THE IMPACT OF COHORT SIZE ON LABOUR FORCE PARTICIPATION IN CANADA

by

Kangyu Qiu

Bachelor of Economics, Shandong University of Finance and Economic, 2016

A Report Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Arts

in the Graduate Academic Unit of Economics

Supervisor: Weiqiu Yu, PhD, Dept. of Economics

Examining Board: Yuri V. Yevdokimov, PhD, Dept. of Economics, Chair

David Murrell, PhD, Dept. of Economics

Murshed Chowdhury, PhD, Dept. of Economics

This report is accepted by the Dean of Graduate Studies

THE UNIVERSITY OF NEW BRUNSWICK

September, 2017

Abstract

Due to the baby boom in the 1950's, decreasing birth rate after the baby boom and long-run decreasing mortality rates, the cohort size of each age group around the world has changed considerably during the past three decades. Fair and Dominguez (1991) explored the effects of cohort size on labour force participation in the United States and found that the relationship between cohort size and labour force participation is positive for men and negative for women. This report adopts a similar approach and uses long panel data set to examine the relationship between cohort size and labour force participation from 1983 to 2015 in Canada. Results show that cohort size has effects on the labour force participation for some cohorts.

Acknowledgement

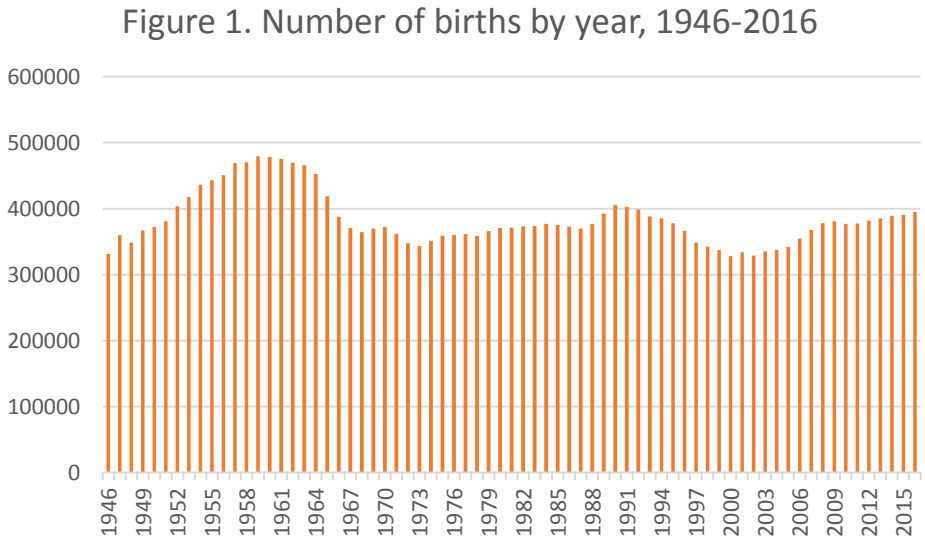
I would like to thank my supervisor Dr. Weiqiu Yu, for her expert guidance, suggestions, supervision and support. I would also like to thank the other members of my committee, Dr. David Murrell and Dr. Murshed Chowdhury, for their very useful comments as readers.

I also appreciate my family members and friends for their support. Without their strong support, I could not complete my MA report.

Table of Contents

I. Introduction

War is the natural enemy of the population. After the World War II, the large baby boom is the most striking feature throughout most of the world. The baby boom is a phenomenon in which the birth rate increases significantly at certain times and in specific areas. The baby boom began from the post-war 1940's, and lasted until the early 1960s, since then began to decline.

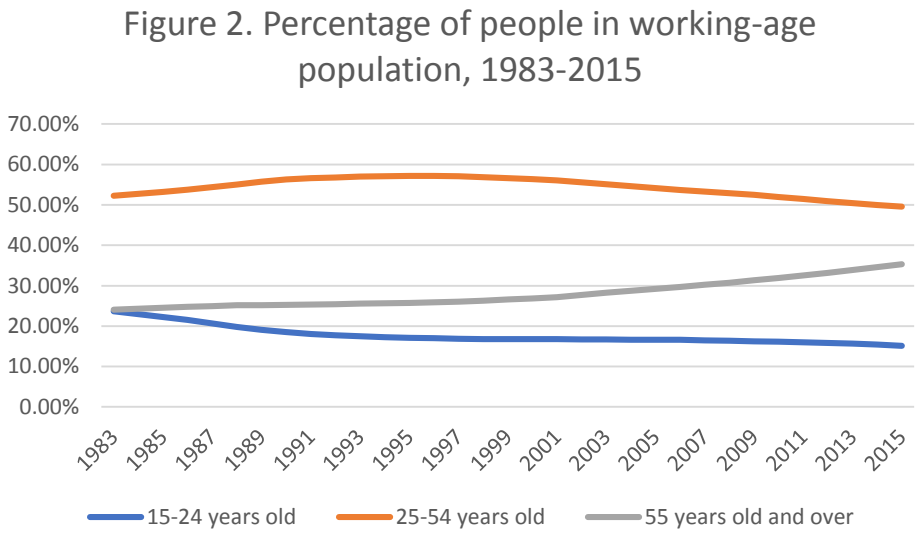


Source: Statistics Canada. CANSIM Table 051-0004- Components of population growth, Canada, provinces and territories, annual (persons).

Figure 1 shows the number of births by year from 1946 to 2016 in Canada. As can be seen from Figure 1, after the World War II, the number of births in Canada rose dramatically from about 0.33 million in 1946 to about 0.48 million in 1959; then fell back to about 0.34 million in 1973.

Furthermore, the baby boom influenced the percentage of people in the working-age (≥ 15 years) population. Figure 2 shows cohort size since 1983 in the working-age

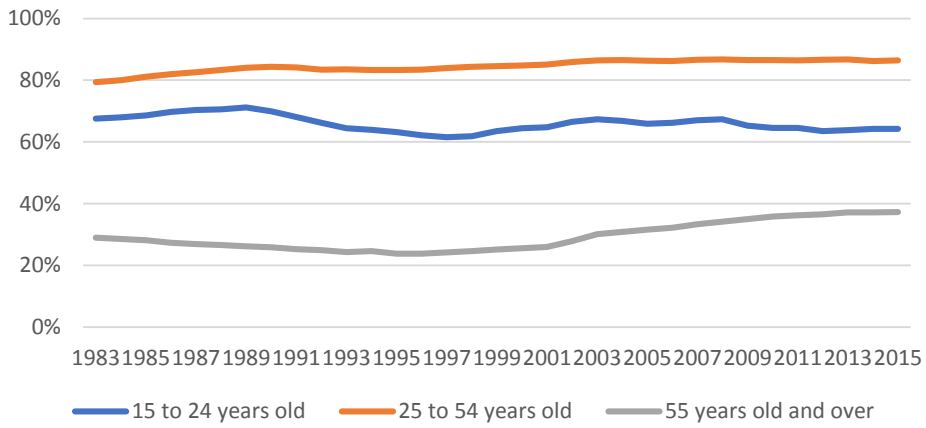
population in Canada:



Source: Statistics Canada. CANSIM Table 051-0001-Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual (persons unless otherwise noted).

In 1983, the percentage of prime-age (25-54) people was around 52%, whereas by 1996, it increased to about 57.1%. Since 1997, the percentage of prime-age people had decreased steadily. The percentage of 15 to 24 years old people was about 23% in 1983. However, by 2015, the percentage was only about 15%. The percentage of 55 years and over was around 23% in 1983. By 2015, the percentage was around 35%. According to the standard economic theory, there are four factors that can affect economic development of a country or an area: human resources, natural resources, capital, and technology. Paul Samuelson (1948) named the four factors as wheels to drive economic growth. Labour force participation is a key indicator of human resource as it reflects the percentage of the working-age population who are either employed or actively looking for jobs which directly impact economic growth.

Figure 3. Labour force participation rate, 1983-2015



Source: Statistics Canada. CANSIM Table 282-0002 - Labour force survey estimates (LFS), by sex and detailed age group, annual (persons unless otherwise noted).

Figure 3 shows labour force participation rates from 1983 to 2015, in Canada, for those major age cohorts. The labour force participation of prime-age people in 1983 was about 79%. However, by 2016, the labour force participation rate of prime-age people increased to about 86%. The labour force participation rate of people 15 to 24 years old reached its highest point in 1989, about 71%. By 2015, it fell to about 64%. The labour force participation rate of people 55 years old and over declined to its lowest point in 1998, around 24%. Whereas by 2015, it increased to 37%.

Previous studies have shown that the aggregate labour force participation rate could be affected by the cohort size. Furthermore, the effects of the cohort size on the total labour force participation are very different for different age and gender groups.

To understand the relationship between cohort size and the total labour force participation rate in America, Fair and Dominguez (1991) explored the effect of cohort size on the

labour force participation of the United States. The link between cohort size and labor force participation is that the cohort size can affect the average hourly wages (Easterlin, 1987) which in turn affects the labour force participation. According to Easterlin (1987), a large cohort size usually means a low average hourly wages. The average hourly wages can affect labor force participation directly. Fair and Dominguez (1991) found the relationship between cohort size and labour force participation is positive for men and negative for women.

The purpose of this MA report is to examine the effects of age cohort changes of the population on the labour force participation rate for Canada, using a method similar to that by Fair and Dominguez (1991). Our results show that cohort size has negative effects on the labour force participation for both prime-age men and women in Canada.

The rest of the report is organized as follows: Chapter II contains the literature review; Chapter III explains the data and methods; Chapter IV presents the results; and Chapter V concludes.

II. Literature Review

The labour force participation rate is the percentage of the population that is either employed or unemployed. As one of the most important economic indicators for economic growth (Bloom and Williamson 1998), the labour force participation rate has been extensively researched in the literature.

Litzinger and Dunn (2015) studied the decline of the labour force participation in the United States since 2000 and argued that "if the decline in the labour force participation

persists, it will exacerbate the polarization of incomes reflective of America, without the positive effects of economic growth." (pp 2259)

Guo and Che (2011) provided evidence to support the importance of the labour force participation on economic growth by using a time series data set from 1990 to 2009 in China. By doing causal relation tests to labour force participation, age structure, and economic growth, they found the labour force participation has a positive effect on economic growth. In the literature on the determinants of labour force participation, many factors have been identified to affect the decision of an individual to take part in labour market. Mincer (2001) concluded the major factors are as follows: wages, the income level of the household, life cycle, business cycle, education, and economic development.

Strand and Dernburg (1964) introduced three hypotheses concerning the labour force participation: "the discouraged worker", "the additional worker" and "the offset" hypothesis. The "discouraged worker" hypothesis holds that when economic activity declines, workers become discouraged and leave the labour force. The "additional worker" hypothesis maintains that the labour force participation increases at low levels of economic activity when "secondary" workers enter the labour force under the pressure of the loss of work by the "primary" workers. The "offset" hypothesis asserts that any inflow of additional workers is offset by an outflow of discouraged workers so that, on balance, the over-all participation rate remains virtually constant, or that at least there is no clearly discernible cyclical relationship.

Liu (2014) examined the relationship between unemployment and labour force participation rates in Japan from a regional perspective using data from 1983 to 2010 and

nine regions in Japan. Based on the conventional univariate co-integration tests and Westerlund (2006) panel co-integration tests, Liu found a long-term relationship between unemployment and labour force participation in several regions in Japan.

Bullard (2014) investigated the relationship between the unemployment rate and the labour force participation rate in the United States and found that unemployment was not as a reliable indicator of macroeconomic performance as it may have been in the past. He found while the unemployment rate has declined in recent years, labour force participation has also been declining.

Beaudry and Lemieux (1999) analyzed the labour force participation of women aged 25 to 64 from 1976 and 1994 in Canada. One striking feature of the Canadian labour market during the 1970s and 1980s was the sustained growth in the labour force participation of women aged 25 to 64. But an equally striking development was the stagnation in the labour force participation of women aged 25 to 64 in the 1990s. The authors used a cohort analysis through data from 1976 to 1994 to study the phenomenon. Their methodology involved isolating the effect of three separate factors on the labour force participation rate of women. One factor is the set of the macroeconomic effect that by definition is common across all age and sex cohorts, such as insurance system. The second factor is the age or life cycle effect, which shows how the cohort's participation rate changes as its members' age. The third is the cohort specific effect, which shows differences between cohorts for a given age and macroeconomic effect. For example, if the cohort that entered the labour force in 1976, and has a participation rate 10 per cent higher than that of the cohort that entered the labour force in 1966 at the same age, the 1976 cohort is said to exhibit a 10 per cent cohort effect relative to the 1966 cohort under

similar macroeconomic conditions. This study found the cohort specific effect can explain the increase in the labour force participation of women aged 25-64 in the 1970s and 1980s.

Julie (2005) divided all factors that can affect the female labour force participation into observed factors and unobserved factors and found even though the observed factors such as the weaker positive pull of education into the labour market and weaker labour market conditions contributed to the decline in the labour force participation rate between 2000 and 2004, among women ages 25 to 54, unobservable factors such as women's response to changes in non-labour income, marriage, children and labour market conditions had stronger impact on the decline in labour force participation rates over this time period.

Using data from the United States, Canada, and the United Kingdom, Schirle (2008) found that the increase in the labour force participation rates of older men since the mid-1990s could be explained by the increase in the participation rates of women. Because wives' leisure time is complementary to the leisure time of their husband, as evidenced by the positive effect of wives' participation on husbands' participation decisions.

Moffitt (1987) focused on the relationship between social security and labour force participation in the United States and found that social security had a negative effect on the labour force participation. But Aaron (1982) argued that the evidence used to support the relationship between social security and the labour force participation was insufficient.

Blau and Robins (1986) analyzed the effects of welfare programs on the labour market by utilizing individual labour market histories to estimate transition rates among various

labour market states and by investigating the effect of welfare programs on the various transition rates. Their empirical results showed that welfare programs had a significant negative effect on transitions out of employment, including both unemployment and out-of-the-labour-force.

Hansen and Liu (2015) also looked the effect of welfare on the labour force participation using data for Quebec since 1989 and found that not only the welfare but also the existence of heterogeneity in response to the welfare had a negative effect on the labour force participation among single men. That means different people will have different responses to the social welfare changes. For example, the effect is smaller for high school graduates than for high school dropouts. Moreover, the effects are largest among those with lower income.

Macunovich (2012) examined the effects of relative cohort size and relative income on married women's labour force participation in the United States, from 1968 to 2010, and found that income has a significant positive effect on the labour force participation of white married women. However, for African American and most of other non-white women, the estimated effects of income are negative. Furthermore, Macunovich also examined the effect of relative cohort size on women's starting wage relative to that of prime-age males. He found the effect of relative cohort size on women's relative wage is negative.

Most studies on labour force participation in the literature assume that the population was homogeneous. Fair and Dominguez (1991) introduced cohort size to their study that allows them to analyze the effects of cohort size on the macro variables, including the

labour force participation rate. Their study used a time series data set, for the United States over 30 years. In their study, all workers were divided into several groups by age and gender. They mainly focused on prime-age (25-54) groups. They found that the labour force participation rates of both prime-age men and women were affected by the percentage of prime-age people in the total population. The relationship between the cohort size and the labour force participation was positive for men and negative for women. Furthermore, the authors explained the relationship by using the substitution and income effect, and stated: "If the substitution effect dominates, it means wage rate has a positive effect on labour force participation. If the income effect dominates, it means wage rate has a negative effect on labour force participation." They found that the income effect dominates for prime-age men and the substitution effect dominates for prime-age women.

Easterlin (1987) and Berger (1985) showed that larger cohorts face a lower wage rate on average, because of the increased competition for jobs. If this is the case, then the size of the cohort should affect the labour force participation of individuals in the cohort. Easterlin also suggested that the baby-boom generation delayed marriage and children, and increased labour participation of young women in response to lower average wages. So, the results of Fair and Dominguez support Easterlin's hypothesis that relative wages vary inversely with cohort size but fail to support his other hypothesis that income effect dominates for women.

In summary, the literature has examined many factors influencing the labour force participation in an economy. Among these factors, cohort size has been identified by many as an important determinant of the labour force participation. While most studies

assumed homogenous population, Fair and Dominguez (1991) assumed that population is not homogenous and constructed an age structure variable by dividing all population into six groups. In this MA report, we adopt a similar approach to examine the relationship between cohort size and the labour force participation in Canada from 1983 to 2015.

III. Data and Methods

1. Methodology

Different from Fair and Dominguez (1991) who used a time series data set, we use a panel data set from 1983 to 2015 for more efficient estimates and richer results.

For the dependent variable, we use the labour force participation rate. As for the principal independent variables, we use the relative cohort size. According to Fair and Dominguez (1991), to pick up the effects of last period's decisions, we include the lagged labour force participation rate. In general, if people were in the labour market last period, they are more likely to stay in the labour market. The expected sign of the coefficient for the lagged labour force participation rate is positive. According to Strand and Dernburg (1964), we also include the unemployment rate. Similar to the "discouraged worker", "additional worker" and "offset" hypothesis, if the sign of the coefficient for the unemployment rate is positive, the "additional worker" effect dominates; if it is negative, the "discouraged worker" effect dominates; if it is insignificant, the "offset" hypothesis holds. Similar to Fair and Dominguez (1991), we also include real earnings. If the coefficient of real earnings is negative, income effect dominates. That means if real earnings increase, people would like to spend less time on working and spent more time on leisure. If the coefficient is positive, the substitution effect dominates. That means if

real earnings increase, people would like to spend more time on working to earn more money and reduce their time on leisure. Following Moffitt (1987), we use the real transfer income from the general government to pick up the effects of social security. As we mentioned in the literature review, the coefficient for the real income from the general governments is expected to be negative. We also include real income from corporations, because “income from corporations" are essentially non-government pension benefits. Real income from corporations is different with real earnings. Real income from corporations here is a kind of secondary distribution, such as pensions from corporations. Only people who have a job can get this income. When people realize that they can get an abundant pension and do not worry about food when they retire, people would more likely to go into the labor market. The coefficient for the real income from corporations is expected to be positive. Adding time trend instead of every year’s time dummy variables to our model was due to two considerations: first, it saves some degrees of freedom (Chen, 2010); second, the time trend variable could pick up some unobserved effects on the labour force participation, such as “women’s movement”, attitudes towards education, etc. However, there are also some disadvantages on using time trend instead of time dummy variable. For example, using time trend may not capture the structure break, even though there is no obvious structural break.

A key feature of this study is to assume that population is not homogeneous. So we divided all the population into six groups by age and sex: 15 to 24 years’ old men, 15 to 24 years old women, 25 to 54 years old men, 25 to 54 years old women, 55 years old men and over, and 55 years old women. Additionally, we assume that there is no perfect substitution across age-groups in the labour market and run separate regressions for each

group. The thoughts of variable selection start from general to specific. So we use the same variables for all groups.

The estimated equation is:

$$LFP_{it}^{j} = f\ (L.LFP_{it-1}^{j}, UE_{it}^{j}, IC_{it}, IG_{it}, W_{it}, Wp_{it}^{j}, T) \qquad (3.1)$$

Where: $LFP_{it}^{j} =$

$the\ labor\ force\ participation\ rate\ in\ group\ j, province\ i\ and\ year\ t,$

$L.LFP_{it-1}^{j} = the\ labor\ force\ participation\ rate\ in\ group\ j, province\ i\ and\ year\ t - 1,$

$UE_{it}^{j} = the\ unemployment\ rate\ in\ group\ j, province\ i\ and\ year\ t,$

$IC_{it} = the\ real\ income\ from\ corporations\ in\ province\ i\ and\ year\ t,$

$IG_{it} = the\ real\ income\ from\ government\ \ in\ province\ i\ and\ year\ t,$

$W_{it} = the\ real\ average\ hourly\ earnings\ in\ province\ i\ and\ year\ t,$

$Wp_{it}^{j} = W\ times\ the\ proportion\ of\ people\ in\ group\ j, province\ i\ and\ year\ t,$

$T = time\ trend.$

Although most of the variables in the equation are disaggregated by age and sex, the real average hourly earnings data are typically not available on an age-sex specific basis. Statistics Canada only provides the age-sex specific data for average hourly wages from 1997 onwards. The aggregate real average hourly earnings are used in place of the more

specific but unobserved real average hourly earnings of the particular age-sex group. However, Easterlin (1987) showed that real average hourly earnings relevant to one age group are proportional to the aggregate real average hourly earnings. So, in this MA report, we follow the hypothesis of Easterlin (1987) and construct the following variables:

$$W_{it}^{j} = \alpha_j W_{it},$$

$$W_{it}^{j}/W_t = \alpha_j.$$

Where: $W_{it}^{j} = the\ real\ average\ hourly\ earnings\ in\ group\ j, province\ i\ and\ year\ t.$

The Easterlin hypothesis also suggested that α_j is a negative function of the percentage of people in age-group j (p_{jt}) in the total population. Thus,

$$W_{it}^{j}/W_t = \alpha_j = \gamma_0 + \gamma_1 p_{it}^{j}, \quad \gamma_1 < 0$$

$$W_{it}^{j} = \gamma_0 W_t + \gamma_1 p_{it}^{j} W_t.$$

So, Equation 3.1 becomes:

$$LFP_{it}^{j} = f\left(L.LFP_{it-1}^{j}, UE_{it}^{j}, IC_{it}, IG_{it}, W_{it}, Wp_{it}^{j}, T\right) \qquad (3.2)$$

What to be tested are whether if Wp_{it}^{j} is correlated with LFP_{it}^{j} and whether the relationship is negative or positive.

Table 3.1: Fisher-type unit-root test

H_0: All panels contain unit root	Number of panels: 10
H_1: At least one panel is stationary	Number of periods: 33
AR parameter: Panel-specific	Asymptotics: T -> Infinity
Panel means: Included	Cross-sectional means removed

Variable	**Statistic (Inverse chi-squared)**	**p-value**
LFP^1 (%)	60.1353	0.0000
LFP^2 (%)	37.8965	0.0091
LFP^3 (%)	54.3389	0.0001
LFP^4 (%)	33.5615	0.0292
LFP^5 (%)	61.5086	0.0000
LFP^6 (%)	57.7282	0.0000
UE^1 (%)	85.3568	0.0000
UE^2 (%)	82.0963	0.0000
UE^3 (%)	82.5754	0.0000
UE^4 (%)	58.6650	0.0000
UE^5 (%)	70.1732	0.0000
UE^6 (%)	85.4201	0.0000
IC ($)	44.3225	0.0014
IG ($)	58.9244	0.0000
W ($)	55.9103	0.0000
Wp^1 ($*%)	64.6529	0.0000
Wp^2 ($*%)	69.7855	0.0000

Table 3.1: continued

H0: All panels contain unit root	Number of panels: 10
H1: At least one panel is stationary	Number of periods: 33
AR parameter: Panel-specific	Asymptotics: T -> Infinity
Panel means: Included	Cross-sectional means removed

Variable	**Statistic (Inverse chi-squared)**	**p-value**
Wp^3 ($*%)	40.7423	0.0040
Wp^4 ($*%)	40.2067	0.0047
Wp^5 ($*%)	40.2534	0.0046
Wp^6 ($*%)	40.1727	0.0048

Table 3.2: Levin-Lin-Chu unit-root test

H_0: Panels contain unit root	Number of panels: 10
H_1: Panel are stationary	Number of periods: 33
Cross-sectional means removed	Asymptotics: root (N)/T -> 0
AR parameter: Common	
LR variance: Bartlett kernel, 10.00 lags average (chosen by LLC)	

Variable	**Statistic (Adjusted t*)**	**p-value**
LFP^1 (%)	-3.51352	0.0002
LFP^2 (%)	-3.7389	0.0001
LFP^3 (%)	-3.3509	0.0004
LFP^4 (%)	-4.8090	0.0000
LFP^5 (%)	-2.0843	0.0186
LFP^6 (%)	-3.7015	0.0001
UE^1 (%)	-3.3438	0.0004
UE^2 (%)	-3.5462	0.0002
UE^3 (%)	-2.3234	0.0101
UE^4 (%)	-3.0570	0.0011
UE^5 (%)	-1.3400	0.0901
UE^6 (%)	-2.4388	0.0074
IC ($)	-2.1852	0.0144
IG ($)	-1.5711	0.0581
W ($)	-2.8165	0.0024
Wp^1 ($*%)	-1.7167	0.0430
Wp^2 ($*%)	-1.8487	0.0323

Table 3.2: continued

H_0: Panels contain unit root	Number of panels: 10
H_1: Panel are stationary	Number of periods: 33
Cross-sectional means removed	Asymptotics: root (N)/T -> 0
AR parameter: Common	
LR variance: Bartlett kernel, 10.00 lags average (chosen by LLC)	

Variable	**Statistic (Inverse chi-squared)**	**p-value**
Wp^3 ($*%)	-2.0788	0.0188
Wp^4 ($*%)	-1.5779	0.0573
Wp^5 ($*%)	-1.8166	0.0346
Wp^6 ($*%)	-2.7212	0.0033

Before doing the regression analysis, we conducted some unit-root tests on the variables since non-stationary panel data may lead to spurious regressions and misleading statistical inference. In this study, the Fisher-type test based on augmented Dickey-Fuller (Choi, 2001) and Levin-Lin-Chu unit-root test are used to determine if the variables are stationary. The results in Table 3.1 and 3.2 show that the hypothesis of a unit root is rejected for all the variables at the 10% level of significance.

Since the model is a dynamic long-panel data model, using classical linear regression model leads to biased estimates (Chen 2010). Therefore, the least squares dummy variable corrected (LSDVC) is used in this study. According to Kiviet (1995), and Judson and Owen (1999), for a dynamic long-panel data set, the results of their Monte Carlo studies show that the LSDVC is better than the difference General Moment Methods (GMM) and system GMM in both standard error and root-mean-square error (RMSE), even though GMM can address the problem of endogeneity by including instrumental variables, which the LSDVC cannot. We have to make a tradeoff between the two methods and we selected LSDVC

As to the initial estimator, the system GMM estimator is used. This means we correct the bias based on the system GMM estimator (also called Blundell-Bond estimator). The accuracy of the approximation is up to O ($n^{-1}T^{-3}$). The repetitions of calculating a bootstrap variance-covariance matrix for LSDVC is 50 (Chen 2010). As a check of robustness, we also break the sample in 2000 and run separate regressions.

2. Data

The data used in this study is a dynamic long-panel data set consisting of 10 Canadian provinces from 1983 to 2015 for the following two reasons: 1) the data for average hourly earnings are available only from 1983 to 2015; and 2) the percentage of prime-aged workers started to rise from the 1980s due to the baby boomers going to their prime-age.

Labour force participation rates and unemployment rates for ten provinces are from Statistics Canada, CANSIM Table 282-0002 - Labour force survey estimates (LFS), by sex and detailed age group, annual (persons unless otherwise noted).

The data for average hourly earnings for ten provinces come from two tables. From 1983 to 2000, the data are from Statistics Canada, CANSIM Table 281-0008 - Average hourly earnings and average weekly hours of employees paid by the hour, (SEPH), annual. From 2001 to 2015 the data are from Statistics Canada, CANSIM Table 281-0030 - Survey of Employment, Payrolls and Hours (SEPH), average hourly earnings for employees paid by the hour, by overtime status and detailed North American Industry Classification System (NAICS), annual (current dollars).

The data for consumer price index for ten provinces are from Statistics Canada, CANSIM Table 326-0021 - Consumer Price Index, annual (2002=100 unless otherwise noted).

The data for the population for ten provinces by age and sex are extracted from Statistics Canada: CANSIM Table 051-0001 - Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual (persons unless otherwise noted).

The data for income from corporations for ten provinces and income from general governments for ten provinces are from Statistics Canada, CANSIM Table 384-0040 - Current accounts - Households, provincial and territorial, annual (dollars unless otherwise noted).

All the data for real value are divided by consumer price index and all the data for per capita are divided by working-age (15 years old and over) population.

Table 3.2 shows the summary statistics for all variables we used.

Table 3.3: Summary Statistics

Variable	Mean	SD	Min	Max
LFP^1 (%)	66.83909	6.654483	44.3	78.1
LFP^2 (%)	63.59576	6.318404	38.2	73.7
LFP^3 (%)	90.63939	3.493288	77	95.9
LFP^4 (%)	76.92909	7.086367	49.8	87.9
LFP^5 (%)	37.20091	7.045956	20.8	55
LFP^6 (%)	21.26394	7.399216	9.2	39.8
UE^1 (%)	17.61121	5.679438	7.2	39.1
UE^2 (%)	13.29818	4.07369	6	27.4
UE^3 (%)	8.642424	3.615782	2.5	19
UE^4 (%)	8.089394	3.394888	3	17.4
UE^5 (%)	7.971515	3.880249	2	21.5
UE^6 (%)	7.074697	3.298144	2.1	17.4
IC ($)	12.06827	5.374512	3.347614	26.85028
IG ($)	44.58886	9.18023	26.02517	66.88677
W ($)	0.1592814	0.019168	0.1074928	0.2073701
Wp^1 ($*%)	1.465142	0.2259279	1.085231	2.444666
Wp^2 ($*%)	1.413006	0.2176302	1.039263	2.364513
Wp^3 ($*%)	4.258267	0.5974792	2.71471	5.96059
Wp^4 ($*%)	4.222779	0.5455205	2.680776	5.594248
Wp^5 ($*%)	2.106757	0.5011682	1.316978	3.645263
Wp^6 ($*%)	2.40316	0.5142546	1.423319	3.924675

Notes: $^{1, 2, 3, 4, 5, 6}$ represent 15-24 years old men, 15-24 years old women, 25-54 years old men, 25-54 years old women, 55 years old men and over and 55 years old women respectively.

IV. Results

Tables 4.1 and 4.2 show that the regression results for 15-24 age groups. The dependent variable is the labour force participation rate for young men and young women. As we can see, the cohort size has an insignificant effect for young men and young women. Not surprisingly, the results show that lagged labour force participation, unemployment rate, and real average hourly earnings are significant determinants of the labour force participation for young men and women.

In particular, a 1-percentage-point increase in the unemployment rate will decrease the labour force participation rate by 0.2% for young men and by 0.38% for young women. The coefficients of unemployment rate are at the 1% level of significance. A 1-percentage-point increase in the lagged labour force participation rate will increase the labour force participation rate by 0.84% for young men and by 0.80% for young women. The coefficients of lagged labour force participation rate are at the 1% level of significance. An increase of 0.1 in the real average hourly earnings increases the labour force participation rate by 3.53% for young men (or 0.01 increase in the real average hourly earnings increases the labour force participation rate by 0.353% for men, which is more realistic about the data). The coefficient of real average hourly earnings is at the 5% level of significance. For the young men and young women, the coefficient of the time trend is -0.134 and -0.089 respectively. The coefficients of the time trend are at the 1% level of significance for young men and at the 5% level of significance for young women.

This means a 0.134% decrease will happen for young men and a 0.089% decrease for young women yearly over the sample period.

Table 4.1: Regression Results

Dependent variable: Labor force participation rate of young (15-24 years old) men				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.838***	0.0289	29.00	0.000
UE	-0.197***	0.0475	-4.16	0.000
IC	0.107*	0.0638	1.67	0.094
IG	-0.00371	0.0378	-0.10	0.922
W	35.316**	18.0259	1.96	0.050
Wp	-0.371	1.234	-0.30	0.764
T	-0.134***	0.0363	-3.69	0.000
Number of Observations		320		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table 4.2: Regression Results

Dependent variable: Labor force participation rate of young (15-24 years old) women				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.799***	0.0308	25.97	0.000
UE	-0.381***	0.0619	-6.16	0.000
IC	0.0739	0.0667	1.11	0.268
IG	-0.0036	0.0410	-0.09	0.930
W	25.36	21.261	1.19	0.233
Wp	1.720	1.4056	1.22	0.221
T	-0.0894**	0.036	-2.50	0.012
Number of Observations		320		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Tables 4.3 and 4.4 show the results for prime-age men and women. The estimates reveal that cohort size has significant negative effects on the labour force participation for prime-age men and women. This variable is at the 10% level of significance for prime-age men and at the 1% level of significance for prime-age women. That means with the increase in the cohort size, the labor force participation rate for prime-age men and women will decrease. Oppositely, the labor force participation rate will increase with the decrease in cohort size. However, since we combine the cohort size and real average hourly earnings together, so we could not estimate precisely how changes of labor force participation rate when the cohort size changes by 1-percentage-point. We can only know that with the increase in the cohort size for these two groups, the labor force participation rates will decrease.

As to other variables, the lagged labour force participation rate is at the 1% level of significance for prime-age men and prime-age women. A 1-percentage-point increase in lagged labour force participation rate will increase the labour force participation rate by 0.86% for prime-age men and by nearly 1% for prime-age women. The unemployment rate is at the 10% level of significance for prime-age men. The coefficient of the unemployment rate for prime-age men is -0.08, which means a 1-percentage-point increase in the unemployment rate will decrease the labour force participation rate by 0.08% for prime-age men. Real transfer income from corporations is at the 1% level of significance for prime-age men and at the 5% level of significance for prime-age women. A 1-point increase in the real transfer income from corporations will increase the labour force participation rate by 0.09% for prime-age men and by 0.07% for prime-age women. Real transfer income from government is at the 1% level of significance for prime-age

women. A 1-point increase in the real transfer income from government will decrease the labour force participation rate by 0.087% for prime-age women. The coefficients of real average hourly earnings are at the 1% level of significance for prime-age men and women. An increase of 0.01 in the real average hourly earnings increases the labour force participation rate by 0.19% for prime-age men and by 0.27% for prime-age women. The time trend also has an effect on the men and women's labour force participation rate. The coefficient of time trend is -0.059 for prime-age men and -0.066 for prime-age women. The coefficients of time trend are at the 1% level of significance, which means the labour force participation will decrease by 0.059% for prime-age men and by 0.066% for prime-age women every year holding constant all other factors.

Table 4.3: Regression Results

Dependent variable: Labor force participation rate of prime-age (25-54 years old) men				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.861***	0.0294	29.26	0.000
UE	-0.077*	0.0421	-1.83	0.067
IC	0.0878***	0.0279	3.14	0.002
IG	-0.0143	0.0191	-0.75	0.454
W	18.972***	7.12	2.67	0.008
Wp	-0.421*	0.249	-1.69	0.091
T	-0.0593***	0.0153	-3.86	0.000
Number of Observations		320		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table 4.4: Regression Results

Dependent variable: Labor force participation rate of prime-age (25-54 years old) women				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.996***	0.0192	57.87	0.000
UE	-0.0333	0.0509	-0.66	0.512
IC	0.0726**	0.0305	2.38	0.017
IG	-0.0847***	0.0199	-4.25	0.000
W	27.37***	9.530	2.87	0.004
Wp	-1.077***	0.309	-3.49	0.000
T	-0.066***	0.0167	-3.94	0.000
Number of Observations		320		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Finally, tables 4.5 and 4.6 contain the results of regressions for 55 years old and over. The estimates show that the coefficients of cohort size are insignificant for neither men nor women. When it comes to other variables, the coefficient of lagged labour force participation rate is at the 1% level of significance for both men and women. A 1-percentage-point increase in the lagged labour force participation rate will increase the labour force participation rate by 0.9% for men and by 0.99% for women. The coefficients of unemployment rate are at the 10% level of significance for men. A 1-percentage-point increase in the unemployment rate decreases the labour force participation rate by 0.089% for men. However, the coefficient of the unemployment rate is insignificant to the labour force participation rate for women. Real average hourly earnings are significant at the 10% level of significance for women. An increase of 0.01-point in the real average hourly earnings will increase the labour force participation rate by 0.26% for women. Time trend also has significant effects on the labour force participation rate for women. The coefficients of time trend are at the 1% level of significance for men and women. The labor force participation rate will increase by 0.74% for men and by 0.112% for women with each year.

To check the robustness of our results, we broke the sampler period into two from 1983 to 2000 and from 2001 to 2015 and ran separate regressions. The results are contained in the appendix. While the summary statistics is found in Tables A1 and A2. The regression results are contained in Tables A3 to A14. As we can see from these tables, the results are quite sensitive to the sample periods, meaning that our results are not robust to sample size. This could be due to lack of variation in cohort sizes over a shorter period of time.

Table 4.5: Regression Results

Dependent variable: Labor force participation rate of 55 years old men and over				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.897***	0.0338	26.54	0.000
UE	-0.0829*	0.0444	-1.86	0.063
IC	0.0300	0.0509	0.59	0.556
IG	-0.0735**	0.0341	-2.16	0.031
W	15.28	15.986	0.96	0.339
Wp	0.378	0.838	0.45	0.652
T	0.075***	0.0269	2.77	0.006
Number of Observations		320		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table 4.6: Regression Results

Dependent variable: Labor force participation rate of 55 years old women and over				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.912***	0.0326	27.97	0.000
UE	-0.0096	0.0374	-0.26	0.797
IC	-0.0136	0.0429	-0.32	0.750
IG	-0.0458*	0.0261	-1.76	0.079
W	26.16*	14.384	1.82	0.069
Wp	-0.27	0.6815	-0.40	0.689
T	0.112***	0.02374	4.71	0.000
Number of Observations		320		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

V. Conclusions and Discussions

Due to the post-WW II baby boom, decreasing birth rate after baby boom and decreasing mortality, the cohort size in Canada has changed a lot. Empirical studies had found that the changes in cohort size have effects on labour force participation. Many studies also showed that the labour force participation plays an important role in economic growth. So, in this paper, one key question considered was: "What is the effect of the cohort size on the labour force participation in Canada?"

Based on the paper by Fair and Dominguez (1991) for the United States, we analyzed the impact of changes in cohort size on the labour force participation in ten Canadian provinces from 1983 to 2015 for the following six groups by age and sex: 15 to 24 years old men, 15 to 24 years old women, 25 to 54 years old men, 25 to 54 years old women, 55 years old men and over, 55 years old women and over.

We found the negative relationship between cohort size and the labour force participation for 25 to 54 years old men and women in ten Canadian provinces. This finding is different from that by Fair and Dominguez (1991) which found a positive relationship between cohort size and the labour force participation for 25 to 54 years old men and a negative relationship between cohort size and the labour force participation for 25 to 54 years old women. We also found that in 25 to 54 years old groups, the real average hourly earnings have a negative relationship with the cohort size, which is consistent with Easterlin (1987). That means a large cohort usually faces low real average hourly earnings.

Moreover, the real average hourly earnings have positive effects on the labour force participation for 25 to 54 years old men and women. That means the substitution effect dominates for 25 to 54 years old men and women. Fair and Dominguez (1991) However, Fair and Dominguez (1991) found a negative relationship between the real wage and the labour force participation for 25 to 54 years old men and a positive relationship for 24 to 55 years old women. That means income effect dominates for prime-age men and substitution effect dominates for prime-age women.

There could be a number of reasons for the different results. For example, data for our study is for Canada from 1983 to 2015 while Fair and Dominguez used the US data from 1954 to 1987. The economy is very different from then. People in Canada from 1983 to mid-1990s were facing low average hourly earnings due to the large cohort size. Those people then quitted the labor market. After the mid-1990s, people in Canada faced increasing hourly earnings due to decreasing cohort size. More and more people who quitted the labor market before went to labor market to earn more money. However, in the United States from 1952 to about 1974, real wage generally grew in this period. For prime-age men, with the increase in real wage, they could earn the same amount of money by working less time. After 1974, real wage flattened out. The labor force participation rate also flattened out.

For prime-age women, facing the rising real wage, prime-age women were more likely to take part in the labor market. Second, the population size in Canada is far smaller than the United States, which could have contributed to the difference. As to the comparison in magnitude between men and women, the labour force participation for 24 to 54 years old men are affected less than that for women by the cohort size. Also, the labour force

participation for 24 to 54 years old men are affected less than that for women by the real average hourly earnings. The results may reflect the conventional view that men as the main bread earners have more responsibilities to support a family thus could not quit the labour market easily.

Furthermore, the labour force participation rate for 25 to 54 years old men is far higher than that for women which indicating that there was less room for men to increase in the labour force participation, even though with the increase the real average hourly earnings.

However, our results show that the relationship between cohort size and the labour force participation for 15 to 24 years old men, 15 to 24 years old women, 55 years old men and over, 55 years old women and over were insignificant in determining on the labour force participation. As to the relationship between the real hourly earnings and the labour force participation, we found that the real average hourly earnings only have a significant effect on the labour force participation for 15 to 24 years old men and women.

Concerning other variables, our results show that the lagged labour force participation has a significant and positive effect in all groups; the unemployment rate has a negative effect on the labour force participation for 15 to 24 years old men and women, 25 to 54 years old men, and 55 years old men and over indicating the "discouraged worker" effects. This effect appears to be very strong for 15 to 24 years old groups. Income from corporations has positive effects on the labour force participation for 15 to 24 years old men, 25 to 54 years old men and women. Income from general governments has negative effects on the labour force participation for 25 to 54 years old women, 55 years old people and over. That indicates that with the increase in social security, fewer people will

participate in the labour market. Finally, the labour force participation for 55 years old people and over had an increasing trend while for other groups there was a decreasing trend.

Regarding policy implications, our results show that for the prime-age (25-54) people, a large cohort size does not necessarily translate to a high labour force participation rate. That the labour force participation rate changes with the cohort size implies that policy makers should take into consideration of the cohort size to increase the labour force participation. Otherwise, a large population and a low labour force participation will give a heavy burden to the social security system. Furthermore, it could also lead to social instability.

This study is subject to a number of limitations: First, by combining the percentage of people and the real average hourly earnings, we could not estimate precisely the effect of the cohort size on the labour force participation. Statistics Canada only provides us specific data for average hourly wages by age and sex from 1997 onwards. However, if we use the data from 1997 onwards, the deviation of cohort size is too small to be detected. Second, besides the variables we mentioned, there are still many factors that can affect the labour force participation, such as education, monetary policy, divorce rate etc. The results, therefore, are subject to potential omitted variable bias. In the future studies, we can use the more specific data and include more variables to improve our results. Moreover, our findings very depend on the length of the period. A short period will lead to different results with the results of a long period.

VI. References

Aaron, H. J. (1982). *Economic Effects of Social Security.* Washington, DC: Brookings Institution.

Beaudry, P., & Lemieux, T. (1999). Evolution of the Female Labor Force Participation Rate in Canada, 1976-1994: A Cohort Analysis. *Canadian Business Economics*, 57-70.

Blau, D. M., & Robins, P. K. (1986). Labor Supply Response to Welfare Programs: A Dynamic Analysis. *Journal of Labor Economics*, 82-104.

Bloom, D. E., & Williamson, J. G. (1998). Demographic Transitions and Economic Miracles in Emerging Asia. *The World Bank Economic Review*, 419-455.

Bullard, J. (2014). The Rise and Fall of Labor Force Participation in the United States. *Federal Reserve Bank of St. Louis Review*, 1-12.

C., B. M. (1985). The Effect of Cohort Size on Earnings Growth: A Reexamination of the Evidence. *Journal of Political Economy*, 561-573.

Easterlin, R. (1987). *Birth and Fortune: The Impact of Numbers on Personal Welfare, 2nd Ed.* Chicago: University of Chicago Press.

Fair, R. C. (1984). *Specification, Estimation, and Analysis of Macroeconomic Models.* Harvard University Press.

Fair, R. C., & Dominguez, K. M. (1991). Effects of the Changing U.S. Age Distribution on Macroeconomic Equations. *The American Economic Review*, 1276-1294.

Guo, L., & Che, S.-y. (2011). The Effect of China's Labor Force Participation Rate and Demographic Dividend on Economic Growth. *Journal of Central University of Finance & Economics*, 45-51.

Hansen, J., & Liu, X. (2015). Estimating Labor Supply Response and Welfare Participation: Using a Natural Experiment to Validate a Structure Labor Supply Model. *Canadian Journal of Economics*, 1831-1854.

Hotchkiss, J. (2005). Waht's Up with the Decline in Female Labor Force Participation? *Federal Reserve Bank of Atlanta Working Paper*(No.2005-18).

Judson, R. A., & Owen, A. (1999). Estimating Dynamic Panel Data Models: A Guide For Macroeconomists. *Economics Letters*, 9-15.

Juhn, C., & Potter, S. (2006). Changes in Labor Force Participation in the United States. *Journal of Economic Perspectives*, 27-46.

Kiviet, J. F. (1995). On Bias, Inconsistency, and Efficiency of Various Estimators in Dynamic Panel Data Models. *Journal of Econometrics*, 53-78.

Litzinger, P. J., & Dunn, J. H. (2015). The Labor Force Participation Rate: A Rexamination of the Determinants of Its Decline. *The Journal of Applied Business Research*, 2283-2296.

Liu, D.-C. (2014). The Link Between Unemployment and Labor Force Participation Rates in Japan: A Regional Perspective. *Japan and the World Economy*, 52-58.

Macunovich, D. J. (2012). Relative Cohort Size, Relative Income, and Married Women's Labor Force Participation: United States, 1968-2010. *Population and Development Review*, 631-648.

Mincer, J. (2001). *Labor Economics.* Beijing: China Economic Publishing House.

Moffitt, R. A., & Rothschild, M. (1987). Variable Earnings and Nonlinear Taxation. *Journal of Human Resources*, 405-421.

Qiang, C. (2010). *Adavanced Econometrics and Stata Application.* Beijing: Higher Education Press.

Samuelson, P. A. (1948). *Economics, an Introductory Analysis.* McGraw-Hill Book Company.

Schirle, T. (2008). Why Have the Labor Force Participation Rates of Older Men Increased Since the Mid-1990s. *Journal of Labor Economics*, 549-594.

Strand, K., & Dernburg, T. (1964). Cyclical Variation in Civilian Labor Force Participation. *The Review of Economics and Statistics*, 378-391.

Westerlund, J. (2006). Testing for Panel Cointergration with Multiple Structural Breaks. *Oxford Bulletin of Economics and Statistics*, 101-132.

Appendix

Table A1: Summary Statistics from 1983 to 2000

Variable	Mean	SD	Min	Max
LFP^1 (%)	67.07556	7.767398	44.3	78.1
LFP^2 (%)	62.1311	7.316174	38.2	73.7
LFP^3 (%)	90.74278	4.099574	77	95.9
LFP^4 (%)	72.80556	6.935462	49.8	84
LFP^5 (%)	34.47556	6.380851	20.8	48.7
LFP^6 (%)	16.18833	3.884323	9.2	24.6
UE^1 (%)	18.91278	5.889504	8.4	39.1
UE^2 (%)	14.74444	4.368785	6.9	27.4
UE^3 (%)	9.644444	3.546581	3.6	19
UE^4 (%)	9.616667	3.403342	3.6	17.4
UE^5 (%)	8.173333	3.587059	2.4	20.8
UE^6 (%)	7.691944	3.119797	2.2	17.4
IC ($)	8.273594	5.374512	3.347614	26.85028
IG ($)	41.85829	9.18023	26.02517	66.88677
W ($)	0.151437	0.019168	0.1074928	0.2073701
Wp^1 ($*%)	1.520595	0.2514573	1.085231	2.444666
Wp^2 ($*%)	1.469721	0.2473528	1.039263	2.364513
Wp^3 ($*%)	4.164109	0.6188037	2.71471	5.380949
Wp^4 ($*%)	4.104617	0.5880584	2.680776	5.16811
Wp^5 ($*%)	1.760355	0.2535358	1.316978	2.315459
Wp^6 ($*%)	2.060063	0.307159	1.423319	2.718309

Notes: $^{1, 2, 3, 4, 5, 6}$ represent 15-24 years old men, 15-24 years old women, 25-54 years old men, 25-54 years old women, 55 years old men and over and 55 years old women respectively.

Table A2: Summary Statistics from 2001 to 2015

Variable	Mean	SD	Min	Max
LFP^1 (%)	66.55533	5.014858	51.9	76.6
LFP^2 (%)	65.35333	4.259764	49.1	72
LFP^3 (%)	90.51533	2.593558	82	94.8
LFP^4 (%)	81.87733	2.811581	72	87.9
LFP^5 (%)	40.47133	6.400517	25.5	55
LFP^6 (%)	27.35467	5.856111	12	39.8
UE^1 (%)	16.04933	5.005054	7.2	29.6
UE^2 (%)	11.56267	2.855574	6	21.3
UE^3 (%)	7.44	3.329954	2.5	17.3
UE^4 (%)	6.256667	2.309607	3	13.7
UE^5 (%)	7.729333	4.204672	2	21.5
UE^6 (%)	6.334	3.36352	2.1	17.1
IC ($)	16.62188	4.068486	9.227971	26.85028
IG ($)	47.86554	9.548683	27.74126	66.88677
W ($)	0.1686948	0.0153929	0.1382609	0.2073701
Wp^1 ($*%)	1.398598	0.1690332	1.164335	1.7999
Wp^2 ($*%)	1.344948	0.1500959	1.09383	1.700257
Wp^3 ($*%)	4.371257	0.5519564	3.277963	5.96059
Wp^4 ($*%)	4.364574	0.4522756	3.442515	5.594248
Wp^5 ($*%)	2.522439	0.398073	1.825763	3.645263
Wp^6 ($*%)	2.814876	0.3971645	2.04884	3.924675

Notes: $^{1, 2, 3, 4, 5, 6}$ represent 15-24 years old men, 15-24 years old women, 25-54 years old men, 25-54 years old women, 55 years old men and over and 55 years old women respectively.

Table A3: Regression Results (1983 to 2000)

Dependent variable: Labour force participation rate of young (15-24 years old) men				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.84***	0.06	15.06	0.000
UE	-0.195***	0.05	-3.99	0.000
IC	0.41***	0.144	2.85	0.004
IG	0.006	0.05	0.13	0.900
W	34.29	29.35	1.17	0.243
Wp	1.68	1.92	0.87	0.383
T	-0.25**	0.10	-2.40	0.016
Number of Observations		170		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A4: Regression Results (1983 to 2000)

Dependent variable: Labour force participation rate of young (15-24 years old) women				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.76***	0.06	12.67	0.000
UE	-0.33***	0.08	-4.03	0.000
IC	0.31**	0.16	1.90	0.058
IG	0.0015	0.06	0.03	0.979
W	41.11	38.5	1.07	0.286
Wp	2.34	2.59	0.90	0.367
T	-0.21*	0.13	-1.66	0.097
Number of Observations	170			

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A5: Regression Results (1983 to 2000)

Dependent variable: Labour force participation rate of prime-age (25-54 years old) men				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.86***	0.06	13.91	0.000
UE	-0.049	0.046	-1.06	0.288
IC	0.15**	0.07	2.18	0.029
IG	-0.039	0.03	-1.33	0.183
W	28.53	30.48	0.94	0.349
Wp	-0.77	1.13	-0.68	0.496
T	-0.062	0.043	-1.45	0.146
Number of Observations		170		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A6: Regression Results (1983 to 2000)

Dependent variable: Labour force participation rate of prime-age (25-54 years old) women				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	1.00***	0.037	27.13	0.000
UE	-0.011	0.066	-0.15	0.878
IC	0.128*	0.08	1.67	0.096
IG	-0.138***	0.03	-4.74	0.000
W	10.97	29.41	0.37	0.709
Wp	0.33	1.04	0.31	0.754
T	-0.104**	0.05	-2.00	0.046
Number of Observations		170		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A7: Regression Results (1983 to 2000)

Dependent variable: Labour force participation rate of 55 years old men and over				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.87***	0.062	14.04	0.000
UE	-0.10	0.061	-1.64	0.102
IC	0.048	0.10	0.47	0.639
IG	-0.04	0.05	-0.9	0.368
W	22.55	37.85	0.60	0.551
Wp	-0.48	2.92	-0.16	0.871
T	0.013	0.0808	0.15	0.877
Number of Observations		170		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A8: Regression Results (1983 to 2000)

Dependent variable: Labour force participation rate of 55 years old women and over				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.719***	0.060	12.02	0.000
UE	0.015	0.049	0.32	0.752
IC	0.09	0.08	1.07	0.284
IG	-0.028	0.035	-0.82	0.413
W	56.43*	33.8	1.67	0.095
Wp	-2.18	2.3	-0.96	0.339
T	0.05	0.05	1.05	0.292
Number of Observations		170		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A9: Regression Results (2001 to 2015)

Dependent variable: Labour force participation rate of young (15-24 years old) men				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.54***	0.079	6.82	0.000
UE	-0.29***	0.067	-4.26	0.000
IC	-0.013	0.116	-0.12	0.907
IG	0.225***	0.09	2.62	0.009
W	42.73	40.43	1.06	0.291
Wp	-10.98***	3.7	-2.97	0.003
T	-0.34***	0.10	-3.41	0.001
Number of Observations		140		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A10: Regression Results (2001 to 2015)

Dependent variable: Labour force participation rate of young (15-24 years old) women				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.60***	0.07	8.36	0.000
UE	-0.44***	0.108	-4.03	0.000
IC	-0.01	0.12	-0.08	0.936
IG	0.038	0.09	0.041	0.679
W	64.37	44.51	1.45	0.148
Wp	-7.61*	3.9	-1.95	0.051
T	-0.21**	0.10	-1.98	0.048
Number of Observations	140			

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A11: Regression Results (2001 to 2015)

Dependent variable: Labour force participation rate of prime-age (25-54 years old) men				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.715***	0.07	10.04	0.000
UE	-0.146**	0.06	-2.38	0.017
IC	0.014	0.05	0.27	0.786
IG	0.036	0.04	0.86	0.389
W	-15.12	49.49	-0.31	0.760
Wp	0.11	1.36	0.08	0.933
T	-0.021	0.077	-0.27	0.785
Number of Observations		140		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A12: Regression Results (2001 to 2015)

Dependent variable: Labour force participation rate of prime-age (25-54 years old) women				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.69***	0.06	11.30	0.000
UE	-0.06	0.10	-0.58	0.563
IC	0.04	0.054	0.83	0.407
IG	0.04	0.04	0.88	0.378
W	50.22	50.71	0.99	0.322
Wp	-2.43	1.66	-1.46	0.145
T	-0.12	0.073	-1.60	0.110
Number of Observations		140		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A13: Regression Results (2001 to 2015)

Dependent variable: Labour force participation rate of 55 years old men and over				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.82***	0.066	12.39	0.000
UE	-0.10	0.105	-0.97	0.333
IC	0.105	0.10	1.09	0.277
IG	-0.08	0.073	-1.09	0.274
W	-11.14	39.10	-0.29	0.776
Wp	1.17	1.73	0.68	0.499
T	-0.028	0.14	-0.20	0.838
Number of Observations		140		

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Table A14: Regression Results (2001 to 2015)

Dependent variable: Labour force participation rate of 55 years old women and over				
Independent variables:	**Coef.**	**Std. Err.**	**Z**	**P>|Z|**
$L.LFP$	0.79***	0.068	11.66	0.000
UE	-0.014	0.12	-0.11	0.910
IC	-0.01	0.087	-0.13	0.896
IG	0.05	0.065	0.81	0.415
W	18.68	29.54	0.63	0.527
Wp	-2.36**	1.12	-2.11	0.035
T	0.24*	0.13	1.85	0.064
Number of Observations	140			

Notes: *Statistically significant at the 10% level; **statistically significant at the 5% level; * statistically significant at the 1% level.**

Curriculum Vitae

Candidate's full name: Kangyu Qiu

Universities attended: Bachelor of Economics

Shandong University of Finance and Economics, 2016.6.

Publications: N.A.

Conference Presentations: N.A.