intended outcome to increase female labour force participation. However, the positive effects of higher education could possibly be a result of positive selection effects where women with greater career aspirations select into higher education. The ambiguity in this effect and the potential endogeneity of education therefore entails further investigation on the link between higher education and female labour force participation. Chapter 6 sets out to achieve this.

The discussion above also implies that it has become increasingly difficult to combine work and family. In order to increase female labour force participation, the findings in this study tentatively suggest that there should be greater policy emphasis on childcare and family-friendly policies in general. However, it is also imperative to examine in a more in-depth manner the effect of fertility on female labour force participation to provide a better understanding of the link between these variables. This motivates the analysis undertaken in Chapter 7 which aims to examine the causal effect of fertility on female labour force participation.

Finally, the decomposition analysis indicates that the ethnic variable has only a very small contribution to the change in the female labour force participation rate between 1970 and 2000. These findings are surprising considering that, earlier in Chapter 2, it was observed that there were differences in female labour force participation between the main ethnic groups in Malaysia. However, as the contribution of the ethnic variable is almost negligible, it raises an important question that possibly it is differences in the behaviour of the women of the various ethnic backgrounds to issues like fertility choices and their response to female labour force participation as a result of fertility, that is the question that matters. Chapter 7 will also examine the effect of fertility on female labour force participation according to ethnicity.

CHAPTER 6 HIGHER EDUCATION REFORM AND FEMALE LABOUR FORCE PARTICIPATION

6.1 Introduction

Contemporary higher education has been influenced by two-mega trends, namely massification and globalisation (Schofer & Meyer 2005; Shin & Harman 2009). In Asia, the expansion of higher education has resulted in explosive growth in enrolments in higher education over the last two decades (Asian Development Bank 2012; Zusman 2005). In 1996, Malaysia implemented a huge higher education reform with the introduction of the Private Higher Education Institutions Act of 1996 which allows the establishment of private higher education institutions. The reform was driven by the ever-growing demand for public higher education in Malaysia that exerts pressure on the public institutions that operate within the constraints of limited allocations from the Government (Morshidi 2006). The reform strengthened the role of private institutions as higher education providers in Malaysia. Furthermore, the reform provides an opportunity to estimate the causal effect of higher education reform on female labour force participation.

The empirical results in Chapter 5 indicate that education has a positive impact on female labour force participation in Malaysia. The relationship between education and female labour force participation is widely documented. However, the results cannot be interpreted as causal because education and labour force participation decisions can be jointly determined. Students who are more talented and have higher career aspirations usually seek more education. This selection creates biases in the OLS estimates of the effect of education. Omitted variables that are correlated to both education and female labour force participation may cause further biases in the estimates. One potential omitted factor is the number of education providers or institutions. The availability of more education institutions increases the opportunities for students to pursue higher education.

Recently, several studies that examined the impact of higher education reform on various labour market outcomes with quasi-experimental identification strategies have emerged (Boccanfuso, Larouche & Trandafir 2015; Li & Xing 2010; Li,

Whalley & Xing 2014). These studies scrutinise the impact of education on the employment and unemployment of university graduates. Due to data limitations, these studies examined the impact of education on labour market outcomes only in the short-term. In the short term, some individuals may pursue a graduate degree while others may go to primary school at an older age and therefore still be in school, and yet others may be repeating schooling (Li & Xing 2010). This thesis therefore contributes to the existing literature in this field by providing evidence of higher education reform on labour force participation in the longer term. Additionally, the focus of this study is on female labour force participation because to date the evidence of the impact of higher education reform on female labour force participation is limited. As Verick (2014) argues, having education beyond the lower secondary level is important to improve employment outcomes for women in developing countries. Due to the fact that male labour force participation rates are historically higher than female labour force participation in most countries, the analysis on female labour force participation is of interest especially in the context of Malaysia where the percentage of enrolment in higher education institutions for female students has surpassed that of male students in recent years. International comparison, especially in the ASEAN regions, suggests that there is scope for Malaysia to increase its female labour force participation rate.

This chapter seeks to analyse the causal impact of tertiary education on female labour force participation by exploiting a reform in the Malaysian higher education system. Specifically, the analysis in this chapter aims to address three questions:
(1) To what extent does higher education reform affect the educational attainment of individuals?
(2) What is the impact of the higher education reform on female labour force participation in Malaysia?
(3) Using the education reform as an instrument, what is the causal effect of higher education on female labour force participation in Malaysia?

An increase in educational attainment is predicted to cause an increase in female labour force participation. The analysis will provide an insight into whether females

with tertiary education have a higher probability of participation in the labour market post-reform.

The implementation of the Private Higher Educational Institutions Act 1996, increases the opportunities for students to pursue tertiary education. This chapter uses the 1996 higher education reform in Malaysia as a source of exogenous variation in educational attainment in a difference-in-differences (DID) framework to analyse the impact of the reform on education and labour market outcomes. The strategy is to compare the impact of the higher education reform on younger individuals who were affected by the reform to those not affected by the reform by using a sample of females aged 25 to 39 from the 2010 Malaysia Housing and Population Census. To control for age difference in the labour force participation rate, a sample of females from the same age group is taken from the 2000 census in which no individuals were affected by the expansion policy. An advantage of using the 2010 census data is that long-term outcomes in the labour force can be examined. The results suggest that the 1996 education reform has a positive impact on the tertiary education of individuals. The education reform can therefore be used as an instrument for educational attainment to identify the effect of education on female labour force participation outcome. The estimates from the 2SLS analysis indicate that education has a large and positive effect on female labour force participation.

The remainder of this chapter is organised follows. Section 6.2 provides the institutional background of the reform and its context. Section 6.3 describes the data used in the analysis and provides a summary of the characteristics of the sample. Section 6.4 discusses the empirical strategy employed in the analysis which includes DID and instrumental variables analysis. Section 6.5 presents the empirical results. Section 6.6 discusses the findings and concludes.

6.2 Institutional background

Investment in education has been one of the primary focuses of human capital development in many developing countries including Malaysia. In 1991, the Malaysian Prime Minister announced the country's 'Vision 2020' framework to become a fully modern industrialised country by the year 2020. The process of transforming the country into a knowledge-based economy requires the development

of the country's human and intellectual capital. Ever since, the potential economic benefits of higher education have been the subject of increasing policy interest.

The formal education system in Malaysia consists of three levels, namely primary, secondary and tertiary levels. Tertiary or higher education is provided through both public and private higher education institutions. Higher education institutions offer programmes leading to the awards of certificates, diplomas, degrees and postgraduate qualifications. In the mid-1990s, the Government enacted several education-related acts which spurred the reform of higher education in Malaysia. These include The Education Act 1996 (Act 550), The Private Higher Educational Institutions Act 1996 (amended 2009), The National Council of Higher Education Act 1996, The National Accreditation Board Act 1996 (later repealed and replaced by The Malaysian Qualifications Agency Act 2007), The Universities and University Colleges (Amendment) Act 1996 (amended 2009) and The National Higher Education Fund Corporation Act 1997 (amended 2000) (Ministry of Education Malaysia 2001). This legislation laid the foundation to expand access to education, control public expenditure and regulate the quality of higher education in order to transform Malaysia into a regional hub for higher education (Morshidi 2006; Sivalingam 2006).

The higher education reform in Malaysia cannot be discussed without considering the political and economic landscape in the country since independence. The growth of institutions of higher education in Malaysia between 1957 and 1990 was slow due to budgetary constraints and the idea that then suggested returns to higher education were much lower than returns to primary schooling resulting in a disproportionately large proportion of the public budget was spent on primary schooling (Sivalingam 2006; World Bank 2000). The excess demand for higher education was supplied by overseas institutions of higher learning. Many of these Malaysian students completed their higher education in the US, Great Britain and Australia, financed by Government scholarships and private sources. The high cost of overseas higher education would later increase concerns on currency outflow (to overseas education) in the early 1990s (Sivalingam 2006).

The introduction of the NEP in 1970 highlighted the importance of education as a determinant of the country's future socio-economic position. In the process of social re-engineering and economic restructuring, an ethnic quota system was introduced to public higher education institutions in 1971, and by 1979, the quotas were set at 55% for Bumiputeras, 35% for Chinese and 10% for Indians and other ethnic groups (Boo 1998, p. 58). This saw a dramatic rise in the proportion of Bumiputera students studying at the higher education level from 53.7% in 1970 to 65.3% in 1988, while the proportion of non-Bumiputera students declined from 46.3% to 34.7% in the same period (Aihara 2009). However, the more affluent non-Bumiputera households tend to send their children to higher institutions overseas (Selvaratnam 1988) such that, throughout the 1980s, non-Bumiputera students represented more than half of the Malaysian students studying overseas (Aihara 2009). In 1981, when Mahathir Mohamad took office as the country's premier, the higher education focus shifted to human resource development for growth for the whole country rather than the more specific inter-ethnic concerns. At the same time, the heightened aspirations of the middle class non-Bumiputeras for higher education and their frustration over the NEP (Aihara 2009), as well as the ongoing debate between the multi-ethnic leadership of the coalition party in power on ethnic quotas, eventually led to the liberalisation and privatisation of the education sector (Sivalingam 2006).

Sivalingam (2006, p. 2) highlights several factors that fuelled the change of policy including:

> the ascendancy of the Reagan-Thatcher doctrine in the early 1980s; the external shock to the Malaysian economy in 1985-1986; the growth of multinational enterprises that created a demand for university graduates; the Vision 2020 Policy; and the liberalising effects of World Trade Organization agreements on the Malaysian economy after 1995. These external forces encouraged the need for reform, especially the introduction of the Private Higher Educational Institutions Act in 1996, which provided the legal and regulatory framework for the privatisation of higher education in Malaysia.

After the East Asian financial crisis in 1997, the sharp devaluation of the Malaysian Ringgit increased the cost of foreign education. This accelerated the growth of the domestic education sector. Furthermore, after the 1997 crisis, Malaysia was losing its

comparative advantage in the production of labour-intensive goods and instead started to focus on producing more technology-intensive goods. The expansion of the higher education sector became crucial in the creation of a knowledge economy to support the production of these technology-intensive goods (Sivalingam 2006).

Before the 1990s, the number of private tertiary institutions was limited. The introduction of the Private Higher Educational Institutions Act in 1996 allowed the establishment of branches of foreign universities and the formation of local private universities and university colleges. The number of private educational institutions increased from 156 in 1992 to 352 in 1996, including 12 private universities and international branch campus (Ministry of Education Malaysia 2001, p. 4-12). The total enrolments in both public and private higher education institutions have increased dramatically as shown in Table 6.1. The percentage of individuals aged 20 years and over with post-secondary education or higher increased from 8.9% in 1991 to 16% in 2000 (DOSM 2002).

Table 6.1: Total enrolments in higher education institutions in Malaysia 1990 to 2005.

	1985^	1990^	1995^	2000	2005
Public	86,330	122,340	189,020	321,729	526,679
Private	15,000	35,600	127,595	261,047	341,310
Total	101,330	157,940	316,615	582,776	867,989

Source: ^Wan (2007, p.47), Economic Planning Unit (2001, p.88).

The public higher education institutions which operated through the ethnic quota system facilitated the entry of more Bumiputera students into public higher education institutions. The quota system was later replaced by the meritocracy system in 2002. During the NEP period, the enrolment rate of Malay students was equal to or higher than that of Chinese and Indian students. However, the enrolment rate of Chinese and Indian students increased considerably during the post-NEP period. Although Aihara (2009) shows that Bumiputera students tend to enrol more in public institutions while the non-Bumiputeras are more often in private institutions, the higher education reform increased educational attainment for both groups after the reform. The lack of Bumiputera enrolment in private higher education institutions is intensified because most private institutions are located within major cities thus limiting the access of

Bumiputera students from the rural areas (Baba, 2004). Using data from the 2000 census, Aihara (2009, p. 100) finds that the establishment of private higher education institutions benefited those in more developed regions more than those from less developed regions. The effect of the 1996 education reform is analysed in subsequent sections.

6.2.1 Defining control groups

The 1996 higher education reform increased opportunities for students to pursue education at the tertiary level with the establishment of more public and private tertiary institutions. In order to analyse the impact of the higher education reform, age at enrolment at higher education institutions is an important indicator of whether individuals were affected by the reform or not. However, there is no information in the dataset used in this study on the exact age of individuals when they enrolled in higher education institutions. Therefore, the age of individuals based on the most common education pathway in Malaysia will be used as a proxy to indicate whether the education reform affected an individual.

The age cohorts of higher education in Malaysia are individuals aged between 17 and 23 years (Ministry of Education Malaysia 2001). In general, individuals who complete secondary school can pursue tertiary education through various pathways. Depending on the pathway that an individual follows after secondary education, the age of enrolment at the tertiary education level can differ. As shown in Figure 6.1, the average age for enrolment in a degree program is 20 years. Students who have completed upper secondary school can opt to pursue one to two years of post-secondary education including Form 6, A-Level or other university preparatory courses. Upon completion of post-secondary education, students can enrol in tertiary education leading to the award of certificates, diplomas, first degrees or higher degree qualifications. Bumiputera students can opt to enrol in matriculation courses before pursuing a Bachelor's degree. The duration of matriculation courses varies between one to two years. Students who complete matriculation courses therefore often enrol in degree programs at an average age of 19 or 20.

Figure 6.1: Education system in Malaysia.

Age	Years of education	Types of education
28	22	Tertiary education: Advanced diploma, Masters,
27	21	PhD
26	20	
25	19	
24	18	
23	17	Tertiary education: Certificate, Diploma, Degree
22	16	
21	15	
20	14	
19	13	Pre-university education: Form 6, GCE 'A' Level,
18	12	Matriculation, College
17	11	Upper secondary school
16	10	
15	9	Lower secondary school
14	8	
13	7	
12	6	Primary school
11	5	
10	4	
9	3	
8	2	
7	1	
6		Kindergarten/ pre-school
5		
4		
3		
2		
1		

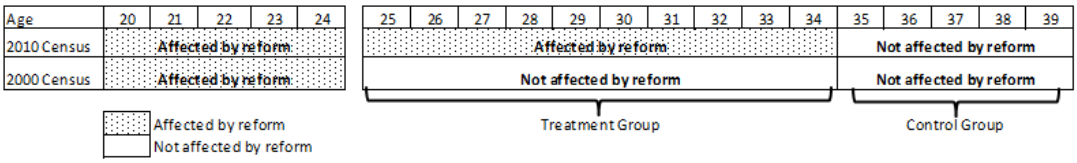
Source: Modified from Mohamad Najib (2004).

For this study, it is assumed that an individual who was 20 years on average would be ready to enrol in tertiary education. In 1996, individuals who were 20 or younger could benefit from the education reform. In the language of the DID framework, members of the treatment group in this study can be defined as the individuals affected by the higher education reform. The treatment group received treatment after the education reform period and was not affected prior to the reform period. On the other hand, individuals who were older than 20 would not have been affected by the reform. This group forms the control group. The control group does not receive treatment before or after the reform.

In order to conform to the experimental design proposed for this study, the sample in this study is pooled from repeated cross-sections of individual data from the 2000 and 2010 censuses. Based on Figure 6.2, in the 2000 census, individuals born in 1976

or later were 24 years old or younger. These cohorts were affected by the reform. Individuals older than 25 years were assumed to be unaffected by the reform. In the 2010 census, individuals born in 1976 or later were 34 years or younger. This group was affected by the reform. Individuals aged 35 years or more were not affected by the reform.

Figure 6.2: Age by census year and status of treatment.



Source: Author's own work.

For the purpose of this study, the treatment and control groups are defined using observations from both the 2000 and 2010 censuses by restricting the sample to females aged 25 to 39 years. By restricting the minimum age of the sample to 25, following Tsai et al. (2009), possible contamination from those receiving higher education (at the census date) can be avoided. By restricting the age to 39 years, similar to Boccanfuso, Larouche and Trandafir (2015), the sample yields a more comparable cohort of young workers.

In the year 2000, the individuals in the sample were assumed to have completed tertiary education before the 1996 education reform. As shown in Figure 6.2, no individuals between 25 and 39 years in the 2000 census were affected by the reform. For the discussion in the subsequent section, the year 2000 is denoted period 0. In the 2010 census, individuals between 25 and 34 years were affected by the reform or received treatment. The year 2010 is denoted period 1, where some individuals completed tertiary education after the 1996 reform. This group forms the treatment group. Only observations from the treatment group in period 1 are treated. Individuals aged 35 to 39 years of age who were not affected by the education reform in either census year formed the control group. In 2010, the affected cohorts were aged 25 to 34 years, allowing the estimation of the impact of education in the long term where the older individuals in the group would have been in the labour market for several years.

The attainment of higher education is hypothesised to increase female labour force participation. In order to compare the participation rate of individuals affected by the education reform to those not affected by the reform, the sample selection in this study follows Li, Whalley and Xing (2014). Li, Whalley and Xing (2014) use data from the 2000 and 2005 censuses and compared the unemployment rate of young college graduates between 22 and 35 years. They argue that a simple comparison of individuals who were affected or not affected by the reform using data drawn from one survey year would not be accurate due to the age difference in the unemployment rate. Thus, in this chapter, the outcome of interest for individuals between 25 and 39 years from the 2010 census is compared with individuals of the same age group from the 2000 census. By comparing individuals of the same age in two different periods, the effect according to age differences can be controlled.

The samples in this study are drawn from the 2000 and 2010 censuses. Females aged 25 to 34 form the treatment group while those aged 35 to 39 form the control group. Due to the age difference in female labour force participation rates, the impact of the education reform cannot be determined simply by comparing individuals from the 2010 census who were or were not affected by the reform. Younger women exhibit different participation behaviour to older women. Thus, individuals from the 2000 census were used to control for age differences in female labour force participation rates. The treatment group receives treatment in period 1 (year 2010) and no treatment in period 0 (year 2000). The control group receives no treatment in either period.

Although tertiary education qualifications can be obtained through direct entry after post-secondary education, the estimates are subject to a caveat, as tertiary education can also be obtained through adult learning education. The data from the censuses do not allow different education pathways to be distinguished. While some universities have offered distance learning since the 1970s, it was only in 1994 that the Malaysian Government announced that all public institutions should offer such programs. More recently, between 2001 and 2005, the Government set up a consortium of eleven Malaysian public universities to offer distance learning courses through Open University Malaysia (EPU 2001, p.93). There is a small possibility

that the sample from the 2000 census would thus be contaminated. The level of contamination in the 2010 census might be even higher. However, due to the relatively small number of individuals who obtain tertiary education through adult learning as compared to direct entry after secondary school, the difference is not expected to have a large effect on the final estimates.

6.3 Source of data

The primary source of data used in this study is pooled from the 2% sample from the 2000 and 2010 Population and Housing Census of Malaysia administered by the Department of Statistics Malaysia. The data for 2000 was obtained from IPUMS-International while the data for 2010 was provided by the Department of Statistics Malaysia. The focus of this study is females between the ages of 25 and 39 in each dataset. By setting the minimum age of the sample to be 25, following Tsai et al. (2008), possible contamination by those currently receiving higher education can be avoided. By restricting the age to 39 years, similar to Boccanfuso, Larouche & Trandafir (2015), the sample yields a more comparable cohort of young workers. The 2010 census, which was conducted 14 years after the 1996 reform, provides a long enough time frame for analysis where individuals would have completed tertiary education and moved into the prime working age group. The population census contains rich demographic variables at the individual level including age, ethnicity, marital status, state of residence, living strata, educational attainment and labour market status. However, it does not include information on hours of work, wages or income. Due to this limitation, this study only analyses the effects of education on female labour force participation status. The impact on wages is not examined.

The 2000 and 2010 samples consist of 214,786 and 258,765 females of all ages, respectively. The number of observations of females between 25 and 39 is 50,610 and 60,934 for the 2000 and 2010 samples, respectively. The outcomes of interest in this study are the level of educational attainment and labour force participation status. Therefore, observations with missing data on the level of educational attainment and labour force participation status are dropped from the final sample. The final sample consists of 97,976 females. The details of the sample selection process is summarised in Table 6.2.

Table 6.2: Sample selection.

	2000 Census	2010 Census
Total female observations	214,786	258,765
Females aged 25 to 39 years	50,610	60,934
Missing educational attainment data	1,885 (3.72%)	11,670 (19.15%)
Missing labour force participation status	-	714 (1.17%)
Final sample size	48,725	49,251

Source: Malaysian Population and Housing Census Surveys, 2000 and 2010.
Note: Some observations in the 2010 census were missing data on both educational attainment and labour force participation status.

6.3.1 Missing data

One of the limitations in the datasets used in this analysis is the problem of missing data, especially in the 2010 census. Prior to 2010, the census data collection was conducted by face-to-face interviews where enumerators visited and interviewed the population to obtain information. For the 2010 census, self-enumeration was introduced for data collection which consisted of two methods. First, the drop-off and pick-up method where enumerator dropped off the census kit to be completed by the respondent and then later picked it up on a different date. Second, respondents completed the census online using the department's e-Census. The self-enumeration method was limited to big cities and areas which were difficult to access (DOSM 2010). The new self-enumeration method could possibly have led to the increase in missing data in the 2010 census. With face-to-face interviews, the enumerator interviewed the respondents and filled in the questionnaire. Enumerators were trained and therefore were more likely to ensure that all responses were given on the census questionnaire. On the other hand, respondents who self-enumerate might have overlooked or skipped some questions while filling in the census data. Thus, it is reasonable to assume that this leads to ignorable missing data.

The number of observations with missing data is shown in Table 6.2. Some observations have missing data on either the level of educational attainment or labour force participation status. Additionally, some observations have missing data on both variables. Missing data is a frequent occurrence in survey data where respondents may simply fail to respond to the questions (Greene 2008, p.61). For the purpose of this study, observations with missing data will be dropped so that only complete

observations will be analysed. This method has some advantages. It is simple and ensures comparability across observations. However, it reduces the sample size available for regression.

The observations with missing level of educational attainment were categorised in the censuses as unknown/missing. However, for these observations, the respondents have indicated that they 'have ever attended school'. Since there is no other information in the dataset that can be used to provide information for this variable, the observations with missing educational attainment were dropped from the sample. Similarly, observations with missing labour force participation status were also dropped from the sample. In the censuses, this was categorised as 'unknown' labour force status. In the census, individuals not working were asked for the reasons for not working. They were also asked whether they had looked for work during the last 7 days. In both of these questions, individuals who had 'unknown' labour force status also had 'unknown' answers to these additional questions. Therefore, it was not possible to determine the labour force participation status using other questions related to labour market activities.

A possible way to treat missing data on education attainment is to impute the value with the occupation of the individuals. However, the sample consists of individuals in the labour force who were employed and unemployed as well as individuals not in the labour force. There is no information on occupation for individuals who were not employed at the time of the census. Such imputation will create a bias in the sample where only individuals with an occupation can be treated. Therefore, to identify the impact of higher education reform on educational attainment and female labour force participation, only individuals with fully completed information were retained in the sample.

6.3.2 Definition of variables

The definition of the variables used in this study is given in Table 6.3. The female labour force participation variable, *FLFP*, is a dummy variable which is equal to 1 for individuals currently in the labour force and 0 otherwise. The impact of the 1996 higher education reform on educational attainment is examined by looking at the highest level of education obtained by individuals. The education variable,

EDUHIGH, in this analysis is a dummy variable which is equal to 1 for individuals who have graduated with diploma/advanced, diploma/degree/advanced, diploma/post-graduate or certificate/post-graduate degree and 0 otherwise.

The Census asks the state of residence of the individuals. Malaysia consists of 13 states and 3 federal territories. The states are classified into more developed or less developed states according to the composite development index (Malaysia 2001). The index includes indicators such as gross domestic product (GDP), unemployment rate, urbanisation rate, registration of cars and motorcycles per 1,000 population, poverty rate, number of population with supply of piped water, number of population with supply of electricity, infant mortality rate and number of doctor per 10,000 population (Hassan & Tampubolon 2013, p. 77). Based on the index for year 2000, the state of Johore, Perak, Penang, Malacca, Negeri Sembilan, Selangor and Federal Territory Kuala Lumpur is classified as developed states. Meanwhile, Kedah, Kelantan, Pahang, Perlis, Sabah, Sarawak and Terengganu is classified as less developed states (Malaysia 2001, p. 115). This information is used to create the region variable *developed*, which is a dummy variable equal to 1 for developed states 0 otherwise.

The experimental design for this study consists of two groups, one affected by the education reform and the other not affected by the education reform. Table 6.4 presents the mean demographic and economic outcomes of the sample according to exposure to the 1996 higher education reform by census year. In both census years, the treatment groups consist of individuals aged 25 to 34 years, while the control groups consist of individuals aged 35 to 39 years. According to Table 6.4, the characteristics of the female samples in 2000 and 2010 are very similar. However, the ethnic composition changed slightly in the period of 10 years, in particular the proportion of Malay females increased. One other notable change includes a decline in the proportion of married females in 2010 when compared to 2000, suggesting a delay in the age of marriage. In the 2000 census, the proportion of females in the labour force was higher for the treatment group as compared to the control group. The proportion of females with tertiary education was also higher for the treatment group in 2000. On average, the years of schooling are higher for the treatment group in 2000. A similar pattern is observed for 2010.

Table 6.3: Definition of variables.

Variable	Definition
Female labour force participation (FLFP)	Binary variable. 1=if woman is in the labour force at the time of the survey; or 0=not in the labour force
Tertiary education (EDUHIGH)	Binary variable. 1=highest educational attainment is tertiary education; or 0=highest educational attainment is not tertiary education
Age	Continuous variable. Age at the time the survey was conducted.
Age-squared	Continuous variable. Age at the time the survey was conducted – squared.
Married	Binary variable. 1=married; or 0=not married (single, widowed, separated, divorced)
Urban	Binary variable. 1=living in an urban area at the time of the survey; or 0=living in a rural area
Developed	Binary variable. 1=if woman resides in a more developed region (Selangor, Penang, Negeri Sembilan, Malacca, Johore, Perak, Federal Territory of Kuala Lumpur or Federal Territory of Putrajaya); or 0=if woman resides in a less developed region (Kedah, Perlis, Kelantan, Terengganu, Pahang, Sabah, Sarawak or Federal Territory of Labuan)
Malay Bumiputera	Binary variable. 1=Malay; or 0=otherwise
Other Bumiputera	Binary variable. 1=Other Bumiputera; or 0=otherwise
Chinese	Binary variable. 1=Chinese; or 0=otherwise
Indian	Binary variable. 1=Indian; or 0=otherwise
Others	Binary variable. 1=Other ethnicity than listed above; or 0=otherwise

Source: Author's own work.

Table 6.4: Summary statistics of sample.

	2000 Census (without reform)		2010 Census (with reform)	
	Treatment group	Control group	Treatment group	Control group
Age group	25-34	35-39	25-34	35-39
Age	29.36 (2.862)	36.94 (1.423)	29.17 (2.846)	36.95 (1.442)
Married	0.778 (0.416)	0.891 (0.311)	0.693 (0.461)	0.864 (0.343)
Urban	0.717 (0.450)	0.700 (0.458)	0.768 (0.422)	0.737 (0.440)
Rural	0.283 (0.450)	0.300 (0.458)	0.232 (0.422)	0.263 (0.440)
Developed	0.592 (0.491)	0.587 (0.492)	0.633 (0.482)	0.594 (0.491)
Less Developed	0.408 (0.491)	0.413 (0.492)	0.367	0.406
			(0.482)	(0.491)
Malay Bumiputera	0.486 (0.500)	0.483 (0.500)	0.530 (0.499)	0.512 (0.500)
Other Bumiputera	0.108 (0.310)	0.097 (0.296)	0.109 (0.311)	0.117 (0.321)
Chinese	0.237 (0.425)	0.265 (0.442)	0.210 (0.405)	0.223 (0.416)
Indian	0.072 (0.259)	0.084 (0.277)	0.075 (0.263)	0.071 (0.257)
Others	0.097 (0.295)	0.072 (0.258)	0.080 (0.272)	0.077 (0.267)
Tertiary education	0.124 (0.329)	0.079 (0.270)	0.243 (0.429)	0.162 (0.368)
FLFP	0.522 (0.500)	0.444 (0.497)	0.641 (0.480)	0.519 (0.500)
Number of observations	33,073	15,652	34,560	14,691

Note: Standard deviations are in parentheses.

6.4 Empirical strategy

This section outlines the empirical strategies used to address the research questions posed at the beginning of this chapter. First, to evaluate the effect of the 1996 education reform on educational attainment and female labour force participation, the DID strategy will be employed. Second, for the effect of the 1996 education reform through the change in educational attainment on female labour force participation, instrumental variables strategy will be used. Both approaches exploit the variation caused by the 1996 higher education reform on the outcome of interest.

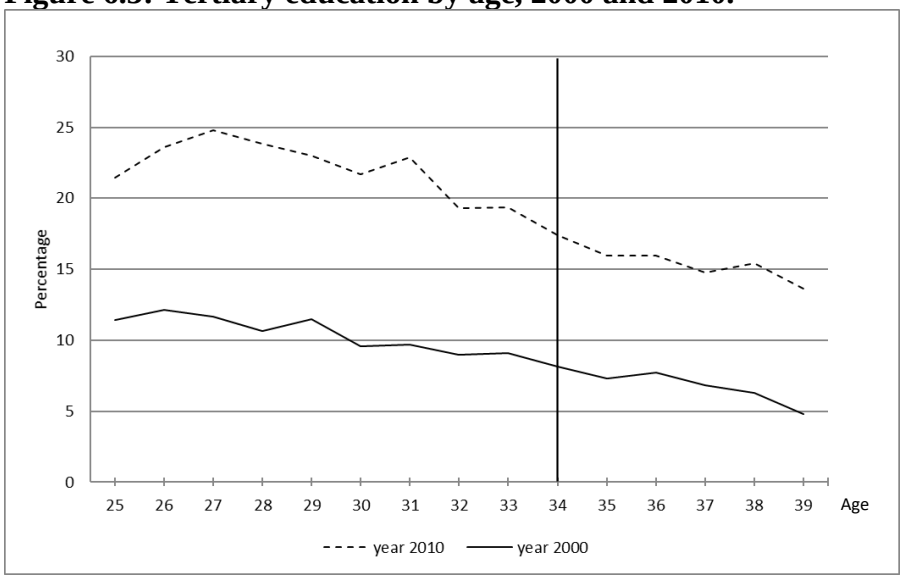
Individuals who have completed secondary school before and after the 1996 education reform have different probabilities of pursuing tertiary education. It is assumed that the reform increased the opportunities for students to pursue tertiary education. According to human capital theory, individuals with more years of

education are more likely to participate in the labour market. However, education and female labour force participation decisions may be jointly determined. The 1996 higher education reform is exogenous to the educational attainment of individuals and the labour force participation decision of any individual, and thus can be treated as a natural experiment to evaluate the impact of the reform on both educational attainment and female labour force participation.

Figure 6.3 shows the proportion of individuals with tertiary education for different ages in both 2000 and 2010. The vertical line represents the boundary between the treatment group and the comparison group. Individuals in 2010 had a higher tertiary education than individuals in 2000. The gap is slightly larger again for the treatment group, aged 25 to 34 years. In Figure 6.4, female labour force participation rate is higher for the younger individuals aged 25 to 34 in 2010, as compared to the older individuals aged 35 to 39 years.

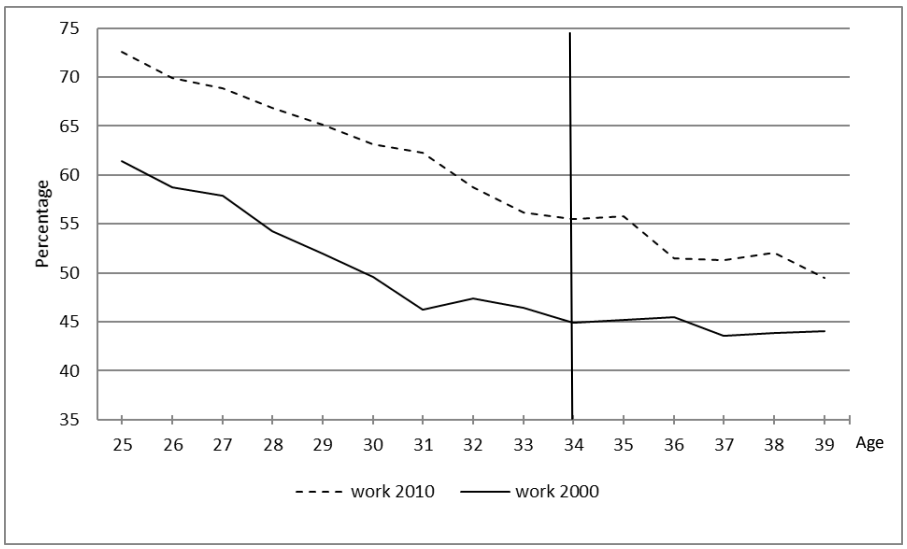
Younger people tend to have a higher labour force participation rate even in the absence of a labour supply shock. Therefore, the age differential in female labour force participation rates cannot be entirely attributed to the education reform. The female labour force participation rate for individuals in 2000 is also shown in Figure 6.4. The majority of these individuals were not affected by the education reform. Therefore, the age differential in the participation rates reflect only behavioural differences associated with age. Overall, the female labour force participation rates for individuals of all ages are higher in 2010 than in 2000. The gap for the treatment group is slightly larger than that of the control group. Therefore, it is possible to use education reform as an instrument for the endogenous education variable. The impact will be examined more formally in the regression models in the next section.

Figure 6.3: Tertiary education by age, 2000 and 2010.



Source: Population and Housing Census of Malaysia, 2000 and 2010.

Figure 6.4: Female labour force participation by age, 2000 and 2010.



Source: Population and Housing Census of Malaysia, 2000 and 2010.

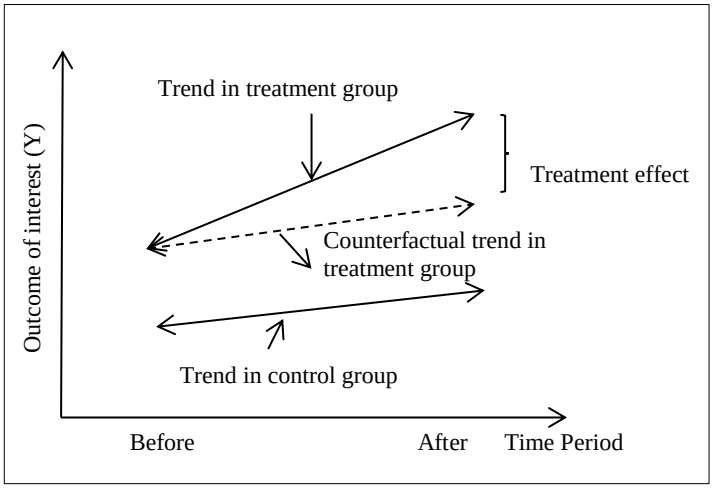
6.4.1 Difference-in-differences identification strategy

The difference-in-differences (DID) framework is used to identify the impact of the 1996 higher education reform on tertiary education and female labour force participation. The outcome of interest will be measured by the level of completed educational attainment and the status of female labour force participation. The point of the DID strategy is to compare the difference in mean outcomes before and after the reform for groups affected by the reform (the treatment group) to groups not affected by the reform (the control group). The crucial assumption for the validity of

the DID strategy is that the trends in the affected versus unaffected cohorts were the same prior to the reform and the only factor influencing the outcome is the intervention, in this case the higher education reform. The DID strategy has been used in many studies to examine the impact of education reform at various educational levels on various economic outcomes including labour force participation, wages and earnings, fertility and infant health (Black, Devereux & Salvanes 2008; Duflo 2001; Osili & Long 2008; Ong 2013).

The outcomes of interest in this chapter are tertiary education and female labour force participation. Assuming an increase in the outcomes of interest after treatment, the DID estimates are depicted in Figure 6.5. The distinctive feature of this policy experiment is the ability to compare individuals working in the same labour market at the same point of time who experienced different tertiary education opportunities. A key assumption can be made where, in the absence of the reform, the changes in the average outcomes between the observations for the treatment group affected by the reform would have been the same as the changes for individuals in the control group. This is a counterfactual trend in the treatment group as shown by the dotted line in Figure 6.5. Treatment therefore induces a deviation from the common trend. Among the affected cohorts, the younger individuals had the highest exposure to the education reform, therefore, it is expected that the effect will be stronger among younger individuals than among older individuals. A sensitivity test can be used to support this assumption which will be shown in the results section.

Figure 6.5: Causal effects in the difference-in-differences model.



Source: Modified from Angrist and Pischke 2009, p.231.

In this study, the individuals who benefited from the 1996 reform cannot be precisely identified from the dataset. There is no information on when individuals enrolled in tertiary education. The exposure of an individual to the reform is therefore determined by the age of an individual at the time of the reform. Referring to the discussion in section 6.2.1, individuals who were 20 years or younger in 1996 (which is individuals born in 1976 or later) were affected by the reform. The samples in this study are drawn from the 2000 and 2010 censuses. Females aged 25 to 34 form the treatment group while those aged 35 to 39 form the control group. It is assumed that no individuals from the 2000 census were affected by the reform. The interactions between the dummy variable for the treated group and the indicator for the 1996 higher education reform as an exogenous variable are used as instruments for female labour force participation decisions.

The variation in the treatment impact of the 1996 education reform on tertiary education and female labour force participation can be generalised to a regression framework and estimated with the following specification:

$$Y_{1ip} = \rho_0 + \rho_1 Treated25\_34_i + \rho_2 Year2010 + \rho_3 (Treated25\_34_i * Year2010) + \delta_1 M_{1ip} + \eta_{1ip} \quad (6.1)$$

where Y_{1ip} is the binary outcome (tertiary education and female labour force participation) for individual *i* and *p* denotes period (binary for years prior to 1996, before the higher education reform, or 1996 and later, after the reform). $Treated25\_34_i$ is a dummy variable for individuals aged 25 to 34. For the 2010 observations $Treated25\_34_i$=1 were affected by the education reform. This is the treatment group. The dummy variable $Year2010$ is a binary variable which equals 1 for observations from the 2010 sample (period 1) or equals 0 for observations from the 2000 sample (period 0). The dummy variable $Year2010$ switches on for observations obtained in the year 2010. The variable $Treated25\_34_i * Year2010$ is the differential effect for the treated group affected by the reform. The coefficient ρ_3 captures the effect of the higher education reform on the outcome of interest examined in the equation. The age difference and time difference are captured by coefficients ρ_1 and ρ_2, respectively whilst ρ_0 is the constant. The term M_{1i} is a vector of socio-economic characteristics including marital status, living strata, state of residence and ethnicity; η_{1ip} is the error term. The reform is not targeted to any

specific demographic group. However, controlling for socio-economic characteristics of individuals can improve the explanatory power of the estimation.

The exposure of individuals cannot be precisely determined. Therefore, age is used as a proxy for exposure to the reform. The treatment group is defined according to specified age groups. In the absence of perfect compliance, the DID estimates identify the intention-to-treat effect. As discussed by Boccanfuso, Larouche and Trandafir (2015), this can create two potential problems. First, it is possible that the differential of the outcome of interest between the treated and control groups is due to age effects correlated with employment probability and age of individuals. In Boccanfuso, Larouche and Trandafir (2015) the authors used a triple-differences model by using individuals with secondary education with the same age groups as additional control groups to address this problem. In this chapter, the effect of education on labour force participation outcome according to age differences is addressed by comparing individuals of the same age using observations drawn from two different census years, following Li, Whalley and Xing (2014). Second, the imperfect identification of individuals exposed to the reform can underestimate the absolute value of the true effect and the estimates can be biased. This problem is potentially related to the analysis in this chapter. Due to the limitations in perfect identification of individuals affected by the reform, the estimated coefficients will be underestimated.

The DID method relies on the assumption that the treatment and control groups followed a common trend over time before the reform. This assumption can be tested using a placebo experiment using a pre-reform period of the data. As a robustness check, a placebo reform is conducted for older individuals aged 40 to 49 years from both the 2000 and 2010 censuses where the individuals in both censuses were not affected by the higher education reform.

6.4.2 Instrumental variables analysis

As discussed earlier in the literature review, education is endogenous and jointly determined with labour force participation decisions. If education is positively linked to female labour force participation, education reforms should increase female labour

force participation holding other variables constant. However, other unobservable factors may affect both education and female labour force participation decisions.

Education may serve as a proxy for unobservable factors such as ability, cognitive skills and motivation which may determine women's labour force participation choices. Ignoring these factors would lead to a bias in the OLS estimates. The DID strategy in section 6.4.1 above isolates the causal impact of education on female labour force participation by including a control group. The instrumental variables approach provides an additional option to examine the impact of education on female labour force participation.

The source of exogenous variation in female educational attainment is the 1996 higher education reform where individuals born in 1976 or later were assumed to be affected and so had greater access to tertiary education. The key measure of the reform can therefore be determined based on the age of individuals at the time of the reform. The identification strategy rests on the assumption that the reform affects female labour force participation only through educational attainment.

A 2SLS model can be used to examine the causal effect of tertiary education on female labour force participation. The empirical model is estimated using the following equations:

$$FLFP_{1i} = \rho_4 + \rho_5 EDUHIGH_i + \rho_6 Treat25\_34_i + \rho_7 Year2010_i + \delta_2 M_{2i} + \eta_{2i} \quad (6.2)$$

where $FLFP_{1i}$ is a binary measure of female labour force participation of women i, the endogenous educational attainment is given by $EDUHIGH_i$ and η_{2i} is the residual. The vector M_{2i} is a vector of exogenous variables including marital status, living strata, region of residence and ethnicity.

The OLS estimates of equation 6.2 may lead to biased estimates if there is a correlation between $EDUHIGH_i$ and η_{2i}. However, under the assumptions that the differences in female labour force participation across individuals would not have been systematically correlated with the reform in the absence of the reform, and that the reform has no direct impact on female labour force participation other than by

increasing educational attainment, the interactions between the treatment group affected by the reform and the year 2010 variable (where individuals born in 1976 or later were affected by the reform) can be used as instruments in equation 6.2 to examine the impact of higher educational attainment on female labour force participation.

The strength of the instruments can be tested using equation (6.1) in section 6.4.1 which identifies the impact of the higher education reform on educational attainment. Equation (6.1) can be used to represent the first-stage equation of the 2SLS estimation of the impact of tertiary education on female labour force participation. The results are presented in section 6.5.

6.5 Empirical results

This section reports and discusses the results obtained from the DID and instrumental variable analyses using the model specifications outlined in section 6.4. The empirical results presented here help to address the research questions posed at the beginning of this chapter:

1. To what extent does the 1996 higher education reform affect the educational attainment of individuals?
2. What is the impact of the 1996 higher education reform on female labour force participation in Malaysia?
3. Using the higher education reform as an instrument, what is the causal effect of higher education on female labour force participation in Malaysia?

6.5.1 Effects of education reform on higher educational attainment and female labour force participation

One of the main goals of the 1996 higher education reform was to increase the supply of tertiary education. This section discusses the impact of the reform on female tertiary education. The results obtained using the DID strategy are presented in columns (1) and (2) of Table 6.5. Additionally, the impact of the 1996 education reform on female labour force participation is also examined. The results are reported in columns (3) and (4).

In column (1), the impact of the 1996 education reform is estimated on female tertiary education without controls. Using the DID strategy, it is shown that the tertiary education of the treated group increased by 3.71 percentage points after the reform. The effect is highly significant. The results in column (2) include controls for demographic backgrounds as well as living strata and the region of residence to eliminate potential bias between the treatment and control groups. The estimated effect drops slightly with controls to 2.73 percentage points but remains significant. Except for the Treat25_34 variable, all the control variables are significant. The indicator variable for the marital status is negative and significant implying that married women are less likely than currently unmarried women to have higher education. In general, this can be for to two main reasons. First, more educated women tend to delay marriage. Second, early marriage can either force women to discontinue their education or be an indication of lower educational aspirations. However, from 1980 to 2010, the singulate mean age at first marriage for females in Malaysia increased from 23.5 to 25.7 years which is partly attributed to the increase in educational attainment (Saw 2015). Therefore, the former issue, causing women to discontinue their education, is more likely in this context.

There is limited evidence on the impact of tertiary education in Malaysia. However, in a recent study, Ong (2013) examines the impact of the NEP in Malaysia on individual tertiary education attainment using data for both men and women (drawn from the 2000 census). The NEP was hypothesised to have increased the tertiary education attainment of the Malays through entry quotas at public institutions. Ong (2013) finds that the Malays and Indians were 1.1 and 1.9 percentage points more likely than the Chinese to obtain tertiary education after the policy implementation. Although the mechanism of the policy and sample is not directly comparable to the analysis in this chapter, the estimates from Ong (2013) provides an approximate idea of the expected change in tertiary education attainment.

In more comparable studies, which use the reform in higher education as exogenous variation for the educational attainment of individuals, Li and Xing (2010) demonstrate that the 1999 higher education expansion in China increased the supply of university graduates. Their models are estimated using a multinomial logit model

where a choice of employment, going to professional college or going to university are given to females who had at least secondary school education. The expansion effect increases the multinomial log-odds of attending university relative to the other two choices by 0.152 (Li & Xing 2010). In another study, the improvement of quality in the universities in Senegal is found to increase commencement of university education (for both males and females). A one unit change in the education reform variable increases the probability of employment by 0.04 percentage points. The effect is small and marginally significant. This is due to capacity constraints in higher education in the short term following the implementation of the reform (Boccanfuso, Larouche & Trandafir 2015). The estimates obtained from this present empirical study cover a period of ten years and therefore provide new evidence of the impact of higher education reform long term.

The results in columns (3) and (4) show the impact of the 1996 higher education reform on female labour force participation. The estimates without controls in column (3) indicate that the 1996 higher education reform increases the female labour force participation rate for the treated group by 4.5 percentage points as compared to the control group. However, the effect is lower when taking into account the control variables where female labour force participation for individuals aged 25 to 34 increases by only 1.9 percentage points compared to individuals aged 35 to 39. Both estimates are highly significant. As a comparison, a one unit change in the education reform variable increased the probability of employment by 0.12 in Senegal (in a sample of males and females aged 20 to 39 years) indicating a strong positive short-term effect on the employment of young workers (Boccanfuso, Larouche & Trandafir 2015).

The DID estimates for both outcomes of interest above can be interpreted as the causal effect of the reform under the assumption that in the absence of the 1996 higher education reform, the outcomes would not have been systematically different for either the treated or the control group. This identification assumption can be tested using a placebo reform to further investigate if the increase in educational attainment and female labour force participation is due to the education reform.

Table 6.5: The effect of the 1996 higher education reform on tertiary education and female labour force participation.

	Dependent variable=Tertiary education (Yes=1 / No=0)		Dependent variable=Female labour force participation (Yes=1 / No=0)	
	(1) No controls	(2) With controls	(3) No controls	(4) With controls
Treat25_34*Year2010	0.0371***	0.0273***	0.0445***	0.0185**
	(0.0047)	(0.0047)	(0.0069)	(0.0065)
Treat25_34	0.0444***	-0.0083	0.0771***	-0.0103
	(0.0028)	(0.0053)	(0.0048)	(0.0079)
Year2010	0.0821***	0.0763***	0.0747***	0.0616***
	(0.0037)	(0.0037)	(0.0057)	(0.0055)
Age		0.0168***		0.0037
		(0.0050)		(0.0069)
Age-squared		-0.0003***		-0.0001
		(0.0001)		(0.0001)
Married		-0.0645***		-0.3758***
		(0.0031)		(0.0032)
Urban		0.0895***		0.0817***
		(0.0024)		(0.0037)
Developed		0.0476***		0.0729***
		(0.0026)		(0.0035)
Malay Bumiputera		0.1243***		-0.0503***
		(0.0033)		(0.0054)
Other Bumiputera		0.0439***		-0.1245***
		(0.0038)		(0.0069)
Chinese		0.0853***		-0.0504***
		(0.0039)		(0.0059)
Indian		0.0373***		-0.0757***
		(0.0050)		(0.0075)
Constant	0.0795***	-0.1880**	0.4445***	0.7926***
	(0.0022)	(0.0747)	(0.0040)	(0.1006)
R-squared	0.0283	0.0696	0.0206	0.1460

Notes: The total number of observations is 97,976. Sample is females aged 25 to 39 years old. The treatment group consists of females aged 25 to 34 years. The control group consists of females aged 35 to 39 years. Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level.

6.5.2 Falsification test

The robustness of the results in section 6.5.1 is verified by estimating a placebo reform based on the specification in equation (6.1) using the DID strategy. The sample selected for the placebo test is females aged between 40 and 49 years from both the 2000 and 2010 censuses. The treated group is women aged 40 to 44 while the control group consists of women aged 45 to 49 years. In the year of the higher education reform (1996), individuals who were 40 in 2000 and 2010 were 36 and 26, respectively. It therefore is assumed that these individuals in both censuses were not

affected by the reform since they should have completed their tertiary education by 1996.

The results from the placebo reform are presented in Table 6.6. The effect of the 1996 higher education reform on female tertiary education is shown in columns (1) and (2). In the model estimated without control in column (1), the tertiary education for the treated group is 0.65 percentage points more than the control group while the results from column (2) estimated with control variables indicate that the tertiary education for the treated group increases by 0.52 percentage points more than the control group. If, before the reform took place for this sample, the estimated effect of tertiary education is large for the control group, the estimated coefficients will be positive and spurious. However, the results in columns (1) and (2) indicate that there is only a small positive impact of the higher education reform and these estimates are not significant. This suggests that the sample is not affected by the reform. Although the sample might be contaminated with individuals who obtained tertiary education at later age, the possibility of this is low and, even if so, would only cause the results to be slightly overestimated.

Next, the results in columns (3) and (4) report the effect of the 1996 education reform on female labour force participation. The model with controls in column (3) indicates that the female labour force participation rate increased by 1.77 percentage points for the treated group as compared to the control group. The estimates with controls in column (4) show a smaller positive effect of 1.28 percentage points. However, unlike the results estimated without controls, this estimate is not significant.

By comparing the effects of the 1996 higher education reform on both tertiary education and female labour force participation from the experiment of interest in section 6.5.1 and the placebo test discussed above, the findings suggest that the rise in tertiary education among females can be attributed to the higher education reform. However, the impact of the higher education reform on female labour force participation should be interpreted with reservation.

Table 6.6: The effect of a placebo reform on tertiary education and female labour force participation.

	Dependent variable=Tertiary education (Yes=1 / No=0)		Dependent variable=Female labour force participation (Yes=1 / No=0)	
	(1) No controls	(2) With controls	(3) No controls	(4) With controls
Treated40_44*Year2010	0.0065	0.0052	0.0177**	0.0128
	(0.0046)	(0.0046)	(0.0088)	(0.0086)
Treated40_44	0.0198***	0.0065	0.0425***	-0.0244**
	(0.0028)	(0.0050)	(0.0063)	(0.0097)
Year2010	0.0461***	0.0436***	0.0428***	0.0389***
	(0.0032)	(0.0031)	(0.0064)	(0.0063)
Age		0.0247*		-0.0147
		(0.0140)		(0.2560)
Age-squared		-0.0003***		0.0000
		(0.0002)		(0.0003)
Married		-0.0063*		-0.3140***
		(0.0036)		(0.0061)
Urban		0.0649***		0.0400***
		(0.0023)		(0.0049)
Developed		0.0234***		0.0400***
		(0.0026)		(0.0049)
Malay Bumiputera		0.0281***		-0.0749***
		(0.0054)		(0.0103)
Other Bumiputera		-0.0109**		-0.0695***
		(0.0055)		(0.0123)
Chinese		0.0004		-0.1030***
		(0.0058)		(0.0108)
Indian		-0.0216**		-0.0646***
		(0.0064)		(0.0126)
Constant	0.0406***	-0.5055	0.3765***	1.3239**
	(0.0019)	(0.3117)	(0.0047)	(0.5671)
R-squared	0.0103	0.0299	0.0054	0.0614

Notes: The total number of observations is 50,333. Sample is females aged 40 to 49 years old. The treatment group consists of females aged 40 to 44 years. The control group consists of females aged 45 to 49 years. Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level.

A caveat to this result is that the use of age as a proxy for exposure to the reform is not a perfect tool to identify individuals who have benefitted from the reform. Therefore, the results in section 6.5.1 is further examined using different definitions of age cohorts. The age of the treated group varied from 25 to 30 to 36 years as

shown in Table 6.7. The effects of the 1996 higher education reform on tertiary education decreases with the size of the treated group indicating that there is an increasing degree of contamination between the treated and the control groups. A wider age group includes both individuals affected by the reform as well as older individuals who might have completed their education before the reform. The preferred treatment group is shown in Panel A.

Table 6.7: The effect of the 1996 higher education reform on tertiary education and female labour force participation using alternative treatment groups.

	Dependent variable=Tertiary education (Yes=1 / No=0)		Dependent variable=Female labour force participation (Yes=1 / No=0)	
	(1)	(2)	(3)	(4)
	No controls	With controls	No controls	With controls
A. Treatment group				
25 to 34 years	0.0371***	0.0273***	0.0445***	0.0185***
	(0.0047)	(0.0047)	(0.0069)	(0.0065)
B. Alternative treatment group				
25 to 36 years	0.0300***	0.2100***	0.0457***	0.0245***
	(0.0054)	(0.0054)	(0.0083)	(0.0079)
25 to 35 years	0.0331***	0.0233***	0.0522***	0.0272***
	(0.0050)	(0.0050)	(0.0074)	(0.0071)
25 to 33 years	0.0392***	0.0303***	0.0395***	0.0155**
	(0.0046)	(0.0046)	(0.0065)	(0.0062)
25 to 32 years	0.0391***	0.0298***	0.0395***	0.0152**
	(0.0046)	(0.0045)	(0.0063)	(0.006)
25 to 31 years	0.0367***	0.0271***	0.0361***	0.0120**
	(0.0047)	(0.0046)	(0.0063)	(0.0059)
25 to 30 years	0.0301***	0.0212***	0.0232***	0.0021
	(0.0048)	(0.0047)	(0.0063)	(0.0059)

Notes: Robust **s**tandard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. Sample is women aged 25 to 39 years old. In the alternative treatment group models, the remaining women from this sample formed the control group.

6.5.3 Two-stage least squares (2SLS) estimates

The OLS and 2SLS estimates of the effects of educational attainment on female labour force participation are presented in Table 6.8. The dependent variable is a dummy variable which is equal to 1 if the female participates in the labour market. The robust standard errors are reported in parentheses. The OLS estimates in column (1) indicate that tertiary education increases female labour force participation by 29.2 percentage points and it is highly significant. This supports the human capital theory, where education is highly correlated with labour force participation decisions.

Table 6.8: The effect of higher education on female labour force participation, OLS and 2SLS estimates.

	Dependent variable: Female labour force participation	
	(1) OLS	(2) 2SLS
Tertiary education	0.2927***	0.6763***
	(0.0036)	(0.2379)
Number of observations	97,976	97,976
F-statistic of excluded instrument	-	34.17

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. Covariates in the models are treatment group dummy, treatment year dummy, age, age-squared, marital status, urban, developed, Malay, Other Bumiputera, Chinese and Indian.

Although the OLS estimates provide a confirmation of the positive association between higher education and female labour force participation in Malaysia, there is a possible bias in the OLS estimates which arises because of potential correlation between unobserved characteristics, educational attainment and female labour force participation. For example, while a highly-educated woman is usually more career oriented and therefore more likely to work, it is also possible that strong preferences for market work may induce women to invest more in education. Thus, the 2SLS estimation is used to identify the causal effect of higher educational attainment on female labour force participation by using the 1996 higher education reform (treatment dummy) as a source of exogenous variation in educational attainment among females. The first-stage results indicate that educational reform increases tertiary education for females by 2.73 percentage points, when estimated in a model with controls (in Table 6.5, column 2). The F-statistic for the instrument in the first-stage is 34.17 (more than 10) suggesting that the instrument is not weak (Stock & Yogo 2010). In column (2), the coefficient from 2SLS estimate indicates that the effect of higher educational attainment on female labour force participation is 0.676. The estimate is highly significant. This implies that higher educational attainment leads women to work more, on average, by approximately 67.6 percentage points.

The coefficients obtained in this analysis are compared against estimates in recent studies that examined the effect of tertiary education on female labour force participation (Birch 2005; Ismail & Sulaiman 2014; Faridi, Malik & Basit 2009; Nawata & Ii 2004). Although the estimates differ in magnitude, the positive sign of

the estimate is consistent with several other studies. In particular, Ismail & Sulaiman (2014) survey 3,520 females in Peninsular Malaysia using a logistic regression model and found that married women with tertiary education are 64.4 percentage points more likely to work outside the home than women with primary education. In a less developed country, the effect of higher education on female labour force participation was also high. Faridi et al. (2009) find that females who graduated with a first degree in Pakistan are 43.9 percentage points more likely to be in the labour force while those with graduate educations are 60.4 percentage points more likely to participate in the labour market. The results were estimated using a binomial logit model with a sample of 164 females with data collected from field surveys.

In contrast, a comprehensive study of the determinants of female labour force participation in Australia by Birch (2005) indicates that the marginal effect on the probability of female labour force participation for women who possessed tertiary education is 21 percentage points more than individuals who have no tertiary education. However, the result obtained in this present study contrasts with the findings for South Korean women where highly educated mothers tend to work less despite the fact that their higher education provides better labour market opportunities (Cho & Lee 2015). More educated mothers tended to work 20.3% less than mothers with incomplete high school educations, especially when they had children in high school, as these mothers are more focused on helping their teenage children to prepare for college entrance examinations. These studies, however, did not account the endogeneity problem. In a recent study, Boccanfuso, Larouche and Trandafir (2015) estimate the causal effect of higher education on female labour force participation and finds that higher education reform in Senegal increases employment of young workers by 6.9 to 12.9 percentage points. Apart from this, limited studies are available for comparison.

The large disparity between the OLS and 2SLS coefficients found in this chapter raises concern. The 2SLS estimates could be larger than the OLS estimates because the 2SLS is estimating the local average treatment effect. On the other hand, the OLS is estimating the average treatment effect over the entire population. It is possible that the instrument shifts the behaviour of a subgroup of individuals whose

female labour force participation status is larger than average. This results in the 2SLS estimates being larger than the OLS estimates due to the heterogeneity in the population studied. There is a possibility that the effect of the education reform is confounded by cohort effects as the treatment and control group is defined based on an individual's birth.

One possible solution to this issue is to examine the difference in program exposure by region or the intensity of the program similar to Duflo (2001) and Osili and Long (2008). In Indonesia, the school construction program varied by region of birth and date of birth (Duflo 2001). The variation in program intensity is due to the allocation of more schools to regions where initial enrolment was low. The results indicate that the average educational attainment has increased over time as a result of the policy reform, especially in regions that received more schools (Duflo 2001, p. 798). Osili and Long (2008, p. 60) examine the variation in a primary school reform in Nigeria on years of schooling. The intensity of the program varied according to the levels of federal capital funds received. Similar to Duflo (2001) high-intensity states are states that had relatively lower primary school enrolment rates prior to the reform. The results indicate that the reform results in a significant increase in years of schooling for individuals in high-intensity states and affected by the reform (Osili and Long 2008, p. 67). Both studies captured the variation in program intensity according to the level of education resources allocated to regions or states with lower educational attainment prior to the reform.

Assuming that there is plausibly exogenous variation in program intensity across states in the case of this present study, the impacts on the treatment and control groups as a result of the reform can be identified. However, there is limited data on program intensity such as fund disbursement and resource allocation among private higher education providers in Malaysia. When such data is available in the future, it may be worthwhile to examine the impact of the higher education reform using the approach similar to Duflo (2001) and Osili and Long (2008).

In general, it can be concluded that the availability of more higher education institutions is expected to increase the opportunity to obtain tertiary education for an

individual. However, it is also common in Malaysia for students to temporarily move from one state to another for education purposes. The census contains migration information where a woman is asked for the place of their residence five years ago. A total of 85.68% of the sample of women is reported to live in the same states at the census date compared to last five years, including women who moved from one locality to another in the same district (in the same state). Although this information can be potentially used to identify the state where women receive higher education, there is potential limitation as the information can only be used to identify the state of education for younger women. This limitation can be addressed when a detailed data on individuals' education background including where they obtain higher education is available in the future.

6.6 Discussion and conclusion

This chapter examines the effect of the 1996 higher education reform on tertiary education and female labour force participation in Malaysia by using data from the Population and Housing Census Malaysia for the years 2000 and 2010. In the first part of the empirical analysis, the estimates from the DID show that higher education reform in Malaysia has increased both female educational attainment and labour force participation by 2.73 and 1.85 percentage points, respectively. In the second part of the analysis, the OLS results indicate that there is a positive effect of education on female labour force participation as evidenced in the literature (Contreras, Puentes & Bravo 2005; Evans & Kelley 2008; Ntuli & Wittenberg 2013; Olowa & Adeoti 2014; Vlasblom & Schippers 2004). The 2SLS estimates show that higher education would increase the probability of female labour force participation by 67.6 percentage points.

The 1996 higher education reform initiated by the Malaysian Government aimed to meet the needs and demands of the domestic market. Although the reform encouraged massification of the higher education sector, which has intensified during recent years, higher education in Malaysia has expanded in terms of quantity and quality (Jomo 1999). While the reform was not targeted to a specific population group, female students have clearly benefitted from the reform as evidenced by their increased enrolment in higher education institutions, surpassing their male counterparts. The higher educational attainment among female students was

confirmed by the DID analysis as discussed in section 6.5.1. In terms of ethnicity, the reform has increased access and equity to the population regardless of ethnic group. The enrolment into public higher education institutions is based on the ethnic quota system. In contrast, enrolment into private higher education institutions is not governed by such quota. This increases equity and equality to education in the country. As a result, educational attainment for all ethnic groups increased significantly. Furthermore, higher education institutions were established across the country, in all 13 states of Malaysia. As a consequence, the cost of education was lowered due to the closer proximity of higher education institutions to a student's home town or state of residence, which leads to higher education attainment. This explanation is supported by the human capital theory which suggests that a decrease in the cost of investment will increase human capital investment.

The findings in this present study imply that Malaysian women with higher educational attainment have a greater probability of working. Higher education increases labour market opportunities for women in terms of job choices. Increased educational attainment increases labour productivity through the accumulation of skills and knowledge thereby allowing females to enjoy higher wages and better fringe benefits. However, in countries like the US, India and Turkey, the effect of higher education on female labour force participation has weakened over time (Hotchkiss 2006; Klasen & Pieters 2015; Dayioglu & Kirdar 2011). Among the reasons cited for the weakening effect of higher education is the issue of self-selection which suggests that there is a possible issue of endogeneity between education and female labour force participation.

Although the impact of higher education reform on female labour force participation has been examined extensively (Hotchkiss 2006; Klasen & Pieters 2015; Dayioglu & Kirdar 2011), there is limited study taking into account the endogeneity of the higher education variable. This study is one of the first attempts to consider the issue of endogeneity of higher education on female labour force participation. The results from section 6.5.3 indicate that education has positive causal effect on female labour force participation. The difference between the OLS and 2SLS estimates in the main analysis is large and surprising. Nevertheless, the positive sign of the estimate is

expected. Due to the limited evidence in the topic examined, the findings cannot be compared with previous studies.

The increase in educational attainment among females drives women to participate more in the labour market. Despite this, the female labour force participation rate in Malaysia remains stagnant. The results in section 6.5.1 show that being married is negatively related to female labour force participation. As discussed earlier in the literature review chapter, being married alone has only a small impact on female labour force participation. It is the presence of children that imposed a more negative effect on female labour force participation. This hypothesis motivates the empirical analysis in the next chapter. In chapter 7, the causal effect of fertility on female labour force participation is analysed to provide more explanation for the stagnant trend of female labour force participation in Malaysia.

CHAPTER 7 FERTILITY AND FEMALE LABOUR FORCE PARTICIPATION

7.1 Introduction

As highlighted at the beginning of this study, fertility is one of the key determinants of female labour force participation. In general, there is a negative relationship between fertility and female labour force participation. Yet, while trends in fertility have generally declined, female labour force participation has remained stagnant in many countries. Policymakers have designed various policies in recent decades in an effort to increase work-life balance so that the increasingly educated and skilled female workforce can be utilised. At the macro level, the underutilisation of labourers such as educated women impose negative effects on an economy in the long run in terms of economic growth and financial stability of welfare systems (Karbownik & Myck 2016). At the micro level, the link between fertility and female labour force participation has important effects on intra-household allocations.

At the same time, there are strong theoretical reasons to believe that fertility and female labour force participation are jointly determined (Nakamura & Nakamura 1992; Rosenzweig & Wolpin 1980). The instrumental variable strategy has been employed to disentangle the causal relationship between these two variables (Angrist & Evans 1998; Cruces & Galiani 2007; Moschion 2013; Vere 2011) in both developed and developing countries. Although the results in these studies are comparable, fertility behaviour is likely affected by differences in cultural contexts between countries. Furthermore, countries have varying levels of economic development and different labour market institutions, which may impact the outcome.

This study seeks to address this gap by examining the effect of fertility on female labour force participation in a country with distinct sub-population groups who share similar basic economic constraints. A country that fits this characteristic is Malaysia. Malaysia is suitable as a case study due to the distinct cultural differences between the major ethnic groups while they share the same labour market institution. The

ethnic variable can therefore be examined in a more in-depth fashion. In the context of Malaysia, the fertility variable is one of the main determinants of female labour force participation between 1970 and 2000 as evidenced in the decomposition analysis in Chapter 5. The theoretical framework underpinning this chapter was previously outlined in Chapter 3, which describes the choices facing parents who already have some children but may decide to have additional children (Angrist & Evans 1996). Furthermore, they indicate that by choosing a combination of work in the market, home production (including childcare) and leisure to maximise utility subject to production technology and family budget constraints, the relationship between home production and the number of children can be determined. These changes consequently affect the labour supply decision. Hence, this chapter attempts to examine the causal effect of fertility on female labour force participation in Malaysia and to what extent female labour force participation differs according to ethnicity.

Using data from the Malaysian Population and Housing Census for the years 1991 and 2000, the heterogeneity of fertility on female labour force participation is analysed using the instrumental variable method. The source of exogenous variation in family size is explored using three main instruments: multiple births; parental preference for mixed sibling-sex composition; and son preference. The use of twin births and parental preference for a mixed sex set of siblings enables a comparison of the effect of planned and unplanned births on female labour force participation.

The key findings show that planned births resulted in a larger negative causal effect of fertility on female labour force participation as compared to unplanned births for the sample of mothers with two or more children. The effect of fertility on female labour force participation for mothers with one or more children is not significant when instrumented using twins at first birth. There is evidence of son preference with increasing daughters at higher parity. This effect is potentially driven by son preference among Chinese families.

In terms of ethnic heterogeneity, the analysis shows that a significant negative causal effect of fertility on female labour force participation exists for Bumiputera women

when instrumented using the same-sex variable, while there is a negative and negligible effect for Chinese women. This indicates that cultural background is an important variable influencing fertility and female labour force participation decisions. The estimates using the multiple births instrument is negative for all ethnic groups but is not significant. The findings in this chapter add a new dimension to the literature and provide interesting insights into the link between fertility and female labour force participation in Malaysia.

Following this introduction, section 7.2 outlines the data used in the analysis and the sample construction. Section 7.3 gives an overview of the empirical strategy used in this chapter. Section 7.4 highlights the empirical results. The results include analysis using multiple birth, sibling-sex composition and son preference instruments. The analysis by ethnic heterogeneity which is the highlight of this chapter is presented in section 7.4.4 Section 7.5 provides the overall discussion and conclusion.

7.2 Source of data

The analysis in this chapter uses cross-sectional data from the Population and Housing Census of Malaysia for the years 1991 and 2000 provided by the IPUMS-International database. The census is administered by the Department of Statistics Malaysia and 2% of the samples are available for public use. The census contains a rich set of demographic variables such as age, sex, ethnic group, marital status, living stratum, years of education, education level and labour force participation status for all individuals residing in a household.

The sample in this study is limited to Malaysian women aged 21 to 35 years with at least one child aged less than 18 years. The selection of this age group follows Angrist and Evans (1998) to allow for comparison. The dataset does not contain retrospective fertility information. Children are matched to mothers using the relationship code provided in the dataset. The census allows identification of a biological mother and child relationship if the children live in the same household. In households with multiple families, identification of relationship is also possible using this relationship code. Further, the code allows identification of spouse and other family members in the household. Although the latest census in Malaysia was conducted in 2010, the analysis in this chapter is limited to data from the 1991 and

2000 censuses due to the lack of relationship codes that allow identification of the mother and child relationship in the 2010 census. The definitions of the variables are listed in Table 7.1.

Table 7.1: Definition of variables.

Variable	Definition
FLFP (Female labour force participation)	Binary variable. 1=if woman is in the labour force at the time of the census; or 0=if not in the labour force
Number of children	Continuous variable.
Samesex	Binary variable. 1=if first two children were same-sex, 0 otherwise
Boy-1	Binary variable. 1=if first child was a boy, 0 otherwise
Boy-2	Binary variable. 1=if second child was a boy, 0 otherwise
Twins-1	Binary variable. 1=if first birth was twins, 0 otherwise
Twins-2	Binary variable. 1=if second birth was twins, 0 otherwise
All twins	Binary variable. 1=if first or second birth was twins, 0 otherwise
Two boys	Binary variable. 1=if first two children were boys, 0 otherwise
Two girls	Binary variable. 1=if first two children were girls, 0 otherwise
Three girls	Binary variable. 1=if third child was a girl, 0 otherwise
Age	Continuous variable. Age in years.
Momfirst	Continuous variable. Mother's age at first birth in years.
Bumiputera	Binary variable. 1=Bumiputera, 0 otherwise
Chinese	Binary variable. 1=Chinese, 0 otherwise
Others	Binary variable. 1=Other ethnic, 0 otherwise
Year 2000	Binary variable. 1=Census year 2000, 0 otherwise

Source: Author's own work.

7.2.1 Sample for multiple births analysis

This section describes the sample used in section 7.4.1 to analyse the effect of fertility on female labour force participation using the multiple births instrument. In the 1991 data, multiple births or twins birth is defined as siblings born in the same month and year. Observations with missing data on either the month or year of birth

of the child is not included in the sample because the multiple births status could not be established. Furthermore, the analysis for multiple births is limited to the 1991 data as the month and year of birth is not reported in the 2000 data. Table 7.2 shows the descriptive statistics of the sample from the 1991 population census.

Table 7.2: Descriptive statistics of sample for multiple births analysis, women aged 21 to 35 years old, from 1991 census.

	1+ children [a]		2+ children[b]	
	Mean	Standard deviation	Mean	Standard deviation
Number of children	2.68	(1.40)	3.13	(1.24)
More than 1 child	0.790	(0.406)	1	(0)
More than 2 children			0.610	(0.488)
Boy-1 (=1 if first child was a boy)	0.513	(0.500)	0.506	(0.500)
Boy-2 (=1 if second child was boy)			0.507	(0.500)
Twins-1 (=1 if first birth was twins)	0.006	(0.075)	-	-
Twins-2 (=1 if second birth was twins)			0.006	(0.074)
Age	29.4	(3.8)	29.9	(3.6)
Age at first birth	22.6	(3.5)	22.1	(3.3)
Bumiputera	0.659	(0.474)	0.67	(0.471)
Chinese	0.218	(0.413)	0.209	(0.406)
Others	0.123	(0.329)	0.120	(0.325)
Female labour force participation (FLFP)	0.340	(0.474)	0.305	(0.460)
Number of observations	16,428		12,880	

Notes: Sample is women aged 21 to 35 years whose first child is less than 18 years old. [a]Sample of women with one or more children. [b]Sample of women with two or more children, excluding women with multiple first births.

The sample is divided into two sub-samples. The first sub-sample consists of mothers who have one child or more (1+ children). The total number of observations is 16,428. The second sub-sample consists of mothers who have two or more children (2+ children), excluding mothers with multiple first births. The total number of observations is 12,880. The one child sample does not include women whose first child is less than one year old. These women may not have a second child yet, especially if the first child is less than 9 months old. Similarly, in the two children sample, a woman whose second child is less than one year old was not included.

The average number of children in the sample of mothers with 1+ children is 2.68, while the sample of mothers with 2+ children is 3.13. The average number of

children in both sub-samples are higher compared to results in previous literature, for example in Angrist and Evans (1998). This could be due to greater fertility in the population selected. For the 1+ children sample, the mean of women with more than one child is 79%. Meanwhile 61% of mothers in the 2+ children sample had a third child. The proportion of mothers in the labour force is 34% in the sample of women with 1+ children. In the sample of women with 2+ children, work participation is slightly lower at 30.5%.

The number of children is instrumented by twins at first birth for mothers with 1+ children and by twins at second birth for mothers with 2+ children. The mean of twins at both first and second birth is 0.006. The average age of mothers at first birth is 22.6 to 22.1. Some studies find that twin births increase with maternal age at birth. Late child bearers can have received fertility treatment which increases the likelihood of multiple births (Bronars & Grogger 1994; Jacobsen, Pearce & Rosenbloom 1999; Lerida Milicic 2009). Additionally, career-oriented women might also be more likely to have their first child at an older age (Lerida Milicic 2009) which increases the chances of twin births. However, in both sub-samples, these women had their first child at a young age. In Malaysia, fertility treatment was not widely accessible in the 1990s and the average age of mothers who had twin births was similar to the sample of women in the non-twin analysis (see Table 7.3).

7.2.2 Sample for mixed sibling-sex and son preference analysis

This section describes the samples used in sections 7.4.2 and 7.4.3 to analyse the effect of fertility on female labour force participation using the mixed sibling-sex and son preference instruments. The data for this analysis is drawn from both the 1991 and 2000 censuses. The observations from both censuses are pooled to increase statistical power. The descriptive statistics for this sample are presented in Table 7.3.

The total number of observations is 34,310. The sample is divided into two sub-samples, and the selection of sub-samples depend on the type of instruments examined. The effect of mixed sibling-sex will be analysed using the 2+ children sample. In contrast, the effect of son preference will be analysed using sub-samples of mothers with 2+ and 3+ children. In the sub-sample of women with at least two children, the instrument “two first-born girls” will be used and finally, in the sub-

sample of mothers with at least three children, the instrument "three first-born girls" will be used.

Table 7.3: Descriptive statistics for mixed sibling-sex and son preference analysis, women aged 21 to 35 years old, 1991 and 2000 census.

	2+ children[d]		3+ children[e]	
	Mean	Standard deviation	Mean	Standard deviation
Number of children	3.193	(1.223)	3.811	(1.072)
More than 1 child	1.000	(0.000)	1.000	(0.000)
More than 2 children	0.659	(0.474)	1.000	(0.000)
More than 3 children	-	-	0.488	(0.500)
Boy-1 (=1 if first child was a boy)	0.515	(0.500)	0.510	(0.500)
Boy-2 (=1 if second child was a boy)	0.513	(0.500)	0.510	(0.500)
Girl-1 (=1 if first child was a girl)	0.485	(0.500)	0.490	(0.500)
Girl-2 (=1 if second child was a girl)	0.487	(0.500)	0.490	(0.500)
Same-sex	0.500	(0.500)	-	-
Two boys	0.264	(0.441)	-	-
Two girls	0.236	(0.425)	-	-
Three girls	-	-	0.119	(0.324)
Age	30.3	(3.5)	30.9	(3.2)
Mother's age at first birth	22.0	(3.4)	21.4	(3.2)
Bumiputera	0.690	(0.462)	0.719	(0.450)
Chinese	0.205	(0.404)	0.179	(0.384)
Others	0.105	(0.306)	0.102	(0.302)
Work	0.319	(0.466)	0.283	(0.451)
Number of observations	34,310		22,608	

Notes: Standard deviations are in parentheses. Sample is women aged 21 to 35 whose first child is less than 18 years old. [c]Sample of women with one child or more. [d]Sample of women with two or more children. [e]Sample of women with three or more children, with one and two first-born girls.

The average number of children in the sample of at least 2 children is 3.19, In the sample of at least 3 children, the average number of children is 3.81. The mean age of mothers is similar in both sample, which is 30 years. The mean age of mothers at first birth is between 21 to 22 years. Labour force participation is slightly higher in the sample of women with at least two children at 31.9%. For women with at least three children, the labour force participation is 28.3%.

Table 7.3 shows that 65.9% of the women who have at least two children had a third child, while 48.8% of the women who have at least three children had a fourth child. In the sample of women with at least two children, 50% of all families have children of the same-sex, and about 51.5% of first births were boys. The percentage of families that have two boys is slightly higher than two girls, 26.4% and 23.6%, respectively. In the sample of women with at least three children, about 11.9% had three first-born girls.

7.3 Estimation Strategy

Economists have consistently tried to tease out the effect of fertility on female labour force participation. In particular, childbearing and female labour force participation may be jointly determined. The explanatory variable, childbearing, may be correlated with the error term. In the context of childbearing and female labour force participation, Angrist and Pischke (2009) reiterate the case of a clear omitted variable bias where mothers with strong labour force attachments may be likely to have fewer children than mothers with lower earnings potentials. The instrumental variables approach will be used in an attempt to disentangle the causal link between fertility and the labour force participation of married women in Malaysia. The results could provide meaningful interpretation against the backdrop of a relatively stagnant female labour force participation rate over the past three decades in the country.

Correlations between fertility and female labour force participation do not imply causality. The number of children and the labour market decision may be affected by unobserved variables such as preferences. There could be a reversed causality in the relationship where a woman with a higher earning potential may be more likely to have fewer children when compared to a woman with lower earning potential. In this case, the causal link between fertility and labour market outcomes could not be disentangled. In order to estimate the causal effect of fertility on female labour force participation in Malaysia, this study will use a natural experiment with instrumental variables design.

The use of these instrumental variables forms a natural experiment. In the case of a mixed sibling-sex composition, it is ‘as if’ the researcher has randomly assigned some families to have two children and others to have three or more. With this

condition, the causal effect of having a third child on female labour force participation can be estimated. The instrumental variables chosen should satisfy two properties. First, the instrumental variables must not be correlated with the unobserved variable in the error term. The instrument should have no partial effect on the outcome variable. This condition is known as instrument exogeneity, $corr(Z_i, u_i) = 0$. Second, the instrumental variables must be correlated to the endogenous explanatory variable of interest. This is known as the instrument relevance $corr(Z_i, X_i) \neq 0$ (Wooldridge 2009, p.508).

7.3.1 Two-stage least squares estimation

This study examines the causal impact of fertility on female labour employment. The source of exogenous variation in family size is explored using three different instruments, namely multiple birth, sibling-sex composition and son preference instruments. The 2SLS estimation will be used to estimate the effect of fertility and a number of other exogenous covariates on the labour market outcome. In the absence of association between the instrument and the exogenous covariates, controlling for exogenous covariates can lead to more precise estimates. It is hypothesised that children have a negative impact on female labour force participation. The instrumental variable estimates are expected to reduce the estimates on the children's effect.

The first-stage estimations can explain the impact of the following on fertility: (1) twin births instrumented by twins at first birth and twins at second birth (Angrist & Evans 1998; Rosenzweig & Wolpin 1980); (2) sibling sex-mix instrumented by same-sex siblings and two boys and two girls (Angrist & Evans 1998); and (3) son preference instrumented by two first-born girls and three first-born girls (Chun & Oh 2002).

The second-stage estimation will investigate the effect of having more children, as a result of the change in family size, on female labour force participation. The baseline result for the women's sample will be presented. Further, the relationship between fertility and female participation may be different for the different sub-population groups in Malaysia. A heterogeneity analysis by ethnicity will be explored. This can potentially indicate which population of mothers has the highest fertility.

The following linear model following Angrist and Evans (1998) is used in this study:

$$y_i = \propto_o' w_i + \lambda_0 x_i + v_i \quad (7.1)$$

where y_i is a binary measure for labour force participation of woman i, the endogenous family size is given by x_i and v_i is the residual. The vector w_i is a vector of exogenous variables with respect to fertility such as the age of the mother, age of mother at first birth and ethnicity.

The first-stage regression is given as follows:

$$x_i = \pi_0' w_i + \gamma_0{}' z_i + \varepsilon_i \quad (7.2)$$

where γ_0 is the effect of the instrument in the first-stage. The instrument variable is given by z_i and ε_i is the error term.

The instruments used in this study must be correlated to the endogenous explanatory variable of interest, in this case fertility, to be valid. This can be evaluated by examining the F-statistics on the excluded instruments. If the first-stage F-statistics of the instrumental variables are higher than 10, the instruments are strong and valid (Stock & Yogo 2002).

7.3.2 First stage estimates

The empirical analysis in this chapter uses twins births, parental sibling sex-mix preference and son preference as instruments in the first stage regressions within the local average treatment effect (LATE) framework first discussed by Imbens and Angrist (1994). In this section, the first-stage models using the instruments above is introduced.

Angrist and Evans (1998) suggest that parents of same-sex siblings are significantly more likely to have additional children. The sex of a child is virtually randomly assigned. Therefore, a mother with two first born children of the same sex is more likely to have a third child.

The effect of same-sex children can be estimated by:

$$x_{2i} = \pi_2' w_{2i} + \gamma_2(boy1_i) + \gamma_3(boy2_i) + \gamma_4(samesex_i) + \varepsilon_{2i} \quad (7.3)$$

where x_{2i} is the endogenous fertility variable. In this chapter, x_{2i} is measured by the number of children born to a woman. Other covariates in the analysis is demographic variable in the analysis is given by w_{2i}.

In order to control for potential offspring effects on labour force participation which exist if the sex of children affects the behaviour of female participation directly, Angrist and Evans (1998) include the sex of the first and second born child. The control variables are included in this study indicated by *boy1* and *boy2*, as seen in equation 7.4.

The *samesex* indicator can be decomposed into two variables indicating the sex composition of the first two children, two boys and two girls, leading to an overidentified model (Angrist & Evan 1998). Angrist and Evans (1998) show that this is useful because the bias from any secular effects of child gender on labour supply should be different from these two instruments, while the labour supply consequences of childbearing seem likely to be independent of whether same-sex equals two boys or two girls.

The first-stage relationship is given by:

$$x_{3i} = \pi_3' w_{3i} + \gamma_5(boy1_i) + \gamma_6(twoboys_i) + \gamma_7(twogirls_i) + \varepsilon_{3i} \quad (7.4)$$

The boy2 variable is dropped to avoid multicollinearity.

In the twins analysis, the first-stage equation is given by:

$$x_{1i} = \pi_1' w_{1i} + \gamma_1(twins\ j_i) + \varepsilon_{1i} \quad (7.5)$$

where $j = 1,2$ indicates twin birth parity in equation 7.5.

Finally, to examine son preference, the following specification can be used:

$$x_{4i} = \pi_4' w_{4i} + \gamma_8(girls\ j_i) + \varepsilon_{4i} \quad (7.6)$$

where $j = 1,2$ indicates daughters birth parity in equation 7.6.

7.3.3 Local average treatment effects

The estimate of λ_0 in equation (7.10) can be interpreted as a local average treatment effect specific to the instrument, z_i (Imbens & Angrist 1994). In the LATE framework, the population affected by the instrument can be classify as the

compliers. In the case of the same-sex instrument, the coefficient λ_0 estimates the average effect of x_i on y_i for individuals (compliers) whose fertility has been affected by their children's sex mix (Angrist & Evans 1998, p. 458). In the sample of mothers with at least two children, the compliers would have a third child following the birth of two same-sex children or when the instrument is switched on. Similarly, when using the two boys and two girls instruments, mother who have two first-born girls or two first-born boys would have a third child. This sub-population is the complier.

The LATE framework does not provide useful information about the effects on never-takers and always-takers (Angrist & Pischke 2009, p. 158). The never-takers would never have a third child and the always-takers would always have a third child regardless of whether the instrument is switched on or off (Moschion 2013, p. 325). The treatment status of these two groups is unchanged. If the effect of fertility is homogenous, the estimates provide true effect or average treatment effect (ATE).

For the twin births instrument, the compliers are mothers who would have a third child following multiple second birth. The LATE using the twins instrument is also the average causal effect of women who are not treated. All women who have a multiple second birth end up with three children, and therefore there are no never-takers when the twins instrument is switched on (Angrist & Pischke 2009). When using, twins at first birth instrument, the compliers are mothers who would have a second child following the birth of twins.

In the son preference analysis, compliers are mothers who would have a third child following the birth of two eldest daughters. Meanwhile, in a sample of at least three children, the compliers are mother who would have a fourth child following the birth of three eldest daughters.

7.4 Empirical results

This section presents the results from the overall sample using the models from section 7.3. The estimates from the 2SLS method are presented to identify the causal effect of fertility on female labour force participation. The first-stage analysis is performed using relevant instrumental variables to identify the effect on the number of children. The OLS analysis provides the basic estimates of the relationship between fertility and female labour force participation.

7.4.1 Multiple birth instruments

The first-stage results for the multiple birth instrument used in this study are reported in Table 7.4. The birth of twins is unanticipated and it is therefore exogenous to the labour supply decision. In this study, there is a total of 93 observations of mothers with twins at first birth (0.57% of the sample) and the total observations for mothers with twins at second birth is 71 (0.55% of the sample). Women who had twins on their first birth have 0.765 more children on average while women who had twins on second birth have 0.73 more children. Both estimates are highly significant. The F-statistic is high. Large estimates are expected as women who have twins generally have more children than women that have single births.

In all regressions, the covariates of mothers' age, mothers' age at first birth, and the ethnicities of Chinese and Others are included. In the twins at first birth analysis, the covariate boy at first birth is included while in the twins at second birth analysis the covariates boy at first birth and boy at second birth are included. Adding boy first and boy second in the regressions reduces the likelihood of omitted variable bias if the sex of the children affects the mother's labour force participation where parents raise boys and girls differently (Angrist & Evans 1998).

In the sample of mothers with twins at first birth, the OLS estimates indicate that there is a negative relationship between fertility and female labour force participation (see Table 7.5, column (1)). An increased number of children decreases a mother's work participation by 6.15 percentage points.

Table 7.4: First-stage estimates of the effects of multiple births on the number of children.

	(1) Twins-1	(2) Twins-2	(3) All Twins
Twins-1	0.7650***		
	(0.1002)		
Twins-2		0.7301***	
		(0.1122)	
All twins			0.8614***
			(0.0771)
Age	0.2127***	0.1797***	0.2125***
	(0.0026)	(0.0028)	(0.0026)
Momfirst	-0.2276***	-0.1963***	-0.2275***
	(0.0028)	(0.0031)	(0.0028)
Chinese	-0.3179***	-0.3323***	-0.3171***
	(0.0194)	(0.0205)	(0.0193)
Others	-0.1832***	-0.1920***	-0.1812***
	(0.0268)	(0.0286)	(0.0268)
Boy-1	-0.0370**	-0.0263	-0.0361**
	(0.0166)	(0.0176)	(0.0166)
Boy-2		-0.0001	
		(0.0175)	
Constant	1.6553***	2.1924***	1.6547***
	(0.0656)	(0.0705)	(0.0655)
Number of observations	16,428	12,880	16,428
F-statistics on excluded instruments	58.33	42.35	124.91

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth and ethnicities of Chinese and Others, and Boy-1. In column (2), the variable Boy-2 is included.

Meanwhile, the 2SLS estimates indicate a small negative of 5.68 percentage points. However, the estimate is not statistically significant. Additionally, the estimate shows large standard errors, indicating the usual loss of power associated with instrumental variables analysis.

Table 7.5: OLS and 2SLS estimates of the effects of fertility on female labour force participation using multiple birth instruments.

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation	OLS	2SLS	OLS	2SLS	OLS	2SLS
Instrument		*Twins-1*		*Twins-2*		*All twins*
Nchild	-0.0615***	-0.0568	-0.0421***	-0.0577	-0.0615***	-0.0635
	(0.0034)	(0.0629)	(0.0039)	(0.0711)	(0.0034)	(0.0411)
Age	0.0168***	0.0158	0.0159***	0.0187	0.0169***	0.0173**
	(0.0013)	(0.0134)	(0.0014)	(0.0128)	(0.0013)	(0.0088)
Momfirst	0.0083***	0.0094	0.0119***	0.0088	0.0083***	0.0078
	(0.0014)	(0.0143)	(0.0016)	(0.0140)	(0.0014)	(0.0094)
Chinese	-0.0340***	-0.0324	-0.0420***	-0.0471*	-0.0339***	-0.0345**
	(0.0090)	(0.0218)	(0.0101)	(0.0257)	(0.0090)	(0.0158)
Others	0.0508***	0.0517***	0.0711***	0.0681***	0.0508***	0.0504***
	(0.0119)	(0.0164)	(0.0133)	(0.0192)	(0.0119)	(0.0140)
Boy-1	-0.0020	-0.0018	-0.0015	-0.0019	-0.0020	-0.0021
	(0.0072)	(0.0075)	(0.0079)	(0.0082)	(0.0072)	(0.0073)
Boy-2			-0.0001	0.0001		
			(0.0079)	(0.0079)		
Constant	-0.1764***	-0.1842*	-0.3017***	-0.2673*	-0.1764***	-0.1731**
	(0.0322)	(0.1087)	(0.0372)	(0.1601)	(0.0322)	(0.0749)
Number of observations	16,428	16,428	12,880	12,880	16,428	16,428

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, ethnicities of Chinese and Others, and Boy-1. In columns (3) and (4), the variable Boy-2 is also included.

In the twins at second birth analysis, the OLS estimate reported in column (3) shows that female labour force participation is reduced by 4.21 percentage points. However, the 2SLS shows a slightly larger negative effect at 5.77 percentage points. The estimate is not significant. This finding is compared to the evidence in other developed and developing countries. In Chile, having twins at first birth reduces a mother's work participation by 10 percentage points while the effect of twins at second birth is smaller at 2 percentage points. The twins at second birth effect is not significant due to imprecise estimation (Lerida Milicic 2009). Cáceres-Delpiano (2012) examines 40 selected developing countries using multiple births in a sample of various birth parities and finds that fertility reduces female labour force participation by between 2 and 4 percentage points depending on the various model specifications used.

The negative effect of multiple births on female labour force participation is slightly higher in developed countries. In Australia, twins at first birth reduce mothers' labour force participation by 15.5 percentage points while the effect of twins at second birth is slightly lower at 11.9 percentage points. In the US, twins at second birth reduce women's labour force participation by 8.7 percentage points in 1980 (Angrist & Evans 1998), and 9.5 and 7.8 percentage points in 1990 and 2000, respectively (Vere 2011). However, Jacobsen, Pearce and Rosenbloom (1999) find a smaller negative effect of twins at first birth on mother's work participation (2 percentage points) in the US.

Although the F-statistic indicates that the multiple birth instrument is a strong instrument in this study, there is no significant causal effect that can be concluded from the multiple births analysis. As an alternative, the sample of mothers with twins at first birth and twins at second birth is pooled to enhance the statistical precision of the estimates. The results of the analysis are shown in Table 7.5, column (3). The 2SLS estimates indicate that twin births reduce labour force participation by 6.35 percentage points. The estimate is not significant.

7.4.2 Sibling-sex composition instruments

In the sub-sample of mothers with at least two children, the instrument considered is the sex composition of the first two children. Table 7.6 reports the first stage estimates of the effect of sibling-sex composition on the number of children. The estimates in column (1) show that having children of the same-sex increases the number of children by 7.7 percentage points, suggesting mixed gender preferences. This estimate is slightly higher than those reported in Angrist and Evans (1998), Cruces and Galiani (2007), Karbownik and Myck (2016) and Moschion (2013), which range between 3.7 and 7 percentage points.

By differentiating the effects using two boys and two girls, it is found that the effect of the birth of two girls is two times larger than the effect of having two first-born boys. Following the birth of two girls, mothers have 1 percentage point more children. In previous studies, mothers with two girls are 1.5 to 2.0 percentage points more likely to have additional child when compared to having two boys (Angrist & Evans 1998; Cruces & Galiani 2007). This suggests that there is a higher preference for sons in the overall sample. The F-statistics for the same-sex, two boys and two girls estimates are large and greater than 10, indicating that the instruments are not weak.

The results of the main specification in this chapter is reported in Table 7.7. The effect of fertility on female labour force participation is examined using the same-sex instrument. The OLS estimate in column (1) suggests a negative and significant relationship between the number of children and women's employment in the specification with controls. In the analysis for mothers with at least two children, having more children decreases labour force participation by 4.6 percentage points. On the other hand, using the same-sex instruments, the 2SLS estimate indicates that having more children reduces work participation by 15.5 percentage points. The effects using the two boys and two girls identifications are slightly lower at 15.0 percentage points. Both effects are significant at the 5% level.

Table 7.6: First-stage estimates of the effects of sibling-sex composition on the number of children.

	(1) Same-sex	(2) Two boys, two girls
Samesex	0.0773***	
	(0.0110)	
Age	0.1708***	0.1708***
	(0.0018)	(0.0018)
Momfirst	-0.1785***	-0.1785***
	(0.0020)	(0.0020)
Boy-1	-0.0234**	0.0039
	(0.0110)	(0.0154)
Boy-2	-0.0273**	
	(0.0110)	
Chinese	-0.3834***	-0.3834***
	(0.0126)	(0.0126)
Others	-0.1888***	-0.1888***
	(0.0189)	(0.0189)
Twoboys		0.0500***
		(0.0153)
Twogirls		0.1046***
		(0.0159)
Year 2000	-0.1791***	-0.1791***
	(0.0111)	(0.0111)
Constant	2.1102***	2.0829***
	(0.0457)	(0.0456)
Number of observations	34,310	34,310
F-statistics on excluded instruments	49.21	27.06

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, year 2000 and, ethnicities of Chinese and Others. In column (1), the variables Boy-1 and Boy-2 are included. In column (2), only the variable Boy-1 is included.

Table 7.7: OLS and 2SLS estimates of the effects of fertility on female labour force participation using sibling-sex instruments.

	(1)	(2)	(3)	(4)
Estimation	OLS	2SLS	OLS	2SLS
Instruments		*Same-sex*		*Two boys, two girls*
Nchild	-0.0456***	-0.1550**	-0.0456***	-0.1501**
	(0.0024)	(0.0658)	(0.0024)	(0.0625)
Age	0.0117***	0.0304***	0.0117***	0.0296***
	(0.0009)	(0.0113)	(0.0009)	(0.0107)
Momfirst	0.0116***	-0.0079	0.0116***	-0.0070
	(0.0010)	(0.0118)	(0.0010)	(0.0112)
Boy-1	-0.0023	-0.0047	-0.0023	-0.0046
	(0.0049)	(0.0053)	(0.0049)	(0.0052)
Boy-2	0.0014	-0.0013		
	(0.0049)	(0.0053)		
Chinese	-0.0307***	-0.0726***	-0.0307***	-0.0707***
	(0.0064)	(0.0261)	(0.0064)	(0.0248)
Others	0.0633***	0.0426***	0.0633***	0.0435***
	(0.0087)	(0.0154)	(0.0087)	(0.0149)
Year 2000	0.0092*	-0.0105	0.0092*	-0.0096
	(0.0050)	(0.0129)	(0.0050)	(0.0123)
Constant	-0.1510***	0.0840	-0.1502***	0.0728
	(0.0238)	(0.1431)	(0.0236)	(0.1350)
Number of observations	34,310	34,310	34,310	34,310

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, year 2000, and ethnicities of Chinese and Others. In columns (1) and (2), the variables Boy-1 and Boy-2 are included. In columns (3) and (4) only the variable Boy-1 is included.

The estimate using the same-sex instrument indicates that having more children reduces women's labour force participation in Malaysia by 15.5 percentage points. The negative effect is higher than what is found in the US, where having more than two children reduces labour force participation by 8 to 12 percentage points (Angrist & Evans 1998) as well as in Mexico and Argentina at 8 and 6 percentage points, respectively (Cruces & Galiani 2007). However, the result found in this study is lower than France and Australia which are 20 percentage points (Maurin & Moschion 2009) and 19.5 percentage points (Moschion 2013), respectively. This result is in contrast to the positive effect of fertility on female labour force participation in Indonesia of 4.9 percentage points (Priebe 2010). Moschion (2013) cited institutional differences between countries as the primary reasons for differences of this magnitude.

7.4.3 Son preference instruments

The analysis in section 7.4.2 shows that women are more likely to have an additional child following the birth of two girls than the birth of two boys. This suggests a son preference in the sample. In this section, the birth of girls at different parities is used as instruments for son preference.

Table 7.8 reports the estimates for the effect of son preference on the number of children. The results in column (1) shows that having two first-born girls increases the number of children in a family by 15.4 percentage points. In column (2), the first-stage estimates indicate that having three first-born girls increases the number of children by 14.8 percentage points. The F-statistics for both instruments are more than 10 indicating that the instruments are not weak.

Table 7.8: First-stage estimates of the effects of son preference on the number of children.

	(1) Two girls	(2) Three girls
Two girls	0.1545***	
	(0.0220)	
Three girls		0.1482***
		(0.0233)
Age	0.1708***	0.1333***
	(0.0018)	(0.0022)
Momfirst	-0.1785***	-0.1427***
	(0.0020)	(0.0023)
Boy-1	0.0539***	0.0273**
	(0.0154)	(0.0135)
Boy-2	0.0500***	0.0165
	(0.0153)	(0.0135)
Chinese	-0.3834***	-0.3638***
	(0.0126)	(0.0145)
Others	-0.1888***	-0.1548***
	(0.0189)	(0.0221)
Year 2000	-0.1791***	-0.2017***
	(0.0111)	(0.0127)
Constant	2.033***	2.8910***
	(0.0483)	(0.0543)
Number of observations	34,310	22,608
F-statistics on excluded instruments	49.21	40.33

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, year 2000 and ethnicities of Chinese and Others.

In the OLS estimate shown in Table 7.9, having two first-born girls reduces a mother's labour force participation by 4.6 percentage points while having three first-born girls reduces labour force participation by 3.6 percentage points. The 2SLS estimates indicate a larger negative effect at 15.5 percentage points for mothers with two first-born girls. In Korea, where there is a distinct son preference, Nam (2010) finds that the decline in female labour force participation is lower, between 3 and 4 percentage points. When instrumented using three first-born girls, the 2SLS estimates indicate a smaller negative effect of 4.3 percentage points. The estimate is not significant, which could be potentially due to measurement errors.

Table 7.9: OLS and 2SLS estimates of the effects of fertility on female labour force participation using son preference instruments.

	(1)	(2)	(3)	(4)
Estimation	OLS	2SLS	OLS	2SLS
Instrument		*Two girls*		*Three girls*
Nchild	-0.0456***	-0.1550**	-0.0352***	-0.0433
	(0.0024)	(0.0658)	(0.0030)	(0.0722)
Age	0.0117***	0.0304***	0.0118***	0.0129
	(0.0009)	(0.0113)	(0.0011)	(0.0097)
Momfirst	0.0116***	-0.0079	0.0103***	0.0092
	(0.0010)	(0.0118)	(0.0012)	(0.0104)
Boy-1	-0.0023	-0.0047	-0.0026	-0.0027
	(0.0049)	(0.0053)	(0.0059)	(0.0059)
Boy-2	0.0014	-0.0013	0.0008	0.0006
	(0.0049)	(0.0053)	(0.0059)	(0.0061)
Chinese	-0.0307***	-0.0726**	-0.0440***	-0.0470*
	(0.0064)	(0.0261)	(0.0079)	(0.0273)
Others	0.0633***	0.0426***	0.0885***	0.0872***
	(0.0087)	(0.0154)	(0.0107)	(0.0155)
Year 2000	0.0092*	-0.0105	0.0028	0.0012
	(0.0050)	(0.0129)	(0.0060)	(0.0156)
Constant	-0.1510***	-0.0840	-0.1700***	-0.1460
	(0.0238)	(0.1431)	(0.0308)	(0.2147)
Number of observations	34,310	34,310	22,608	22,608

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, year 2000 and ethnicities of Chinese and Others.

7.4.4 Heterogeneity by ethnicity

The effect of fertility on female labour force participation in Malaysia may vary between women of different ethnicities due to differences in taste and preferences for both childbearing and labour force participation decisions. In this section, the effect

of fertility on labour force participation will be analysed by ethnicity. The analysis in this section is carried out using instruments from the main analysis namely multiple birth, sibling-sex composition and son preference instruments. In order to examine the heterogeneity by ethnicity, the instruments used in this analysis is interacted with the three ethnic groups namely, Bumiputera, Chinese and Others. This reduces the loss of statistical power from splitting the sample into three groups.

7.4.4.1 Multiple births instrument

The first-stage results of the effect of twin births on the number of children by ethnic groups are given in Table 7.10. The estimates show that Bumiputera women have 0.573 more children on average following the birth of first twins while Chinese women have 0.479 more children. Women of other ethnicities have 0.937 more children on average. The first-stage estimates in Table 7.11 for twins at second birth shows that Bumiputera women have 0.701 more children on average while the estimate for Chinese women is larger at 0.834. Women of other ethnicities have 0.691 more children on average. All estimates except for Others category, are highly significant at the 1% level. The F-statistics for both the Bumiputera and Chinese samples are greater than 10. The multiple birth instrument has a strong explanatory power to predict fertility among Bumiputera and Chinese parents with unplanned births.

Table 7.10: First-stage estimates of the effects of twins at first birth on the number of children by ethnic group.

	(1)	(2)	(3)
DV:	Bumiputera* No of children	Chinese* No of children	Others* No of children
Twins-1*Bumiputera	0.5730***		
	(0.1434)		
Twins-1*Chinese		0.4791***	
		(0.1379)	
Twins-1*Others			0.9379**
			(0.3788)
Age	0.1552***	0.0338***	0.0236***
	(0.0025)	(0.0012)	(0.0012)
Momfirst	-0.1532***	-0.0441***	-0.0302***
	(0.0027)	(0.0015)	(0.0014)
Boy-1	0.0017	-0.0260***	-0.0096
	(0.0155)	(0.0084)	(0.0075)
Chinese	-2.7589***	2.4345***	0.0075***
	(0.0153)	(0.0188)	(0.0025)
Others	-2.8273***	-0.0153***	2.6576***
	(0.0185)	(0.0041)	(0.0296)
Constant	1.6548***	0.0133	-0.0110
	(0.0614)	(0.0342)	(0.0302)
Number of observations	16,430	16,430	16,430
F-statistics on excluded instruments	15.97	12.07	6.13

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1 and ethnicities of Chinese and Others.

Table 7.11: First-stage estimates of the effects of twins at second birth on the number of children by ethnic group.

	(1)	(2)	(3)
DV:	Bumiputera* No of children	Chinese* No of children	Others* No of children
Twins-2*Bumiputera	0.7017***		
	(0.1158)		
Twins-2*Chinese		0.8340***	
		(0.1985)	
Twins-2*Others			0.6910
			(0.7113)
Age	0.1362***	0.0246***	0.0189***
	(0.0027)	(0.0012)	(0.0013)
Momfirst	-0.1372***	-0.0323***	-0.0267***
	(0.0029)	(0.0014)	(0.0015)
Boy-1	0.0033	-0.0246***	-0.0051
	(0.0160)	(0.0079)	(0.0076)
Boy-2	0.0026	-0.0148*	0.0123
	(0.0160)	(0.0079)	(0.0076)
Chinese	-3.2221***	2.8855***	0.0035
	(0.0154)	(0.0187)	(0.0023)
Others	-3.2658***	-0.0131***	3.0869***
	(0.0646)	(0.0032)	(0.0299)
Constant	2.1704***	-0.0005	0.0223
	(0.0646)	(0.0327)	(0.0322)
Number of observations	12,880	12,880	12,880
F-statistics on excluded instruments	36.72	17.65	0.94

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1 and Boy-2, and ethnicities of Chinese and Others.

In Table 7.12, the results indicate that twin births (both first and second-born) shows that Bumiputera women have 0.784 more children following twin births. Chinese women have 0.777 more children while the estimate for Others is 0.982. The F-statistics are more than 10 for both the Bumiputera and Chinese sample.

Table 7.12: First-stage estimates of the effects of twins at first and second birth on the number of children by ethnic group.

	(1)	(2)	(3)
DV:	Bumiputera* No of children	Chinese* No of children	Others* No of children
All twins*Bumiputera	0.7849***		
	(0.0963)		
All twins*Chinese		0.7778***	
		(0.1295)	
All twins*Others			0.9827***
			(0.3403)
Age	0.1551***	0.0338***	0.0236***
	(0.0025)	(0.0012)	(0.0012)
Momfirst	-0.1532***	-0.0441***	-0.0302***
	(0.0027)	(0.0015)	(0.0014)
Boy-1	-0.0014	-0.0258***	-0.0092
	(0.0155)	(0.0083)	(0.0075)
Chinese	-2.7538***	2.4295***	0.0076***
	(0.0153)	(0.0188)	(0.0025)
Others	-2.8224***	-0.0153***	2.6549***
	(0.0185)	(0.0041)	(0.0296)
Constant	1.6537***	0.0127	-0.0098
	(0.0613)	(0.0341)	(0.0302)
Number of observations	16,430	16,430	16,430
F-statistics on excluded instruments	66.39	36.09	8.34

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1, and ethnicities of Chinese and Others.

The effect of fertility on female labour force participation is examined by ethnicity using the twins instruments. The OLS estimates reported in Table 7.13 indicate that fertility reduces labour force participation for Bumiputera women by 5 to 6 percentage points. The negative effect for Chinese women is slightly larger between 6 and 8 percentage points. On the other hand, the 2SLS estimates show that fertility has positive and significant causal effect for Bumiputera women fertility is instrumented by twins-1. The estimates using twins-2 and all twins variable show a negative but not significant effect. For Chinese women, fertility when instrumented using twins-1 has negative effect on female labour force participation. However, most coefficient is not significant which is likely due to the large standard errors in the estimate.

Table 7.13: OLS and 2SLS estimates of female labour force participation using twins at first and second birth instruments.

	Twins-1		Twins-2		All twins	
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Nchild	-0.01199	-0.2711*	0.0159	-0.3141	-0.0120	-0.2472*
	(0.0082)	(0.1454)	(0.0101)	(0.5790)	(0.0082)	(0.1393)
Nchild*Bumiputera	-0.0529***	0.3753*	-0.0651***	0.2607	-0.0529***	0.2352
	(0.0085)	(0.2037)	(0.0105)	(0.5875)	(0.0085)	(0.1520)
Nchild*Chinese	-0.0755***	-0.0020	-0.0762***	0.3265	-0.0755***	0.1479
	(0.0102)	(0.2479)	(0.0129)	(0.5957)	(0.0102)	(0.1699)
Age	0.0171***	0.0032	0.0162***	0.0213	0.0171***	0.0148
	(0.0013)	(0.0168)	(0.0014)	(0.0160)	(0.0013)	(0.0094)
Momfirst	0.0081***	0.0180	0.0119***	0.0049	0.0081***	0.0086
	(0.0014)	(0.0163)	(0.0016)	(0.0196)	(0.0014)	(0.0098)
Boy-1	-0.0023	-0.0092	-0.0220*	-0.0016	-0.0023	-0.0046
	(0.0072)	(0.0096)	(0.0127)	(0.0096)	(0.0072)	(0.0079)
Boy-2			-0.0008	0.0041		
			(0.0079)	(0.0111)		
Chinese	0.0196	0.9410	-0.0122	-0.2350	0.0196	0.1964
	(0.0206)	(0.7094)	(0.0294)	(0.4953)	(0.0206)	(0.2909)
Others	-0.0911***	1.0748*	-0.1314***	0.8751	-0.0911***	0.6849*
	(0.0259)	(0.5574)	(0.0079)	(1.8170)	(0.0259)	(0.4090)
Constant	-0.1694***	-0.4507**	-0.2876***	-0.2714	-0.1694***	-0.2601***
	(0.0322)	(0.2094)	(0.0372)	(0.1884)	(0.0322)	(0.0994)
Number of observations	16,430	16,430	12,880	12,880	16,430	16,430

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1 and ethnicities of Chinese and Others. In column (2), Boy-2 is included.

7.4.4.2 Sibling-sex composition instruments

The first-stage analysis by ethnicity as shown in Table 7.14 indicates that Bumiputera women with same-sex children will have on average 0.055 more children. Chinese and Others women have 0.13 and 0.11 more children on average. The effects are statistically significant. The F-statistics for the Malay and Chinese women are more than 10.

Table 7.14: First-stage estimates of the effects of same-sex children on the number of children by ethnic group.

	(1)	(2)	(3)
DV:	Bumiputera* No of children	Chinese* No of children	Others* No of children
Samesex*Bumiputera	0.0552***		
	(0.0140)		
Samesex*Chinese		0.1298*	
		(0.0222)	
Samesex*Others			0.1098***
			(0.0395)
Age	0.1347***	0.0212***	0.0148***
	(0.0018)	(0.0007)	(0.0007)
Momfirst	-0.1305***	-0.0278***	-0.0202***
	(0.0018)	(0.0009)	(0.0008)
Boy-1	0.0022	-0.0259***	0.0005
	(0.0101)	(0.0047)	(0.0042)
Boy-2	-0.0132	-0.0207***	0.0066
	(0.0101)	(0.0047)	(0.0042)
Chinese	-3.2541*** (0.0115)	2.8258***	0.0072***
		(0.0152)	(0.0012)
Others	-3.2877***	-0.0043**	3.0762***
	(0.0131)	(0.0018)	(0.0269)
Year 2000	-0.1225***	-0.0374***	-0.0192***
	(0.0102)	(0.0046)	(0.0041)
Constant	2.1150***	0.0076	-0.0022
	(0.0423)	(0.0192)	(0.0180)
Number of observations	34,310	34,310	34,310
F-statistics on excluded instruments	15.60	34.31	7.73

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1 and Boy-2, year 2000, ethnic Chinese and Others.

Although both Malay and Chinese women displayed a mixed gender preference, Chinese women indicate a higher probability of having a third child following two same-sex children. The results from the analysis using the two boys and two girls instruments is shown in Table 7.15.

Table 7.15: First-stage estimates of the effects of two boys and two girls on the number of children by ethnic group.

	(1)	(2)	(3)
DV:	Bumiputera* No of children	Chinese* No of children	Others* No of children
Twoboys*Bumi	0.0428**		
	(0.0178)		
Twogirls*Bumi	0.0677***		
	(0.0183)		
Twoboys*Chinese		0.0247	
		(0.0255)	
Twogirls*Chinese		0.2462***	
		(0.0296)	
Twoboys*Others			0.1427**
			(0.0494)
Twogirls*Others			0.0752
			(0.0485)
Age	0.1347***	0.0213***	0.0148***
	(0.0018)	(0.0007)	(0.0007)
Momfirst	-0.1305***	-0.0277***	-0.0202***
	(0.0018)	(0.0009)	(0.0008)
Boy-1	0.0108	-0.0030	-0.0030
	(0.0113)	(0.0036)	(0.0031)
Chinese	-3.2543***	2.8263***	0.0073***
	(0.0115)	(0.0152)	(0.0012)
Others	-3.2878***	-0.0040**	3.0760***
	(0.0131)	(0.0018)	(0.0269)
Year 2000	-0.1225***	-0.0371***	-0.0191***
	(0.0102)	(0.0046)	(0.0041)
Constant	2.1045***	-0.0173	0.0037
	(0.0419)	(0.0188)	(0.0178)
Number of observations	34,310	34,310	34,310
F-statistics on excluded instruments	8.30	35.89	4.43

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1, year 2000, and ethnicities of Chinese and Others.

The estimates in Table 7.15 shows that having two first-born girls increases the number of children by 0.246 for Chinese mothers and the effect is highly significant. On the other hand, having two first-born boys increases the number of children by 0.025 for Chinese mothers. The analysis suggests a son preference among Chinese women. The F-statistic is 35.89 indicating that the instruments are not weak. Bumiputera women with first two boys have 0.043 more children, while women with first two girls have 0.068 more children. This implies that while Bumiputera women prefer a mixed-sex composition of children, there is no preference for children of a particular sex. For Others, having first two boys increases the number of children by 0.143, while having first two girls increases the number of children by 0.075, potentially suggesting a preference for daughters. However, the F-statistics for both Bumiputera and Others are not significant.

According to the bilateral kinship system in the Malay, there is a preference for married daughters to live near their mothers, therefore explaining why daughters are valued as much as sons, if not more sometimes (Wee 1995, p. 192). In contrast, in other countries previous research has documented a strong son preference among women in India (Kishor 1993), primarily due to the economic burden of dowry (Diamond-Smith, Luke & McGarvey 2008, p. 703). The Indians in Malaysia, however, generally do not practise the dowry custom (Boo 2013) although dowries are given in some minority ethnic groups such as the Ceylonese Tamils (Rajakrishnan 2006).

The results in Table 7.16 show the effect of fertility on female labour force participation. The OLS estimates indicate that having more children reduces work participation by 4.8 percentage points for Bumiputera women. The negative effect is slightly larger for the Chinese at 6.4 percentage points. The effects are highly significant.

Meanwhile, the 2SLS estimates using same-sex as the instrument in Table 7.16 show that the negative effect of having more children is large for the Bumiputera women at 20.2 percentage point. On the other hand, fertility reduces female labour force participation for Chinese women by 6.17 percentage points. Both estimates are not significant.

Table 7.16: OLS and 2SLS estimates of female labour force participation using same-sex instrument by ethnic group.

	(1) OLS	(2) 2SLS
Nchild	-0.0015	-0.2218
	(0.0068)	(0.1631)
Nchild*Bumiputera	-0.0472***	0.0198
	(0.0070)	(0.2040)
Nchild*Chinese	-0.0632***	0.1601
	(0.0086)	(0.1844)
Age	0.0119***	0.0358**
	(0.0009)	(0.0155)
Momfirst	-0.0116***	-0.0128
	(0.0010)	(0.0152)
Chinese	0.0142	-0.4961
	(0.0190)	(0.4454)
Others	-0.0849***	0.0962
	(0.0239)	(0.6513)
Boy-1	-0.0028	-0.0021
	(0.0049)	(0.0057)
Boy-2	0.0007	0.0004
	(0.0049)	(0.0058)
Year 2000	0.0089**	-0.0140
	(0.0050)	(0.0154)
Constant	-0.1442***	0.1837
	(0.0238)	(0.2433)
Number of observations	34,310	34,310

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1, year 2000, ethnic Chinese and Others.

For Chinese women, the 2SLS estimates in Table 7.17 using two boys and two girls as instruments exerts a small negative effect on female labour force participation at 4.5 percentage points. The effect is not significant. The results for the Bumiputera and Others groups are not reported due to the two boys and two girls instruments being weak for these ethnic groups.

Table 7.17: OLS and 2SLS estimates of female labour force participation using two boys and two girls instruments for Chinese women.

	(1) OLS	(2) 2SLS
Nchild	-0.0428***	-0.2088**
	(0.0025)	(0.0929)
Nchild * Chinese	-0.0219***	0.1638
	(0.0058)	(0.1067)
Age	0.0117***	0.0361**
	(0.0009)	(0.0140)
Momfirst	0.0115***	-0.0129
	(0.0010)	(0.0142)
Boy-1	-0.0028	-0.0017
	(0.0049)	(0.0055)
Chinese	0.0337*	-0.5668*
	(0.0188)	(0.3392)
Others	0.0637***	0.0331*
	(0.0087)	(0.0197)
Year 2000	0.0089*	-0.0139
	(0.0050)	(0.0144)
Constant	-0.1562***	0.1984
	(0.0236)	(0.1996)
Number of observations	34,310	34,310

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1, ethnicities of Chinese and Others, and Year 2000.

7.4.4.3 Son preference instruments

In Asian culture, there is a stronger preference for sons over daughters. The Chinese in Malaysia have a stronger son preference than the other ethnic groups. The first-stage result for the son preference instruments in the main sample in section 7.4.3 is potentially driven by the Chinese ethnic group. The analysis is reported in Table 7.18.

Following the birth of two daughters as the first two born children, Chinese women have 0.242 additional children as shown in Table 7.18. The Bumiputera mothers have 0.072 more children. Both estimates are highly significant at 1% level. The Others women have 0.037 more children. The F-statistics for Bumiputera and Chinese women is more than 10. Therefore, the two girls instrument is a strong instrument for Bumiputera and Chinese.

Table 7.18: First-stage estimates of the effects of first two girls on the number of children by ethnic group.

	(1)	(2)	(3)
DV:	Bumiputera* No of children	Chinese* No of children	Others* No of children
Two girls * Bumi	0.0722***		
	(0.0198)		
Two girls * Chinese		0.2419***	
		(0.0283)	
Two girls * Others			0.0374
			(0.0461)
Age	0.1347***	0.0213***	0.0148***
	(0.0018)	(0.0007)	(0.0007)
Momfirst	-0.1305***	-0.0277***	-0.0202***
	(0.0018)	(0.0009)	(0.0008)
Boy-1	0.0275**	-0.0008	0.0024
	(0.0109)	(0.0039)	(0.0036)
Boy-2	0.0120	0.0044	0.0087**
	(0.0109)	(0.0038)	(0.0034)
Chinese	-3.2646***	2.8340***	0.0072***
	(0.0103)	(0.0123)	(0.0012)
Others	-3.2980***	-0.0040**	3.1211***
	(0.0127)	(0.0018)	(0.0226)
Year 2000	-0.1225***	-0.0372***	-0.0191***
	(0.0102)	(0.0046)	(0.0041)
Constant	2.1010***	-0.0208	-0.0044
	(0.0426)	(0.0190)	(0.0179)
Number of observations	34,310	34,310	34,310
F-statistics on excluded instruments	13.28	73.19	0.66

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1, Boy-2, ethnicities of Chinese and Others, and Year 2000.

For mothers with at least three children, the first-stage estimates indicate that Chinese mothers have 0.288 more children following the birth of daughters as the first three children as indicated in Table 7.19. For Bumiputera mothers, having three girls increases the number of children by 0.103 while for Others, it is 0.011. Similar to the two girls instrument, the three girls instrument is not a weak instrument for Bumiputera and Chinese women.

Table 7.19: First-stage estimates of the effects of first three girls on the number of children by ethnic group.

	(1)	(2)	(3)
DV:	Bumiputera* No of children	Chinese* No of children	Others* No of children
Three girls * Bumi	0.1028***		
	(0.0268)		
Three girls * Chinese		0.2878***	
		(0.0444)	
Three girls * Others			0.0114
			(0.0698)
Age	0.1092***	0.0128***	0.0114***
	(0.0020)	(0.0007)	(0.0008)
Momfirst	-0.1119***	-0.0161***	-0.0147***
	(0.0022)	(0.0009)	(0.0009)
Boy-1	0.0287**	-0.0049	-0.0013
	(0.0117)	(0.0041)	(0.0043)
Boy-2	0.0092	-0.0081**	0.0107**
	(0.0118)	(0.0041)	(0.0042)
Chinese	-3.8813***	3.4938***	-0.0006
	(0.0104)	(0.0127)	(0.0011)
Others	-3.9038***	-0.0056***	3.7654***
	(0.0120)	(0.0013)	(0.0236)
Year 2000	-0.1416***	-0.0340***	-0.0256***
	(0.0116)	(0.0043)	(0.0045)
Constant	2.9525***	-0.0263	-0.0287
	(0.0495)	(0.0189)	(0.0206)
Number of observations	22,608	22,608	22,608
F-statistics on excluded instruments	14.72	42.00	0.03

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1, Boy-2, ethnicities of Chinese and Others, and Year 2000.

From the analysis, the Chinese clearly has a strong son preference. By using the number of daughters, the F-statistics indicate that son preference is a strong instrument for Chinese children at birth parities two and three. At higher birth parities, Chinese mothers show a greater probability of having an additional child. Similar to other Asian families, Chinese mothers in Malaysia can be seen to have a strong son preference, which is rooted in the Confucian patriarchal tradition (Robey 1985). However, referring to the two boy and two girls analysis earlier, Bumiputera

women shows preference for mixed sibling-sex composition. The effect is greater at higher birth parities.

Table 7.20: OLS and 2SLS estimates of female labour force participation using son preference instruments for Chinese women.

	Two girls		Three girls	
	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
Nchild	-0.0015	-0.0593	0.0129	2.9564
	(0.0068)	(0.5969)	(0.0093)	(24.1013)
Nchild*Bumiputera	-0.0472***	-0.1986	-0.0545***	-3.1925
	(0.0070)	(0.7486)	(0.0097)	(25.4709)
Nchild * Chinese	-0.0632***	0.0120	-0.0505***	-3.0776
	(0.0086)	(0.6187)	(0.0122)	(24.6466)
Age	0.0119***	0.0406**	0.0120***	0.0009
	(0.0009)	(0.0203)	(0.0011)	(0.1189)
Momfirst	0.0116***	-0.0164	0.0103***	0.0304
	(0.0010)	(0.0182)	(0.0012)	(0.1929)
Boy-1	-0.0028	-0.0017	-0.0025	0.0028
	(0.0049)	(0.0056)	(0.0059)	(0.0415)
Boy-2	0.0007	-0.0011	0.0002	-0.0338
	(0.0049)	(0.0084)	(0.0059)	(0.2797)
Chinese	0.0142	-0.7224	-0.0604*	-0.5245
	(0.0190)	(0.5999)	(0.0322)	(3.4962)
Others	-0.0850***	-0.5975	-0.1178***	-11.9674
	(0.0239)	(2.3731)	(0.0382)	(96.1501)
Year 2000	0.0089**	-0.0172	0.0031	0.0481
	(0.0050)	(0.0181)	(0.0060)	(0.4059)
Constant	-0.1442***	0.3035	-0.1496***	0.5127
	(0.0238)	(0.4077)	(0.0309)	(4.7883)
Number of observations	34,310	34,310	22,608	22,608

Notes: Robust standard errors are in parentheses. Statistically significantly different from zero at the *0.1 level, **0.05 level and ***0.01 level. The covariates included are mother's age, mother's age at first birth, Boy-1, Boy-2, ethnicities of Chinese and Others, and Year 2000.

The OLS and 2SLS estimates of fertility for work participation for Chinese are shown in Table 7.20. The OLS estimates indicate that fertility has a negative effect on female labour force participation. The negative value is larger for lower birth parity. On the other hand, the results show that fertility decreases labour force participation for Bumiputera women by 25 percentage points. The negative effect for Chinese women is smaller at 4%. Both estimates are not significant. Finally, the analysis using three girls is not significant for both Bumiputera and Chinese women due to the large standard errors.

7.5 Discussions and conclusions

This chapter presented evidence for the effect of fertility on female labour force participation using data from the Population and Housing Census Malaysia for the years 1991 and 2000. In order to address the problem of omitted variable bias, the source of exogenous variation in family size is explored using three main instruments; multiple births, parental preference for mixed sibling-sex composition and son preference. Consistent with previous empirical findings (Angrist & Evans 1998; Karbownik & Myck 2016; Moschion 2013), the findings from the overall sample in this study confirmed that fertility has a negative causal effect on female labour force participation in Malaysia. The analysis using the multiple birth instruments show that the negative effect of fertility on female labour force participation is between 5 and 6 percentage points based on the models used. The twins at second birth estimate is comparable to the impact found in the developed countries such as the US (Angrist & Evans 1998; Vere 2011) and Australia (Moschion 2013). Meanwhile, the same-sex instrument indicates that fertility reduced female labour force participation by 15.5 percentage points. Again, this effect is comparable to that in the US and Australia (Angrist & Evans 1998; Moschion 2013).

The focus of this empirical analysis centres on the decision of parents who already have children but may decide to have more children. The findings in this chapter indicate that the negative effect of fertility on female labour force participation for unplanned births is smaller than planned births. A similar impact is found in the US (Angrist & Evans 1998) and in Australia (Moschion 2013). In general, the occurrence of twins is an unplanned additional child to the household that increases the quantity of childcare required by the family which subsequently raises the marginal value of time at home. In response, mothers may withdraw from the labour force or reduce the intensity of their work effort (Jacobsen, Pearce & Rosenbloom 1999). Moschion (2013) indicates that unpaid domestic work increases by about 4 to 5 hours per week with the twins instrument, while with the same-sex instrument there was no effect on domestic work. However, an unplanned birth increases family size and the direct cost of children. Assuming that families do not have savings, the unplanned birth of twins creates a need to work more. This possibly explains why the

negative effect of fertility on female labour force participation is small when compared to planned effects. Also, Angrist and Evans (1998, p. 471) explain that the effect of planned births can be large due to the age factor of children where younger children are negatively linked to female labour force participation. A third child born as a consequence of twinning will be closer in age to its siblings than a third child born for other reasons. The negative impact of fertility declines as the third child ages. Therefore, mothers with twin births tend to work more.

Angrist and Evans (1998, p. 471) consider the age of the children in examining the effect of twin births on labour supply and suggest that a third child born as a consequence of twinning will be older than a third child who is born for other reasons. This implies that if younger children have a more negative effect on female labour supply, then the negative effect of planned births on labour supply would be larger than unplanned births. However, closely spaced children may require more attention. In addition, an unexpected birth increases family size and the direct cost of raising a child which might induce a negative income effect that drives women with twin births to work more. The net effect, therefore, depends on the relative magnitudes of the two offsetting pressures.

In the main specification, where fertility is instrumented by same-sex children, the findings in this chapter indicate that the OLS estimates underestimate the negative effect of fertility on female labour force participation in Malaysia. This implies a case of self-selection into larger families where women who have a lower inclination to work may decide to have more children. In South Korea, a similar relationship was found where the OLS estimates of fertility on female labour force participation were significantly positive while the 2SLS estimates indicated significantly negative values (Nam 2010). It is assumed that working women tend to have more children as the level of household income might serve as a major determinant of the number of children in developing countries (Nam 2010; Priebe 2010). When women with a higher labour market attachment decide to have more children, the OLS estimates would understate the negative effect of the number of children on female employment (Karbownik & Myck 2016).

The key contribution of this chapter is the examination of the effect of fertility on female labour force participation according to ethnicity. Moschion (2013, p. 22) suggests that apart from institutional characteristics, the varying effect of fetility and female labour force participation could potentially be a result of cultural differences and varying institutional features. Thus, the impact of cultural differences is analysed in this present chapter against the backdrop of a heterogeneous population that share the same labour market institution.

In the heterogeneity analysis by ethnicity, the first-stage regressions indicate that the instruments used in this study are strong only for Bumiputera and Chinese women. In the main specification, when fertility is instrumented using the same-sex instruments, both ethnic groups indicate a preference for mixed sibling-sex composition, especially Bumiputera mothers. Having two boys or two girls increases the number of children for Bumiputera mothers by the similar proportions. On the other hand, Chinese women display a strong son preference. Although most 2SLS estimates indicate a negative effect between fertility and female labour force participation, the estimates are mostly imprecise due to large standard errors. In the analysis by ethnicity, Bumiputera women have a larger negative causal effect of fertility on labour force participation at 20.2 percentage points, when instrumented using the same-sex variable. The 2SLS estimates for Chinese women show a smaller and imprecise negative effects of 6.2 percentage points.

Previous studies have shown that the direct cost of children matters in analysing the link between fertility and female labour force participation (Priebe 2010; Rosenzweig & Wolpin 2000). In the case of developing countries such as Indonesia, families with tight budget constraints and more children have an incentive to search for employment. In this case fertility has a positive impact on female labour force participation, and this effect is even greater during economic crises (Priebe 2010, p.21). This implies that while women might find it easier to participate in the labour market when having fewer children, they might also lack incentive to find employment due to a relaxation in budget constraints (Priebe 2010).

Although the direct cost of children in Malaysia was not examined in this present study, the cost of clothing and schooling expenditure at secondary level or lower is non-trivial in the average Malaysian household budget. It is reported that the average monthly household expenditure on clothing and footwear increased gradually from RM41 in 1993/94 to RM75 in 2009/10 which is 3.5% and 3.4%, respectively of average monthly household expenditure (DOSM 2015). The average household expenditure on education increased from RM17 in 1993/94 to RM38 in 2004/25 and subsequently decreased to RM31 in 2009/2010 as a result of lower fees for primary and secondary education (DOSM 2015). This implies that the cost of raising children in Malaysia for an average family would be similar. However, if this cost is similar for all women, there would be no significant differences in the female labour force participation rate among the various ethnic groups.

Although many factors could impact the differences by ethnic group, the direct cost of childcare is considered first. The difference between the labour force participation of Bumiputera (majority Malay) and non-Bumiputera (Chinese and other ethnic groups) women in general can be attributed to the affirmative action program in the country. The Malaysian affirmative action program aimed to alleviate poverty, generate growth and increase education, labour market participation and ownership (Lee 2010). The Bumiputeras were accorded special privileges to education opportunities, training programs and scholarships. Direct affirmative action policies in education included the establishment of pre-university matriculation colleges for Bumiputera and quota systems and scholarships for university enrolment. This provided Bumiputera children more opportunities to acquire an education at a lower cost. Matriculation colleges and universities were heavily subsidised by the Government. Non-Bumiputera students who did not secure a place in local universities could still pursue higher education abroad or opt for private tertiary education, both of which are more costly (Lee 2010). With the increase in children's future education expenditure, non-Bumiputera mothers faced increasing pressure to work to meet the financial demands of the household. Meantime, the affirmative action practices were expected to reduce the pressure for Bumiputera women to work, especially when these benefits indirectly lowered the direct cost of children.

In general, educational attainment has increased for females of all ethnic groups in Malaysia suggesting a higher probability of labour force participation assuming that education and female labour force participation is positively related. However, Bumiputera women still have a tendency to stay at home and raise children. Larger family sizes indicate that, in aggregate, the cost of raising children is higher. At the same time, a lack of quality childcare facilities is also a major impediment to female labour force participation. Limited access to childcare and the high cost of formal childcare suggest that women who have more than one child might find it more cost-effective to stay at home and raise their children. This aligns with South Korea where, when the number of children increased from one to two, the increasing time needed for child caring causes women to participate less in the labour market (Nam 2010, p.345). Nonetheless, this should be interpreted with a caveat. When South Korean women have three children, the need for more income exceeded the time needed for child caring, therefore inducing women to participate more in the labour market (Nam 2010, p. 345). Furthermore, the opportunity cost for Bumiputera women to stay at home in terms of foregone income is lower when compared to the Chinese. The mean monthly salaries and wages for Malay Bumiputera women is RM1,920 while for Chinese women it is RM2,149 (DOSM 2013, p. 11).

The Bumiputera live in predominantly rural areas while the Chinese live in more urban areas. Job opportunities in rural areas and wage offers are on average lower than those in urban areas. Monthly salaries and wages for females in rural areas are lower as compared to urban area households at RM1,419 and RM1,945, respectively (DOSM 2013). In addition, rural dwellers often own the house they live in or live in ancestral homes. This lower cost of living in rural areas results in a relaxation of family budget constraints which reduces the need for women (especially those with children) to work outside the home.

The effect however cannot be viewed purely from a household cost-benefit perspective. Cultural norms may affect the labour force participation of women. The theoretical framework underpinning this chapter was outlined in Chapter 3, where according to Angrist and Evans (1996), by choosing a combination of work in the market, home production (including childcare) and leisure to maximise utility subject

to production technology and family budget constraints, the relationship between home production and the number of children can be determined. These changes consequently affect female labour force participation decisions. The effect of having more children impacts Bumiputera and Chinese women differently due to different tastes and preferences for work. Noor (1999) found that Chinese women tend to have a more positive attitude towards participating in the labour force compared to Malay Bumiputeras. The Malays are perceived to have more traditional attitudes towards gender role division within society which affects their child-rearing practices and labour market participation decisions (Aziz 2011). The Malay women are usually more family-oriented and therefore devote more time to their children. At the same time, they desire a larger family size as compared to the Chinese. Malay women might therefore participate less in the labour market as a result of carrying out more home production activities and having more children as implied in Angrist and Evans' (1996) utility model. Meanwhile, the Chinese, whose values are rooted in Confucianism, place greater emphasis on upward social mobility.

The effect of fertility on labour force participation is more negative for Bumiputera women when compared to non-Bumiputera women. While the Government has initiated many programs and reforms to increase female labour force participation in recent years, the generous affirmative action benefits might actually reverse the impacts of these programs. The ethnic heterogeneity of the impacts of fertility on female labour force participation should therefore be taken into account in the effort to increase female labour force participation in Malaysia.

The sizeable difference in female labour force participation following childbearing reported in this chapter between the Bumiputera and the Chinese has an important impact on the implementation of family-work policies designed to increase female labour force participation. While labour market institutions in developed countries provide mechanisms for labour market re-entry after a break for childbearing and child-rearing, such mechanisms are limited in Malaysia. The varied results from the empirical analysis between Bumiputera and non-Bumiputera women can help policymakers in drawing effective strategies to increase the rate of female labour

force participation in Malaysia. The policy implications of these findings will be discussed further in Chapter 8.

CHAPTER 8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

The thesis statement posed at the beginning of this study opined that if female higher educational attainment and a decline in fertility motivate Malaysian women into the labour force, as hypothesised in conventional economic theories, the combined effects of education and lower fertility should increase the rate of female labour force participation. The key findings in this thesis indicate that the rise in educational attainment has a positive causal effect on the female labour force participation rate. At the same time, fertility has a negative causal effect on female labour force participation. The decline in fertility therefore contributes to a rise in the female labour force participation rate. Notwithstanding this evidence, the rate of female labour force participation rose only moderately between 1970 and 2010. This could be attributed to the weaker pull of education into the labour market and a larger negative effect of having more children on female labour force participation.

The discussion in section 2.8 earlier highlighted the various policies and agendas implemented by the Malaysian Government since independence to increase female labour force participation. Although many policies and agendas were put in place to increase women's employment opportunities and improve gender equality, the female labour force participation rate increased only modestly between 1970 and 2010. The findings in this thesis potentially suggest that policymakers can give greater focus to policies related to education and work-life balance in order to further increase female labour force participation in the country.

Following this introduction, the key findings from the empirical analyses in the preceding chapters are highlighted in section 8.2. Section 8.3 discusses the policy implications of the findings in this study. Section 8.4 highlights the contributions of this present study while section 8.5 outlines some limitations of the study. Section 8.6 offers suggestions for future research.

8.2 Summary of key empirical findings

The main aim of this study is to identify the determinants of female labour force participation in Malaysia over the past decades, with a focus on the effects of education and fertility. By examining the data from the Population and Housing Census Surveys from various census years between 1970 and 2010, this thesis has systematically addressed the research questions raised in Chapter 1. A summary of the key findings is presented below.

8.2.1 Determinants of female labour force participation in Peninsular Malaysia

The purpose of the empirical analyses in Chapter 5 is twofold. First, the average marginal effects of female labour force participation were estimated using logit regression for the years 1970, 1980, 1991 and 2000 to identify the key determinants of female labour force participation in Malaysia and how the effects of the determinants change over time. In terms of the age variable, the marginal effect of labour force participation for prime age working females aged 25 to 34 and 40 to 49 years is small and negative and the effect has remained steady throughout the years examined when compared to the reference group aged 35 to 39. The probability of labour force participation for females aged 20 to 24 decreases significantly over the same period due to their delayed entry into the labour market. The marginal effect of labour force participation has also become more negative for women aged 50 to 54 years, signalling earlier retirement from the labour force. In terms of education, the marginal effects of labour force participation for women with at least secondary school education have decreased from 1970 to 2000 when compared to the reference group which is women with primary school education. Meanwhile, women with tertiary education are more likely to be in the labour market in 2000 than in 1970.

The results in the empirical analysis indicate that single women in general have higher labour force participation than married women. However, again, the positive effects have decreased over the years under examination. Further, in terms of household characteristics, women living in extended households are shown to participate more in the labour force and this factor became more important in 2000. The presence of family members is often seen to provide additional help to women in terms of household work and child caring activities. This is important considering

that it is the presence of children that reduces female labour force participation. In addition, a woman with a spouse present in the household is less likely to participate in the labour force.

A non-linear decomposition method was used to identify the extent to which the determinants in the model affect the change in the female labour force participation rate. Between 1970 and 2000, the female labour force participation rate has increased from 40.2% to 48.6%. The results from the Fairlie (1999; 2005) decomposition method indicate that the characteristics that contribute most to the rise in the female labour force participation rate between 1970 and 2000 are the increase in female educational attainment and the decline in fertility among women in Peninsular Malaysia. In summary, the results in this chapter suggest that the relatively stagnant female labour force participation in Malaysia could be attributed to a decline in the positive effect of education on female labour force participation and a larger negative effect of the presence of children on female labour force participation.

8.2.2 Higher education reform and female labour force participation

The impact of education on female labour force participation was further analysed in Chapter 6 by exploiting a reform in the Malaysian higher education system as a potential source of heterogeneity in tertiary educational attainment among females in Malaysia. The reform saw the rapid establishment of new higher education institutions, offering more places for students to pursue higher education. Students who could not obtain an offer from public higher education institutions now had options to pursue affordable tertiary education through gaining various tertiary qualifications offered by private institutions. Using DID analysis, the results in Chapter 6 show that the higher education reform has had positive and significant outcomes on female tertiary educational attainment. Higher education reform increases the educational attainment of the treatment group by 2.73 percentage points. Additionally, female labour force participation for the treatment group increases by 1.85 percentage points as a result of the higher education reform.

The reform in higher education was then used as an instrumental variable to identify the causal effect of education on female labour force participation. The results indicate that tertiary education has a positive causal effect on female labour force

participation. The 2SLS is large in magnitude, at 67.6%, and is statistically significant. Meanwhile, the OLS estimate of 29.2% suggests that the positive effect of education in underestimated. Although the positive causal effect of higher education on female labour force participation is intuitive, a lack of evidence in this area limits the comparison of the estimate obtained from the 2SLS analysis.

8.2.3 Fertility and female labour force participation

In Chapter 7, the effect of fertility on female labour force participation was examined using the instrumental variable strategy. Sources of exogenous variation in family size were explored using three main instruments, namely multiple births, parental preference for mixed sibling-sex composition and son preference. The empirical analysis confirmed that fertility has a negative causal effect on female labour force participation in Malaysia. The findings from the instrumental variable strategy using twins instruments reduces female labour force participation by 6 percentage points. The 2SLS estimate using the same-sex instrumental variable indicates that having an additional child for mothers with two or more children results in a reduction of female labour force participation by 15.5 percentage points. This implies that the effect of fertility on female labour force participation is greater for planned births than unplanned births. In the son preference analysis, the 2SLS estimates show that fertility reduces female labour force participation by 15.5 and 0.4 percentage points for two girls and three girls, respectively. The estimate is significant only for the two girls instrument.

This chapter also presents a heterogeneity analysis of fertility on female labour force participation by ethnicity. The negative causal effect of fertility on female labour force participation estimated using twin births as the instrumental variables for Bumiputera and Chinese women indicates mixed results. The 2SLS estimates using sibling-sex composition as instrument show that the negative effect for Bumiputera women is statistically significant, which is 20.2 percentage points lower than their peers. This is larger than the negative effect for Chinese women, where twin birth reduces labour force participation by 6 percentage points. In addition, the analysis in Chapter 7 suggests a strong son preference exists among Chinese women. Although the 2SLS estimates using son preference show that there is a negative effect of fertility on female labour force participation, the effect is not significant. The

heterogeneity analysis by ethnicity indicates that being Bumiputera has a more negative effect on labour force participation than being non-Bumiputera. These findings imply that the impact of fertility on female labour force participation is affected by cultural background where the emphasis on family and work can vary for women in different sub-population groups.

8.3 Policy implications

The key findings in this study indicate that education and fertility are important determinants of female labour force participation decisions in Malaysia. These findings provide important policy implications indicating that policymakers should give greater emphasis to policies related to education and work-life balance in order to encourage labour force participation among women in Malaysia.

The Malaysian Government aims to turn Malaysia into a fully developed country by the year 2020, which requires the availability of more knowledgeable workers. As primary and secondary education becomes universally available in Malaysia, the Government's efforts to increase tertiary educational attainment during the period studied, between 2000 and 2010, have produced a significant increase in the number of tertiary graduates. The educational attainment of females has increased during this period. The results indicate that the higher education reform played an important role in increasing tertiary educational attainment in Malaysia. The higher education reform in Malaysia increased educational attainment of females through increased access to higher education in both public and private institutions. The findings in this study indicate that the Government should continue to improve access to higher education for the population in general. At the same time, the quality aspect of higher education should not be compromised. While it can be expected that more highly educated workers have a higher probability of participating in the labour market, it is also important to take into account the macroeconomic conditions of the labour market. Furthermore, continuous assurance on the quality of higher education is necessary to ensure that students are equipped with knowledge, skills and core transferable competencies relevant in the ever-changing labour market.

Although better educated females in Malaysia are found to participate more in the labour market, the data used in this study shows that there is a changing trend in the

demographic variables of the female population. The composition of single females has increased over the decades analysed in this study. This implies that, as educational attainment of females increase, the probability of delays to marriage and having children increases. A recent report from the United Nations (2015) indicates that the fertility rate in Malaysia is projected to fall to 1.90 children per household in the period of 2015 and 2020. This is slightly lower than the rate in 2012, which was 2.1 children. Malaysia has to maintain a population of not less than 30.5 million for healthy domestic consumption growth; therefore, the Government has encouraged families to have at least four children. However, females with more children, especially younger children, is shown to work less. Thus, while on one hand, the Malaysian Government aims to increase female labour force participation, the social policy target (to encourage families to have more children) can be seen to have an opposing effect on female labour force participation.

The effect of fertility on female labour force participation analysed in this thesis uses data from the years 1991 and 2000. During this period, the length of maternity leave for the public sector was increased and paternity leave was introduced. In 2007, the Government implemented flexible work arrangement, which allowed women the flexibility to work and meet family needs. In the same year, the provision of child care subsidy for public sector employees was also implemented. While this move helped ease the financial burden for low-income workers, it may not necessarily increase female labour force participation in a significant way as the benefits are offered only to public sector employees. Although this move may encourage more females to enter the labour market, employment in the public sector is limited. Thus, at the same time, the Government encouraged the establishment of childcare centres generally, especially in private sector workplaces where a 10% tax exemption will be given on the cost of building the childcare centres for a period of 10 years.

The recent introduction of the regulation for part-time workers is also hoped to encourage the entry of women in the labour market. However, at the present time, part-time work arrangement is not a popular option in Malaysia. Other flexible working arrangements in Malaysia including working from home, teleworking and career break are more common in multinational companies in Malaysia

(Subramaniam, Overton & Maniam 2015). Therefore, it would take time before businesses can change their workplace culture and part-time work become normalised. Nevertheless, the Government plays an important role to encourage the incorporation of part-time work into the Malaysian labour market. Subramaniam, Overton and Maniam (2015, p. 37) finds that women with higher education are more interested in flexible working arrangements. Such arrangements would therefore also encourage women with higher education to participate in the labour force.

As discussed earlier in the literature review, with the right measures, the goals of high participation and high fertility can be achieved, as evidenced in some European countries. This requires a continuous development of policy design and implementation that encourages work and family life balance. The relevant areas include childcare, family-friendly workplaces, and more universal and generous paid maternity and paternity leave. In terms of work arrangements, the options of part-time employment, job-sharing options and flexible work arrangements have recently been implemented in Malaysia. To date, the implementation is still limited. Besides that, the Government can also provide monthly allowance to help ease the cost of child care. Considering that female labour force participation rate in Malaysia is relatively low compared to neighbouring ASEAN countries, there is still scope for further increase in the participation rate.

8.4 Contributions of the study

Based on the aims and objectives of this study outlined in the previous sections, this study has three significant contributions to the field of female labour force participation and labour economics in general. The stagnant rate of female labour force participation observed in Malaysia is not unique to this country. Other developing countries with evidence of high female educational attainments, such as Indonesia (Priebe 2010), India (Kapsos, Silberman & Bourmpoula 2014; Klasen & Pieters 2015), Turkey (Karaoglan & Okten 2015) and Sri Lanka (Gunatilaka 2013; Gunawardena 2015), are among many that have experienced a similar phenomenon. In a broader perspective, a report from the IMF indicates that while women now represent 40% of the global labour force (World Bank 2011), the global female labour force participation rate has stagnated at around 50% over the past two decades (Elborgh-Woytek et al. 2013).

Therefore, first, by using Malaysia as a case study, the empirical tools employed in this thesis may provide a general blueprint applicable to any country that aims to understand changes in the pattern of their female labour force participation rate. A decomposition analysis is useful as a starting point to identify to what extent the various determinants of female labour force participation affect the trend in a particular country. In the case of Malaysia, the decomposition analysis allows the contribution of each determinants of female labour force participation to be quantified separately. Consequently, this allows policymakers to craft effective policies to increase the level of female labour force participation, which is deemed to be the catalyst of more desirable growth for a nation.

Second, to the best of the author's knowledge, this study is one of the few studies that provides evidence for the causal impact of higher educational attainment on female labour force participation by exploiting an exogenous variation in education due to a reform in higher education. This is important for two reasons - there is a rapid expansion of higher education around the world and the educational level of females in most countries has increased over recent decades.

Third, in examining the link between fertility and female labour force participation, the analysis in this thesis has dealt with the ethnicity variable. The heterogeneity of the population allows the effect of fertility on female labour force participation to be compared between ethnicities existing within the same labour market institution.

In the context of Malaysia, this study addresses potential endogeneity issues in education and fertility on female labour force participation, which to date, have been limited. This is important given that most central research questions in labour economics are plagued by econometric concerns related to the simultaneous determination of individual decisions (List & Rasul 2011). In the case of this study, the education and labour force participation decisions could be jointly determined. A similar issue was also found between fertility and female labour force participation decisions. Although field experiments have been popularly used in recent labour economic literature to examine causal effects on economic outcomes, the strategy has not been widely explored in Malaysia. The empirical analyses in this thesis

therefore advance the literature of female labour force participation in Malaysia in this regard so that the evidence is comparable to the burgeoning literature on field experiments in labour economics at the international level.

8.5 Limitations of the study

Although this study is relevant and has its empirical merit, there are several limitations that could be considered in future research on female labour force participation in Malaysia. The limitations in this study arise mainly from data limitations. The dataset used in this study provides information on labour force participation and employment status. However, information on earnings and hours of work, for example, was not available in the dataset. Therefore, the choice of labour market outcomes in this study was limited to labour force participation.

Next, the dataset used contains rich information on demographic and family characteristics, such as information on spouses and children. However, the more recent datasets, such as the 2010 census, lack the information necessary to link household members, especially children to mothers for example. While fertility is an important determinant of female labour force participation decisions, it was not possible to examine this effect in more recent times. This data limitation allows the analysis to be conducted only up to 2000.

The empirical analysis of the impact of the higher education reform in this thesis focused on the quantity of education. However, with increasing access to tertiary education worldwide, including in Malaysia, a sole focus on quantity possibly distorts policies and leads to inefficient allocation of resources in the investment of education. The measure of quality should be taken into consideration as higher quality education generally translates into greater labour market opportunities and higher earnings for individuals over their lifetime.

8.6 Areas for future research

The findings and limitations of the current research on female labour force participation in Malaysia provide directions for future research. The empirical analyses in this study focus primarily on female labour force participation decisions. While it is commonly asserted that labour supply responses at the extensive margin

(participation) are much greater than at the intensive margin (hours), analysing the change in hours of work is equally important. A woman who is a participant in the labour market could potentially be overworked or underworked, which leads to disutility. Therefore, future studies could consider using hours of work as the dependent variable. This would be insightful, especially with the Malaysian Government's proposal to introduce more part-time work arrangements in the country.

The literature has also shown that the participation decisions of females are often found to be related to their life course events, such as marriage and childbearing. By looking at how the participation decisions of females change over their lifecycles, the changing impact of education and fertility as well as other variables, such as potential non-labour income (husband's earnings) and living arrangements, can also be examined. Therefore, future research could examine decisions on female labour force participation in Malaysia from a lifecycle perspective.

The Malaysian Government has introduced many policies to encourage female labour force participation in the Tenth Malaysia Plan (2011-2015) that are beyond the scope of the period analysed in this study. The gradual increase in the female labour force participation rate in Malaysia between 2011 and 2015 coincides with the introduction of the Work Regulation for Part-time Workers in 2010, possibly suggests that, similar to the phenomenon observed in developed countries such as Australia, Malaysian women who found it difficult to combine work and family over the past decades, are responding positively to this move. However, until further data are available, it is still too early to reach any conclusions. This is also due to the fact that in the same period, the Minimum Wage Order which was introduced in 2012 affected many low-income workers in a variety of sectors including agriculture, manufacturing and services. This prematurely suggests that either one of these important policies, or indeed both policies, could have a significant impact on female labour force participation.

The effort to increase female labour force participation continues at the time of the writing of this thesis. The impact of part-time work regulations, minimum wages and

other policies on female labour force participation could be investigated as data becomes available. Finally, while the results of this study show that education reform has a positive causal effect on female labour force participation, the effect estimated using the instrumental variable approach cannot be effectively compared due to the limited number of other studies in this area. Thus, similar studies could be conducted in other countries to provide additional evidence to the literature in this field.

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