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The Impact of Demographics on Inflation in Thailand[1]

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Abstract

Recently, Thailand has simultaneously experienced low inflation rate and aging population. Is there a linkage between these two variables as questioned by policy makers and researchers in many countries? The lower working age population and a higher aged people ratio could theoretically change economic agent's behaviors such as consumption, saving, and others affecting to the macro-level economy and inflation pressures. This paper, hence, tries to find the impact of demographic change on inflation in Thailand from an empirical view. Based on the overall CPI basket and its subcomponents over the sample period 2001 to 2016, the results show that, in general, a declining Thai working age population has a significant deflationary impact. In contrast, in the case of housing and furnishing inflation, the results suggest an inflationary pressure. The findings support the view that demographics are one of the structural factors that alter the economic contexts and have implications on macroeconomic policies in Thailand.

Keywords: aging, demographic change, inflation

JEL Classification: C22, E31, J11

[1] The opinions expressed in this paper are those of the author and do not necessarily represent those of the Bank of Thailand.

1. Introduction

Inflation in Thailand has remained significantly low and stable in recent decades after adopting the inflation targeting system as the monetary policy framework since the early 2000s. Previously, Manopimoke and Direkudomsak (2015) indicated that the Thai annual headline and core inflation have declined persistently and remained subdued, coinciding with inflation rates in many countries. The annual average headline inflation in Thailand in 2016 stood at 0.2 percent and core inflation was at 0.7, which was below the target range of 1-4 percent and its historical mean. Their empirical findings suggest that the major contribution affecting Thai inflation is from the process of globalization such as the global output growth and world oil prices. However, in the recent years, the effect of structural factors on inflation has increasingly caught the attention of policymakers, particularly in light of the aging process. As can be seen in Figure 1, over the past few decades, demographic change seems to be the prominent variable for deflation in the Thai economy.

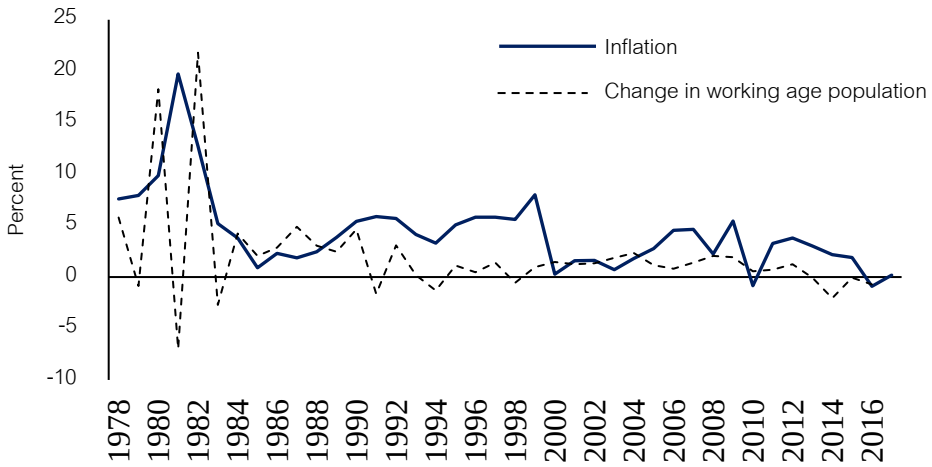

Figure 1: Headline inflation and working age population growth in Thailand

Source: Bank of Thailand

In Thailand, the aging population (people who are 60 years old or older) is growing rapidly. According to the data obtained from United Nations, the old aged dependency ratio has already over 10 percent of the total population since 2005. Going forward, the aged

population is expected to reach 20 percent by 2021 (Figure 2). In other words, the proportion of non-working people keeps rising over the projection period. In addition, the trend decline in fertility rates over the decades exacerbates the ratio of working age population in Thailand, like Japan, Korea and other countries, which are also aging at the global frontier (Figure 3). Both the change in age structure and a sharp decline in labor supply may alter economic performance and the price level.

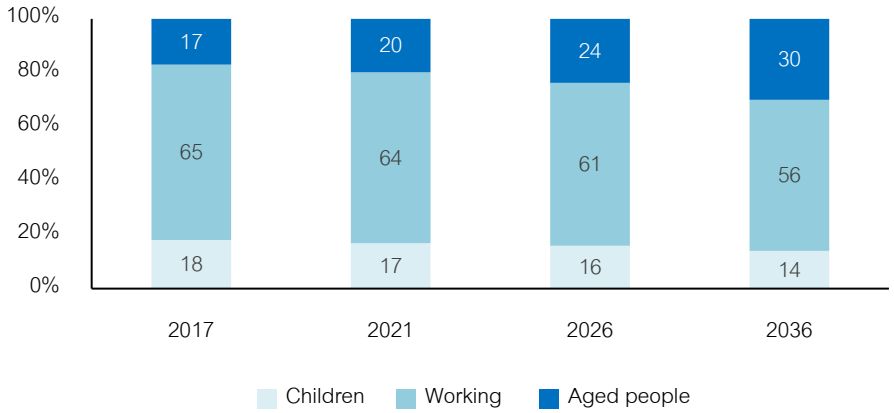

Figure 2: Dependency ratio in Thailand

Source: United Nations

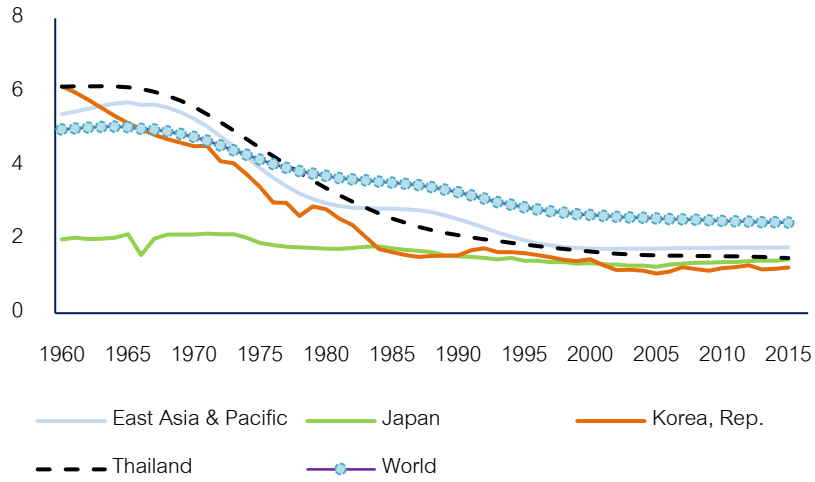

Figure 3: Total fertility rate in number of children per woman

Source: World Bank Statistics

To inform the policy debate, previous studies have found a negative relationship between aging and inflation in Japan. For example, Katagiri, Konishi and Ueda (2014) and Liu and Westelius (2016) show that aging can lead to deflationary pressures by deterring expectation of future economic performance from the slow growth in labor productivity. Moreover, Bobeica, Lis, Nickel, and Sun (2017) prove that demographic trends are the force that lowers inflation in Europe. However, Juselius and Takats (2015) argue that demography leads to inflationary pressure. The explanation is that the aged population try to smooth their consumption while aging constraints productivity, leading to excess demand and thus pushes inflation upward.

Unfortunately, there is now no clear empirical evidences on the impact of aging on inflation and research on this issue is quite scare in Thailand. This paper, therefore, tries to look at the relationship between demographic change and inflation dynamics and the potential connection in the Thai context. By figuring out the link, the finding can be discussed as the factors that influence the economic behaviors in which monetary policy operates.

To investigate the impact of demographics on inflation in Thailand, a regression analysis will be employed. The methodology framework is similar to Bobeica, et al. (2017) and Liu and Westelius (2016). Specifically, overall inflation and its components will be regressed on aging and other macro control variables (e.g. the output growth, and the interest rate). The models will be estimated over the sample period 2001 to 2016. Data involving in this study are taken from the Bank of Thailand (BOT), the Office of the National Economic and Social Development Council (NESDC), the Ministry of Commerce, and the World Bank.

2. Literature Review

This section provides a comprehensive background of the potential relationship between inflation and demography. The relevant articles here can be classified into two sub-sections. The first sub-section begins by theoretically analyzing an impact of the demographic change on inflation, while the second sub-section investigates empirically the link between demography and inflation in several countries.

2.1 Demographics and Inflation: A Theoretical View

The interest in the potential link between population aging and inflation has been sparked by researchers at policy institutions such as the International Monetary Fund (IMF), and at central banks, for instance, in Japan, where the aging population is rapidly growing. Although there is little consensus about the link between these two variables, inflation could be impacted by the demographic transition as follow:

Aging and relative prices

An aging or decreasing population can lower land prices because the longevity of the elderly population decreases demand for housing, land and natural resources from living in a smaller house. International Monetary Fund (IMF, 2014), moreover, found that aging leads to secular shifts in consumption patterns as the aged people's preferences differ from those of the young with a reduction of expenditure on housing, transportation, communication and education. On the other hand, aged people spend more on medical expenses, utilities, and other related consumption goods. Consequently, Cashell (2010) showed that the prices of health care products have risen faster than the overall inflation rate in the United States. However, whether this shift affects inflationary pressures depends on how fast supply can adjust to the changes in demand. Of course, the substitution effect between products in the market could be also explained in this case.

Aging and economic growth

The effect of the aging population on economic growth can be described through both direct and indirect effects. The direct effect is the scale effect on economic growth with the low output from a low labor supply or labor productivity, eventually pressuring inflation. Peng (2008) investigated the relationship between population and economic growth in China. The results showed that the aging population would lower economic growth through a reduction in the labor force and a reduction in new demand for investment. Lee and Mason (2007) also found that an increase in elderly people affects income growth in Taiwan. Choi et al. (2014) also concluded that the demographic change in South Korea had a negative impact on real GDP growth. As a consequence, the growth in the aging population could lead to deflationary pressure in this case.

In contrast to the aforementioned literatures, some have found that the scale effect from the aging population may instead spur economic growth through human capital. Examples of this type of research include Azarnert (2005) and Boucekkine, Croix, and Licandro (2003). The explanation is that the greater longevity would increase the period of schooling because the result of a long-term education investment is more income over a longer period of time. Therefore, the aging population may not always have a negative effect on the economy and not dampen inflation in the economy.

The indirect effects are the increasing public expenditure on pensions and health care and the change in consumption and saving patterns. In many countries, aging would lead to higher government expenditure through pension and social security. Kashiwase Nozaki and Saito (2014) concluded that the deficit budget in Japan is mainly driven by the high government subsidy in social security provisions. The higher fiscal burden would lead to a prolonged period of negative output gap and deflationary pressure.

In terms of the life cycle saving and consumption considerations, the decision of people's saving depends on their consumption and their dependency burden. In Japan, Horioka (2009) showed that an increase in aging population contributes to the declining saving rate, which undermines the future growth and inflation in the economy. Although, Juselius and Takats (2015) argued that while aging restricts the production side through the shortage of labor, dissaving by elderly keeps demand unchanged, thus leading to excess demand and inflationary pressure. However, this effect is then cancelled out by a currency appreciation from the repatriation of foreign assets of aged people in Japan (see Anderson, Botman, & Hunt, 2014).

Aging and policy objectives

Unlike young generations, older aged groups who work less are likely to prefer lower inflation in order to have higher real return on their saving. When their population share grows rapidly, old aged groups could gain increased political influence, and thereby indirectly impact monetary policy decision (Bullard, Garriga, & Waller, 2012). This case can lead to a deflationary bias in policy settings, specifically on the level of inflation targets and the speed of policy responses.

In short, population aging can affect other macroeconomic real variables. The impact of demographic changes has been tested with, besides growth in GDP, saving-investment, consumption smoothing, preferences, fiscal burden, and politics. Consequently, these dynamic changes will put pressures on the price level in a country, in which monetary and fiscal policies operate.

2.2 Demographics and Inflation: An Empirical View

In the past, empirical studies for analyzing the link between inflation and demographic change were quite scarce. However, in light of prolonged low inflation in many advanced countries after the global financial crisis, there appeared to be a growing attention given to understanding the relationship between inflation and aging society. Given the unclear theoretical aspect, the results from this topic are mixed.

Most of the papers in this area focused on Japan's experience, which is at the frontier of the global demographic transition. For example, Anderson et al. (2014) investigated the potential effect of an aging population on inflation by using the IMF's Global Integrated Fiscal and Monetary Model (GIMF). They found that aging substantially created deflationary pressures as a result of declining growth and falling land prices. Moreover, the large fiscal consolidation in Japan could further magnify the deflationary impact in the near future. Based on prefectural data, Liu and Westelius (2016) also found that aging of the working age population has had a significant negative impact on total factor productivity. In addition, overall inflation was lowered by a rapid growth in the aged population, while prefectures with higher population growth experienced higher inflation.

Bobeica et al. (2017) studied the impact of aging on the macroeconomic environment in European countries via a cointegrated VAR model. The results showed that there was a negative long run relationship between inflation and aging population. The main driving forces are demographic transition changes such as the life cycle consumption and saving, financial wealth allocation and political economy in the Eurozone. On the basis of a cross countries view, Yoon et al. (2014) analyzed the macroeconomic impacts of demographic change by employing a panel data set covering 30 OECD countries. The findings suggested that the ongoing demographic changes would lead to a significant

deflationary impact in the period ahead, especially in a country facing the decline of working-age population and the growth of an aging population.

However, in contrast to the papers mentioned above, Juselius and Takats (2015) 1have argued that population aging has led to higher pressure on inflation. Their sample countries cover 22 advanced economies and the models are checked against robustness tests over different time periods, adding more control variables and inflation expectations. The economic reason behind this result is that aged people, who consume more goods and services than they produce, could induce inflationary pressure through excess demand.

Table 1: Summary of empirical evidence for aging and inflation

Paper	Result	Coefficient on Demographics	Channels
Japan			
Anderson et al. (2014)	Deflationary pressure	Old age: -0.1	Lower growth and land price
Liu and Westelius (2016)	Deflationary pressure	Old age: -0.1 Pop. Growth: 0.3	Lower labor productivity
EU			
Bobeica et al. (2017)	Deflationary pressure	Working age: 1.57	Consumption and saving behaviors Political economy
Cross countries			
Juselius and Takats (2005)	Inflationary pressure	Old age: 0.31	Excess demand
Yoon et al. (2014)	Deflationary pressure	Old age: -0.4 Pop. Growth: 0.3	Population size, asset prices, fiscal position

Source: author's compilation

In conclusion, empirical evidences on inflation in the context of the aging population dynamic are now rather inclusive and limited. Although there are significant relationships among aging and macroeconomic variables, especially inflation, some papers have showed the negative relationship between aging and inflation, while some have suggested the

opposite view. Table 1 provides the summary for various studies mentioned in this sub-section in order to highlight the various conclusion.

3. Methodology and Data

To examine the relationship between demographic changes and inflation in Thailand, the specification of a multivariate model by adding other control variables is used following the same methodology as Liu and Westelius (2016) and Bobeica, Nickel and Sun (2017). Specifically, the model can be expressed as follows:

$$\pi_t = c + \alpha WA_t + \beta GDP_t + \gamma i_t + \delta \pi_{t\text{-}1} + u_t \quad (1)$$

Annual rate of inflation at time t denoted as π_t. To proxy the demographic structure, in contrast to other studies, WA_t represents the working age population (15 to 64-year olds) instead of the number of workforce. The variable focuses on the young people entering the workforce and the old people leaving it, and prevents us from capturing changes in the age distribution due to changes in labor participation rates. Moreover, this also ensures that the estimation is not exposed to the measurement errors and endogeneity bias (see Liu & Westelius, 2016).[2] GDP_t is the Gross Domestic Product of Thailand at time t to capture overall demand activities, while i_t is a short term interest rate at time t for controlling monetary policy actions. The lagged inflation rate, π_{t-1}, is added capturing the degree of inflation persistence, c is a constant term and u_t represents an error terms. To investigate how demographic change affects relative prices, equation (1) can be estimated for each of the sub components of the CPI basket.

To analyze the impact of demographic change on inflation, the models are estimated over the sample of 2001 to 2016 capturing almost the full inflation targeting period and including the largest possible available data of demographics. Quarterly data on GDP is taken from the NESDC. The number of working age population is taken from the National Statistical Office (NSO). Data on the short term interest rate represented by the interbank rate is obtained from the Bank of Thailand (BOT). While the quarterly data on overall or headline inflation, core inflation excluding energy and food, and its components including

[2] To avoid the perfect multicollinearity, our models drop the dependency age cohorts including the young and the old age groups.

food and beverages, apparel and foot wears, housing and furnishing, medical and personal care, and transport and communication are calculated through a year on year growth of CPI from Bureau of Trade and Economic Indices, Ministry of Commerce.

At a first look, Table 2 reports some summary statistics. Because quarterly working age data is available in the first quarter of 2001, by growth calculation, leaving us with usable data from 2002 onwards. While Figure 4 shows the data variation over time for the working age population growth, GDP growth, the short term interest rate and inflation. For Thailand, it seems that almost all of the price variables are positively correlated with the working age. The decline the growth rate of working age is indeed consistent with the lower rate of inflation after 2009. In addition, low and stable inflation is commonly in line with the short term interest rate set by the BOT. In sum, data shows some possibilities that Thai demographic headwinds have a crucial role in downward price pressures.

Table 2: Summary statistics for the data set used in estimations (60 0bservations, 2002 to 2016)

Series	Mean	S.D.	Minimum	Maximum
Headline Inflation	2.3220	2.1019	-2.7797	7.4682
Core inflation	1.2194	0.8626	-0.4801	3.0024
Food and Beverage Inflation	4.4411	3.0010	-0.0383	14.3540
Housing and Furnishing Inflation	0.5083	2.1100	-7.7730	3.6273
Medical and Personal Care Inflation	1.0731	0.3695	0.3858	2.2569
Transport and Communication Inflation	1.8128	6.2403	-15.2674	15.1012
Working age (15-64) growth	0.9003	0.5367	-0.0419	2.1693

Source: author's calculation

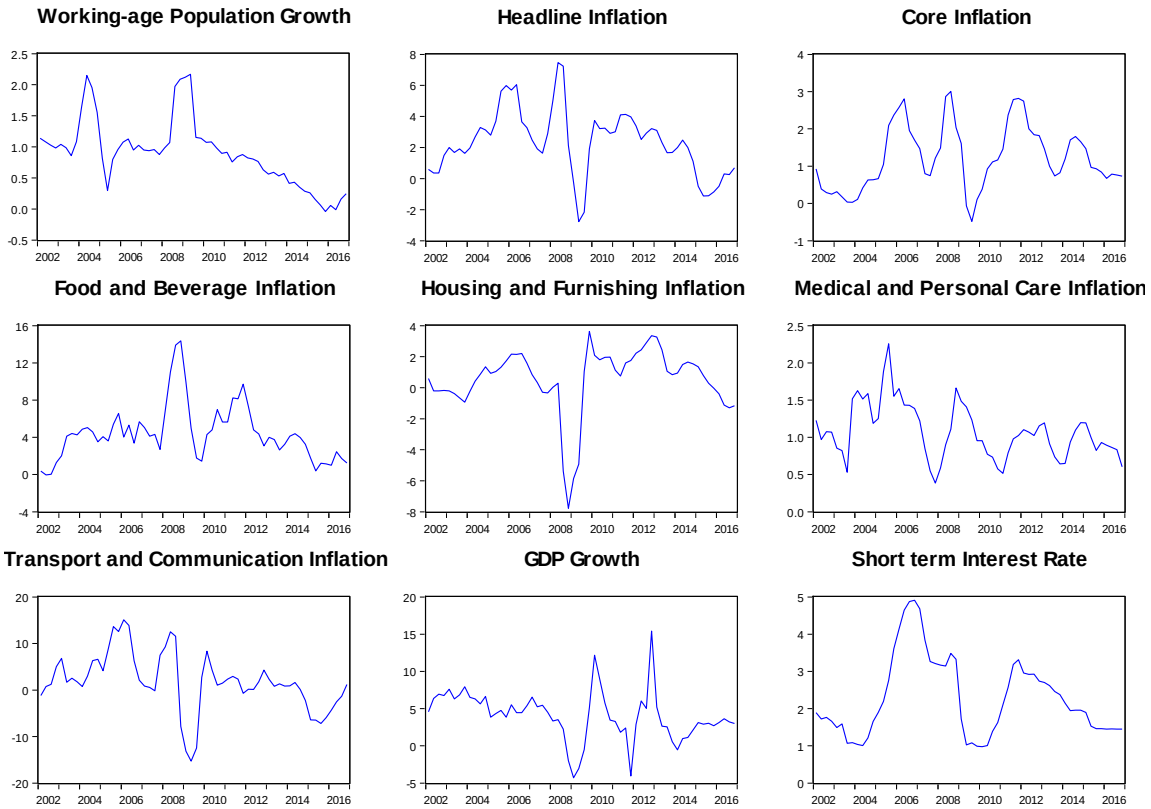

Figure 4: Demographic and economic variables

Source: author's calculation

4. Regression Analysis

Theoretically, most of economic time series data show a strong pattern in the time trend i.e. mean and variance are not constant overtime, and the covariances are affected by a change of time origin. Thus, these variables are non-stationary and sometimes called unit root problem.[3] To investigate the unit root properties, the Augmented Dickey Fuller (ADF) test and the KPSS test are presented in Table 3. The ADF unit root tests fail to reject the null hypothesis of being nonstationary in level terms, *I*(0) except the short term interest rate, and rejecting the null hypothesis in the first difference terms, *I*(1). This is supported by the KPSS test in each series which it is nonstationary in the level terms and stationary in the first difference terms.

[3] Pornpattanapaisankul (2010), for example, provides a more detailed discussion about this issue.

Table 3: Unit root tests

	The ADF unit root test		The KPSS unit root test	
Variables	**t-statistic for *I*(0)**	**t-statistic for *I*(1)**	**LM-statistic for *I*(0)**	**LM-statistic for *I*(1)**
Working age population	1.0057	-6.1425***	1.0007***	0.6626
Headline CPI	-2.1486	-5.5662***	1.5861***	0.0714
CPI: Food and beverage	-1.3611	-4.1806***	1.5159***	0.5074
CPI: Apparel and Foot wears	-0.2807	-6.0862***	1.4869***	0.7210
CPI: Housing and Furnishing	-0.8479	-9.0652***	1.4860***	0.8349***
CPI: Medical and Personal Care	-0.4672	-7.9558***	1.5755***	0.4776
CPI: Transport and Communication	-1.4668	-10.9555***	1.5439***	0.1446
Core CPI	-0.6043	-5.6563***	1.3233***	0.4840
GDP	-2.3799	-4.2583***	1.2864***	0.1980
Short term interest rate	-3.5553**	-8.1600***	0.8462***	0.0302

Note: CPI stands for Consumer Price Index. ***, and ** indicate significance level at the 1 percent, 5 percent, respectively. Differ from the ADF test, the KPSS test provides the null of stationarity against the alternative of nonstationary.

Source: author's calculation

Relying on the unit root tests, in order to avoid the spurious problem, equation (1) is estimated in terms of the rate of growth as well as by adding a lagged inflation rate. Standard errors are made robust to autocorrelation and heteroscedasticity by applying the Newey and West estimation:

$$\pi_t = c + \alpha WAG_t + \beta GDPG_t + \gamma iG_t + \delta \pi_{t-1} + u_t \qquad (2)$$

Where $\pi_t = \frac{CPI_t - CPI_{t-4}}{CPI_{t-4}}$, $WAG_t = \frac{WA_t - WA_{t-4}}{WA_{t-4}}$, $GDPG_t = \frac{GDP_t - GDP_{t-4}}{GDP_{t-4}}$,

$iG_t = \frac{i_t - i_{t-4}}{i_{t-4}}$

Table 4: Effect of demographics on inflation

Dependent variable	Headline inflation	Food and Beverages	Apparel and Foot wears	Housing and Furnishing	Medical and Personal Care	Transport and Communication	Core inflation
Constant	0.9567	2.6392**	-0.0697	2.211	0.8186***	-2.3458	0.7256*
(c)	(0.7835)	(1.0926)	(0.5552)	(1.502)	(0.1582)	(2.2461)	(0.4125)
Working age pop.	0.6639	**2.4355*** **	0.2565	**-2.5013*** **	**0.2104***	0.7281	**0.3609** **
(α)	(0.6030)	**(0.7948)**	(0.2398)	**(0.5605)**	**(0.1171)**	(1.7341)	**(0.1672)**
GDP	0.1563***	-0.0975	-0.0206	0.0154	0.006	0.7859***	0.0251**
(β)	(0.0549)	(0.0764)	(0.0233)	(0.0522)	(0.0122)	(0.1738)	(0.0096)
Interest rate	0.0212***	0.0246**	0.0065**	-0.0116*	0.0022*	0.0524***	0.0099***
(γ)	(0.0057)	(0.0081)	(0.0027)	(0.0064)	(0.0012)	(0.0174)	(0.0017)
Lagged inflation rate	0.7174***	0.7548***	0.8799***	0.8946***	0.7006 ***	0.6634***	0.8486***
(δ)	(0.1060)	(0.0974)	(0.068)	(0.0705)	(0.1017)	(0.1119)	(0.0624)
F-statistics	40.17***	46.4***	47.7***	41.23***	20.58***	34.81***	53.53***
R-squared	0.75	0.77	0.78	0.75	0.60	0.72	0.80
Durbin-Watson stat	1.38	1.53	1.34	1.19	1.65	1.57	1.59

Notes: Newey and West estimates of heteroscedasticity and autocorrelation consistent standard errors in parentheses. ***, **, and * indicate the significance level at 1 percent, 5 percent and 10 percent respectively.

Source: author's calculation

Table 4 displays the results from the inflation regression represented by equation (2). Generally, the R-squared is not less than 0.6 in all models with a maximum of 0.8 for the case of core inflation. The estimated results between inflation and demographics appear to have a significant relationship with regards to core inflation rather than headline inflation. This is in line with the study of Manopimoke and Direkudomsak (2015) who show that headline inflation in Thailand has been largely affected by the global factors and supply side shocks such as lower oil prices. The result of core inflation model suggests that a one percent decrease in the working age population would reduce the core inflation rate by 0.36 percent. Compared with other papers, although the impact of working age population share on overall inflation is not as strong as in the EU data as shown by Bobeica et al. (2017), but the coefficient is comparable to the case of Japan (see Liu & Westelius, 2016) and other cross countries (see Yoon et al., 2014). According to UN projections as mentioned earlier, the change in population's age structure, therefore, could potentially further dampen inflation in Thailand.

Looking at the sub components of the CPI basket, the demographic variable is significant in the food and beverage, housing and medical and personal care prices. As expected, a fall in the working age population leads to the deflationary pressure on food and beverage prices from lowering demand for consumption. One percent shift in working age group significantly affects food and beverage prices by almost 2.5 percent. Interestingly, the magnitude is quite high as compared to Liu and Westelius (2016). Using total population instead, they find that a decline in the population growth rate reduces the food price by around 0.5 percent. The difference is expected from life-cycle spending as the worker group spends a relative higher than others putting more deflationary pressures (Anderson et al., 2014).

However, the results from housing and medical items do not seem to provide the expected signs. For example, an increase in the old age people or a decrease in working age group is shown to lower the cost of medical care. One possible reason for this result is that medical care prices in Thailand are enormously intervened by the government policy especially after launching the "30 baht treat all" scheme for universal access to subsidized

health care since 2001[4]. Under the scheme, people pay 30 baht (around 0.9 US dollar) for each visit or admission (Figure 5).

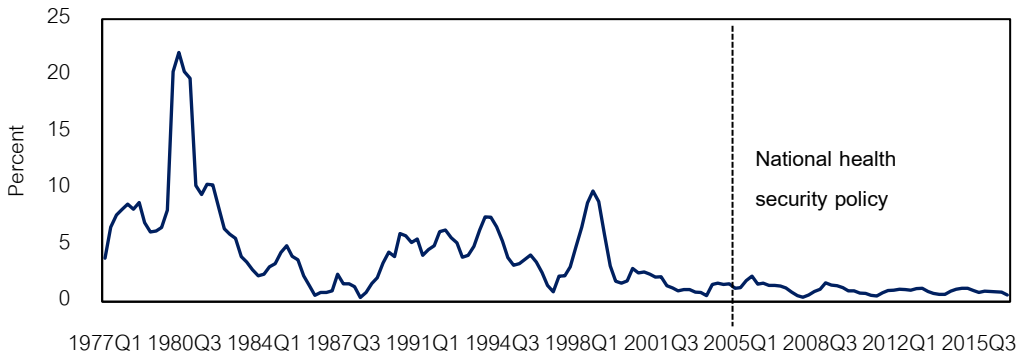

Figure 5: Medical Inflation in Thailand

Source: Bureau of Trade and Economic Indices

In Figure 6, the paper presents health financing in Thailand. The out-of-pocket (OOP) expenditure has continuously declined since 1994. This is because Thailand has gradually expanded health financial risk protection using several approaches; for example, by providing social welfare for the poor and vulnerable, including older people and children under 12 years old; and voluntary public subsidized health insurance for the non-poor informal sector. When universal health coverage (or 30 baht treat all) was achieved in 2002 covering 75 percent of total population, the benefit packages provided were comprehensive and OOP dropped to 27.2 percent of total health expenditure. On average during 2010 to 2014, Thailand spent about 3 percent of GDP on its public health expenditure, which is higher than other countries in South-east Asia such as Malaysia and Singapore (Figure 7). In 2012, the public expenditure per capita was 195 US dollars, up from 39 US dollars in 1994.

[4] The National Health Security Act was passed by parliament in 2002 creating new institutions to regulate the quality and financial elements of the scheme.

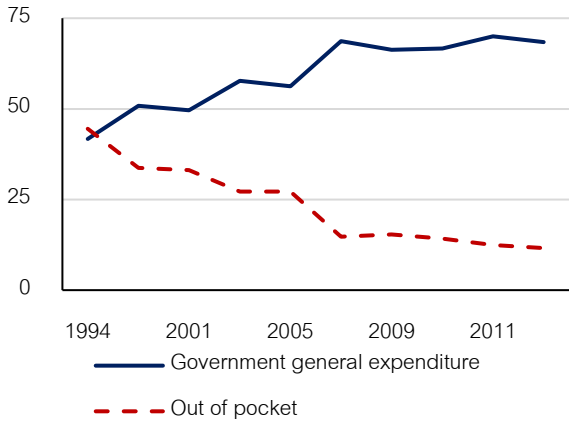

Figure 6: Health care spending (percent of total health expenditure)

Source: World Health Organization

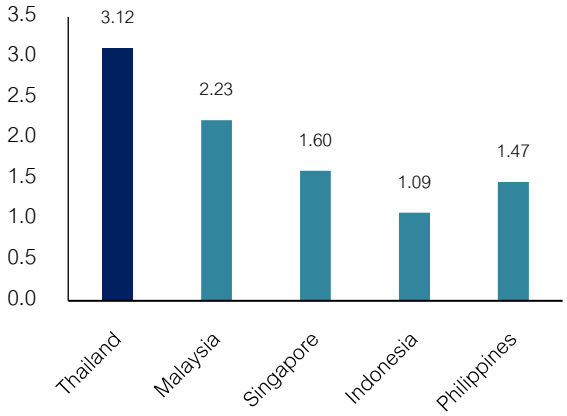

Figure 7: Public health expenditure (percent of GDP)

Source: World Health Organization

In short, the universal coverage scheme has controlled medical care prices well during the past decade. In addition, medicine prices are regulated by the Food and Drug Administration and set daily at different levels, such as, by the Subcommittee for the Development of the National List of Essential Medicines. Therefore, medical care prices are significantly regulated by government not from demand of the aging per se. This is consistent with Liu and Westelius (2016) showing a negative relationship between aging population and the cost of medical care in Japan.

A similar puzzle appears in the case of housing prices, where the working age population growth is negatively related to the cost of housing. As people age, the pattern of their spending on good and services also change. According to the National Statistics Organization's data on the expenditure structure of household with retirees, it is revealed that they spend 9 percent more than average households on home renovations, improvements and decorations. This figure is also in line with the survey by the Economic Intelligence Center (EIC) of the Siam Commercial Bank on post-retirement consumption, which found that around 80 percent of respondents want to renovate their homes upon retiring. Given that 90 percent of the elderly surveyed said they would continue to live in their existing house after retirement, renovations and improvements are needed to equip the house with amenities suitable for old age.

Given that old people spend more on home product and furniture as well as buying new smaller houses such as condominiums (see IMF, 2014), this reflects their preferences for convenience and the fact that more individuals prefer to live alone nowadays. Figure 8 shows the trend of real estate price indices. The evidence indicates that land and condominium prices continued to grow, and especially in some areas, at a faster rate.

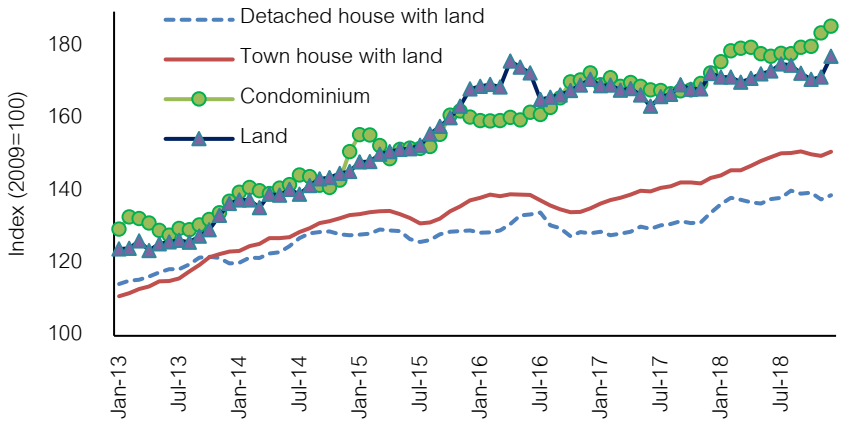

Figure 8: Real estate price indices

Source: Bank of Thailand

5. Concluding Remarks

Many high and middle income countries are facing a declining working population and increase in population aging. These new normal trends pose potentially daunting economic challenges in terms of their impact on growth, resource scarcity, and economic stabilities. However, empirical paper estimating realized the impact has been relatively scarce. This study, therefore, presents empirical evidence in favor of the impact of population aging on the inflation rate in Thailand, a country in which demographic transitions have changed rapidly.

Based on the regression analysis, the positive relationship between the inflation rate excluding energy and food components (i.e. core inflation) and demographic trends, is represented by the growth rate of working age relative to total population. This relationship still holds after controlling for monetary policy by using the short term interest rate. The results affirm the findings that slow population growth or population aging has contributed to deflationary pressures in Thailand. This is also true in case of food and beverage and medical prices. The major reason for the medical prices is that the cost of medical care in Thailand is mainly subsidized by the government. However, inflationary pressures from aging are found in the case of housing and furnishing prices, which are from old age people demand.

Although demographic transition is a slow-moving process with no sudden impact on the usual policy implementation, the models show that it is a powerful structural headwind for the near future. A possible reason is demographic change significantly affects the number of the labor participation, with important effects on consumption and saving decisions. On the structural challenges, structural reforms such as female and older workers' labor participation as well as pension system that directly address the effects of population aging should be considered.

In addition, the deflationary risk from demographic changes could reduce monetary policy effectiveness. Societies dominated by old people would tend to be less sensitive to interest rate changes than young societies. Therefore, monetary policy may become less effective in a society going through a demographic transition to an older population. According to the UN demographic projections, by 2050, more than a third of Thailand's population will

be aged people. This implies that monetary policy will have to operate differently from the present to achieve the same goal.

For example, the relative preference of price stability versus output growth in likely to change in an aging society because older people have on average larger asset holding, and therefore they more to lose from unexpected inflation. Besides the policy trade-off, some economists suggest that monetary policy should be more aggressive in an aging society. If monetary is less effective, the higher interest rates adjustment will be needed. However, given monetary policy becoming less effective, to stabilize the economy, the relative role of fiscal policy and macroprudential policy may be needed to overcome this issue.

Empirical results, especially regression analysis, are subject to a number of caveats. Most important, the sample is this study is not quite long compare to traditional macroeconomic standards. It is relatively more interesting if the time period is longer. Hence, the results should be considered cautiously. Moreover, with the limitation of empirical technique, this study cannot explicitly point out which channels underlie the impact of demographic transition on inflation. However, this study may be treated as the beginning stage to support theories of inflationary or deflationary pressures coming from demographic changes.

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