

Does increasing Inflation lead to income inequality in Thailand
and south-east Asia?



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Field of Study of Business and Managerial Economics
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การเพิ่มอัตราเงินเพื่อทำให้เกิดความเหลื่อมล้ำในไทยเลยกลุ่มประเทศเอเชียตะวันออกเฉียงใต้
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พาดิถัก มณีไทย : การเพิ่มอัตราเงินเพื่อทำให้เกิดความเหลื่อมล้ำในไทยเลขกลุ่ม
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ความไม่เท่าเทียมกันของการกระจายรายได้ทำให้เกิดผลด้านลบต่อผู้คนและการเติบโต
ของเศรษฐกิจโดยรวมในประเทศ เพื่อที่จะลดความเหลื่อมล้ำทางรายได้ การศึกษาปัจจัยที่ส่งผล
กระทบต่อความเหลื่อมล้ำเป็นสิ่งจำเป็น ในช่วงที่ผ่านมา ปัจจัยต่างๆ อาทิเช่นเงินเพื่อ การพัฒนา
ของเทคโนโลยี การเปิดโลกาภิวัตน์ ถูกนำเสนอขึ้นมาในแง่ของปัจจัยที่มีผลกระทบต่ความ
เหลื่อมล้ำในประเทศที่พัฒนาแล้วทั้งสิ้น ในงานวิจัยนี้ เราได้มุ่งเน้นความสนใจในประเทศกำลัง
พัฒนาในเอเชียตะวันออกเฉียงใต้ ในประเทศไทย เราได้รับผลลัพธ์ว่าเงินเพื่อมีปัจจัยบวกต่อ
ความเหลื่อมล้ำในช่วงปีที่ผ่านมา (2000-2020) ทว่ากลับมีปัจจัยลบในช่วงปีก่อนหน้า
(1980-1999) เพิ่มเติม สำหรับพื้นที่ในเอเชียตะวันออกเฉียงใต้ เราพบว่าวงจรธุรกิจมีปัจจัย
ด้านลบต่อความเหลื่อมล้ำ ทว่า ในกลุ่มประเทศ OECD ที่เป็นประเทศที่พัฒนาแล้ววงจร
ธุรกิจกลับมีผลกระทบด้านบวกต่อความเหลื่อมล้ำ นอกเหนือจากนั้น มีเพียงปัจจัยเดียวที่มี
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Increasing income inequality has negative effects on human well-being and the nation's economic development. Understanding how income inequality is affected by various economic factors is the first step toward alleviating it. Previously, inflation, economic and technology development, and the openness to globalization have been suggested to affect income inequality in various developed nations. In this work, we are interested in developing countries in south-east asia. In Thailand, we found that the inflation rate had a positive impact on income inequality in recent years (2000-2020), yet had the opposite impact in earlier years (1980-1999). On the other hand, we found the negative impact of the business cycle on inequality in south-east asia countries as a whole in earlier years. The opposite (positive) impact was found instead in the OECD countries during the same period. Only openness to international trade was a common significant positive factor between both regions of countries. This work suggests that empirical study of this kind is specific to the countries and periods of study. Generalizations made from the findings may not be warranted.



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Advisor's Signature

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Does increasing inflation lead to income inequality in Thailand and south-east Asia?

Abstract

Increasing income inequality has negative effects on human well-being and the nation's economic development. Understanding how income inequality is affected by various economic factors is the first step toward alleviating it. Previously, inflation, economic and technology development, and the openness to globalization have been suggested to affect income inequality in various developed nations. In this work, we are interested in developing countries in south-east asia. In Thailand, we found that the inflation rate had globalization's a positive impact on income inequality in recent years (2000-2020), yet had the opposite impact in earlier years (1980-1999). On the other hand, we found the negative impact of the business cycle on inequality in south-east asia countries as a whole in earlier years. The opposite (positive) impact was found instead in the OECD countries during the same period. Only openness to international trade was a common significant positive factor between both regions of countries. This work suggests that empirical study of this kind is specific to the countries and periods of study. Generalizations made from the findings may not be warranted.



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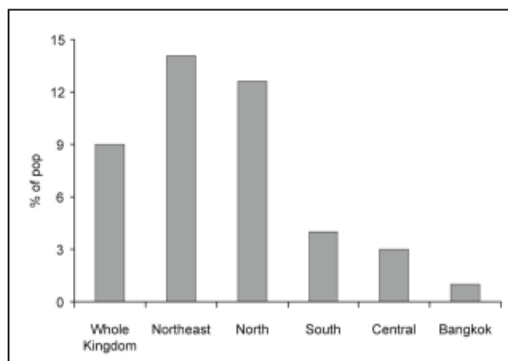
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1. Introduction

Increasing technology, globalization, decline of unions and eroding of minimum wages affect income inequality that is rising in Asia (Park, Kang Hoon, 2017). Thailand is one of the countries in southeast Asia that have particularly high income inequality among South East Asia. Specifically, income inequality is strongly occurring in the northeast of Thailand (Kelly Bird, 2011). High income inequality potentially has various negative effects on human well-being and development such as inferior infant development, poorer health and higher mortality, limited career advancement in women, fostering government distrust, escalating levels of violence and social unrest inhibiting poverty alleviation (Hamid Lahouij, 2017), and increasing physical violence (see Park, 1986). Not only affecting individuals, it has also been found that unequal income distribution has negative effects on a nation's economic growth (Park 1996b, 1998).

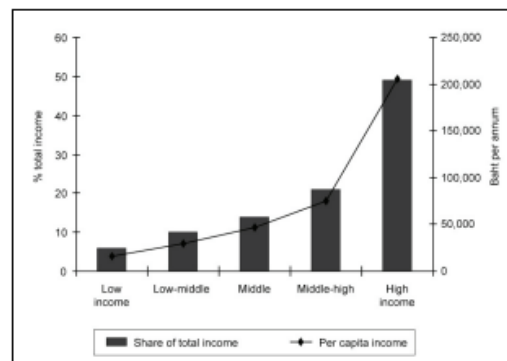
Despite Thailand's significant progress in eliminating national poverty, pockets of poverty still exist throughout the country. The government's Household Socio-Economic Survey is used to compute Thailand's poverty rate. It shows that poverty rates have progressively dropped since 1988, from around 33.8 percent to only 9.0 percent in 2008. The poverty rate of 9.0 percent is low when compared to other middle-income countries. However, the aggregate figure conceals the development disparities between different regions and demographic groups of Thailand. Over 40% of Thailand's impoverished live in the north-eastern part of the country. Moreover, poverty affects children and the elderly in particular (Kelly Bird, 2011). According to many indices of income inequality, the Thai income distribution is skewed toward a tiny fraction of the population. The richest 20% of households earn as much income as the rest of the households in the country combined. With the Gini index of 0.51, Thailand is one of the most unequal countries in Southeast Asia in terms of income (Kelly Bird, 2011).

Figure 1: Poverty Incidence by Subnational Region
(% share of region's population)



Note: Poverty rates refer to persons above 15 years of age.
Source: National Economic and Social Development Board (NESDB). 2008. Household Socio-Economic Survey 2008.

Figure 2: Income Distribution in Thailand



Source: NESDB. 2008. Household Socio-Economic Survey 2008.

Understanding of factors contributing to income inequality is likely the first step toward reducing it. Several economic factors have been suggested for their relationships to the rise of inequality among various countries including unemployment, skill-based technology change, and openness to international trade, unionization, inflation, and economic development business level. (Monnin, 2014). Monnin found that higher inflation rates, higher GDP per capita (long-term), and higher labor unionization were related to lower income inequality among 10 OECD countries during 1971-2010. The U-shape relationships were also suggested in inflation and GDP per capita. It is yet unclear whether this conclusion from highly developed countries will transfer to developing countries with vastly different socioeconomic backgrounds such as south-east asian countries and Thailand in particular.

This paper aims to investigate the relationships between the aforementioned economic factors and income inequality in Thailand and other developing countries in south-eastern asia. We analyze the positive and negative impacts on the dependent variable which is income inequality. We have discovered that while inflation has a negative impact on income inequality among OECD countries, confirming Monnin 2014, it has no significant impact on income inequality among south-east asian countries. For Thailand in particular, inflation has had a positive impact on income inequality in recent years (2000-2020), yet this trend does not precede earlier years (1980-1999).

1.1. Methodology overview

There are three questions we are answering in this study:

- What are the empirical links between income inequality and other five factors, including inflation, economic development level, business cycle, unemployment, and openness to international trade, in Thailand? We studied both links in the recent years (2000-2020) and in the earlier years (1980-1999).
- Do the empirical links hold up in the panel study of countries in south-east asia including Indonesia, Malaysia, Singapore, Vietnam, Philippines and Thailand?
- Do the empirical links hold up in the panel study of ten OECD countries?

The empirical links are studied by applying least-square regression models on the pooled cross-sectional data. By observing the coefficients of the regression model, we can measure the significance and direction of contribution of each factor to the income inequality.

1.2. Summary of results

- Inflation rate (short-term) had a significant positive contribution to income inequality in Thailand in recent years (2000-2020) while it had an opposite contribution (negative) during the earlier years (1980-1999). However, the link between inflation and income inequality was not present in the panel study of six south-east asia countries, including Thailand, Indonesia, Malaysia, Philippines, Singapore, and Vietnam.
- Instead, in the panel study of south-east asia countries, we found a significant negative link between GDP per capita (business cycle) and income inequality in recent years (2000-2020). However, the opposite was true in the OECD countries where we found a positive link between GDP per capita (business cycle) and income inequality. This suggests that empirical links between economic variables are specific to the countries of study.
- Openness to international trade was found as a positive contributor to income inequality in both south-east asia countries (2000-2020) and OECD countries (1980-1999 and 2000-2020).

1.3. Structure of paper

This research paper is organized as follows; section 2 is literature review which will express the previous research information and some information that will be used in methodology later section 3 is data and data description including where that data was collected from and how this research prepared the data, section 4 is Methodology and briefly regression model that will be used in this research section 5 is empirical results and analysis including the contradiction analysis that might happened after receiving the number from model regression the and finally 6 is conclusion and suggestion for further research.

2. Literature review

2.1. Inflation

Inflation is the increase in price due to the devaluation of currency over time. In other words, Inflation can be reflected by increasing the price level of goods and services over the period of time. To quantify the inflation, CPI or consumer price index, which indicates the change of prices of items commonly used in households over time, is often utilized. An increase in any percentage unit in the CPI indicates that fewer items can be bought by the same amount of currency, hence, inflation. The opposite of inflation is deflation. Deflation occurs when the price decreases and purchasing power increases. The rise of inflation can be affected by many factors such as unionization, economic development level, and openness to trade, etc. (Monnin, 2014).

2.2. Inflation effects on Income

Many researchers suggested that income can be affected by Inflation as well (Heer, 2007). The impact on income varies depending on which industries are most affected by inflation. In real terms, if a person's income grows faster than the rate of inflation, there is net income growth. If the income rises at the same rate as inflation, there is no income growth. If the income grows slower than inflation, there is a net reduction in income, hence goods and services will be more expensive.

The effect on income previously stated also impacts the nation's income distribution which can influence the standard of living as well. People who have higher payment than inflation will have higher living standard than people who received equal payment to inflation and People who received equal payment as equal as inflation will have higher living standard than people who have lower payment than inflation. This creates inequality in income distribution. As people that have lower wages will have a reduction in living standard if they did not receive at least equal wages compared to inflation.

Different income channels are affected unevenly by inflation. Income from dividends and interests usually rises, to some extent, with inflation. Therefore, mitigating the effects on households with this channel of income which usually are high-income households. This gives them advantages over lower-income households which rely mostly on labor income such as wages that are less elastic to change due to inflation. This may lead to a positive relationship between inflation and inequality suggested by Cysne et al. (2005) and Areosa (2006).

Besides, we also might equally claim that rising minimum wages has nothing to do with increasing inflation. In theory we know that raising minimum wages makes business owners have to raise goods and service prices. This can accelerate inflation. but in reality the relationship between raising wages and flationtion is more complex. Due to the fact that Wages are simply one component of the total cost of a product or service that consumers pay for. higher wages can be replaced by higher productivity or timming down company man's power. Thus, we can not say that raising minimum wages is directly related to increasing inflation.

2.3. Kuznets Curve

An inverted U-shape relationship between inequality (usually Gini coefficient) and economic development (usually GDP per capita) was hypothesized by Simon Kuznets in 1955. Kuznets Curve, as it is called, suggests that although the inequality may grow in the early stages of economic development, in more developed economies, the inequality tends to decrease. The inflection point in between the development stages incurs an inverted bell (U-shape). The curve is shown in the picture below

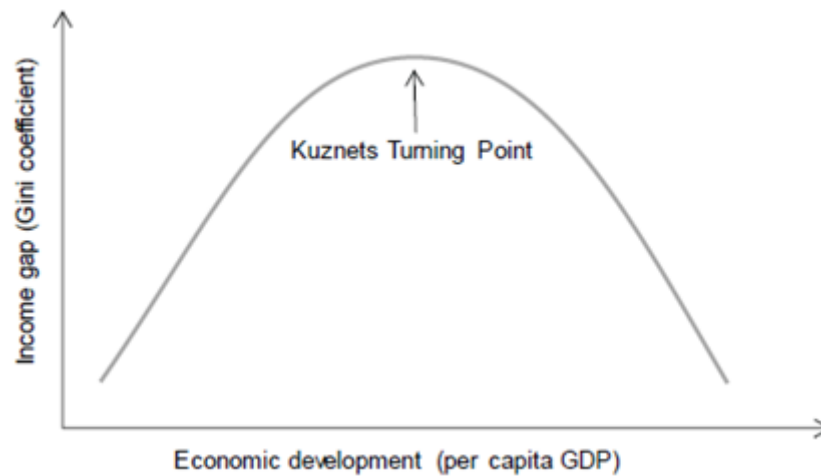


Figure 1. Kuznets curve

However, Kuznets' idea has been refuted by empirical evidence. Bulir and Gulde (1995) concluded in their first thorough analysis that the Kuznets theory explains just a small portion of the inter-country variance in income distribution. Because the relationship between economic progress and inequality varies by country, according to Hossain (2013), Kuznets' hypothesis is not confirmed because some countries experience an increase in income inequality along with economic development level after an estimated threshold level of income, while others experience a decrease relationship between inequality and economic development at the early state.

2.4. Unit Root Test

Unit root test is the test that is used for testing whether that time-series data that consist of past and present variables demonstrate non-stationary characteristics or not. In other words, this test is used to find out that mean and variance of the time-series data are time-invariant. Time-invariant variance is one of Gauss-Markov assumptions required for least-square regression, used in this study, to be consistent and produce meaningful interpretations. Otherwise, spurious regression may occur, that is when a statistical model produces false statistical signals of a linear relationship on a bogus correlation between independent non-stationary variables. There are many tests devised for this purpose for example augmented Dickey-Fuller test (cite) used in this study.

2.5. Augmented Dickey-Fuller Test

Augmented Dickey-Fuller Test is one of the unit-root tests used to test whether time series data is stationary or not. Null hypothesis, that a unit root exists in a time series sample, is tested against an alternative hypothesis using Augmented Dickey-Fuller Test. A failure to reject the null-hypothesis suggests that the time series is non-stationary. The framework of the augmented Dickey-fuller test was present as following formula

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t,$$

Equation 1. Augmented Dickey Fuller Test

where α is a constant, β is the coefficient on time trend and p is the lag order of the autoregressive process.

2.6. Hodrick-Prescott Filter

HP-Filter or Hodrick-Prescott Filter is the technique used to smoothen short term oscillation using in business cycles. This technique helps remove short term fluctuation and reveals long term trends in the business cycle.

$$\min_{\tau} \left(\sum_{t=1}^T (y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \right).$$

Equation 2. Hodrick-Prescott Filter 1

The first term of the equation is a sum of the squared deviations Where y_t donated the logarithms of a time series variable., T_t donated trend component, C_t donated cyclical component, and E_t donated error component.

$$HP = [\lambda L^2 - 4\lambda L + (1 + 6\lambda) - 4\lambda L^{-1} + \lambda L^{-2}]^{-1}$$

Equation 3. Hodrick-Prescott Filter 2

The second term of the equation is the sum of the squares of the trend component's second differences. This second term penalizes variations in the growth rate of the trend component. Where the value of λ indicated how high its penalty. In This paper we used λ of 100 which is the common choice in practice for annual data.

2.7. Economic factors related to income inequality

This part, we look at the possible mechanisms that relate inflation to income disparity before moving on to additional variables that economists usually point to as drivers of rising income inequality in industrialized nations.

2.8. Labor income

(OECD, 2012) stated that Individual labor income inequality among the working-age population is fueled by three major sources. the dispersion of hourly wages among full-time employees, the dispersion of hours worked, and the unemployment rate. Labor income is one of the factors that affect income inequality. When the research is expanded to include part-time employees or the total working-age population, inequality rises in all nations, indicating the huge income disparities between these groups and full-time workers. The growth of labor income disparity among full-time workers varies significantly among nations. It has climbed significantly in several nations over the last decade, while it has stayed mostly stable or even decreased in others. In almost half of the countries, the rise in full-time worker inequality was concentrated in the upper half of the income distribution between the mid-1990s and the mid-2000s. In many countries, rising inequality among those with jobs was matched by rising employment, resulting in a reduction in disparity among those of working age.

2.9. Economic development level

The economic development level of the country was used to measure the economic progress. Mostly used to measure through GDP and GDP per capita. The level of indicators can be influenced by many factors such as environment, government policy and social economical. To measure the link between economic development level and inequality Kuznets curve (1995) was used. From the kuznets hypothesis, when the economic development level is increased the inequality is changing to inequality and change back to equality when the country passes through the stage of business growing.

2.10. Business cycle

Income distribution is also another factor that influences income distribution. According to early research, the income share of the top income groups increased during recessions and decreased during booms in the interwar US economy (Mendershausen, 1946, Kuznets and Jenks, 1953). However, more recent study indicates that this association has decreased since WWII (Parker, 1998). (Heathcote, Perri, and Violante, 2010) recently found that in recessions, incomes for the bottom percentiles of the income distribution fall dramatically, implying that recessions are periods when earnings inequality grows dramatically. In this paper.

2.11. Unemployment

Another element that has received a lot of attention in the literature is the relationship between unemployment and income inequality. The empirical findings are inconclusive. Some investigated that unemployment does a poor job of accounting for shifting income proportions of income groups found over business cycles, according to the findings. Over the previous decade, unemployment has been more associated with a rise in total labor market inequality. This involves, among other things, disengagement from the labor force, as well as increased registered unemployment. With a rise in wage disparity, Policies must be reviewed not just for their success in lowering unemployment, but also for the distribution of costs and benefits in this larger context. (Glyn, 1995)

But, for the United states, some researchers find out that Unemployment, In a simple linear regression, unemployment has no significant correlation with Gini coefficients. In an error correction model, however, there is a substantial positive relationship between unemployment and Gini coefficients. Institutions can, in theory, have opposing impacts. A bigger unemployment benefit, for example, tends to raise the wage share, which decreases inequality, but it also raises the unemployment rate, making the income distribution more unequal.

2.12. Unionization

It will come as no surprise to anyone that unionization has fallen considerably at the same time that inequality has soared. Thus, we can say that unionization is one of the factors that affect income inequality. (Jonas Pontusson, 2013). The evidence for a relationship between union membership and income disparity is rather substantial. Inequality is lower in countries where a larger proportion of the workforce is unionized. In addition, unions raise salaries for the poorest 35% of the population while decreasing earnings for the richest 20%, resulting in a direct reduction in inequality.

2.13. Openness of international trade

Openness of international trade has a relatively strong connection with export, import rate and GDP per capita. Increased wealth inequality in the importing nation is associated with reduced costs and quality, according to these frameworks, when exporting enterprises optimize profits by serving both rich and poor consumers and selling positive amounts to both. (Andrea Ciani, 2021). Rich countries import more high-quality items, according to evidence (Hallak 2006; Hummels and Lugovsky 2009). Indeed, because family income correlates with quality demand (Bils and Klenow 2001), firms export their most costly items to countries with high per capita income. Despite the fact that various research has looked into how per capita income affects trade flows, the significance of income distribution has been neglected. In this setting, determining how income disparity affects import demand is critical for the firm's optimum pricing strategy as well as policymakers whose actions affecting inequality may have an impact on global trade patterns.

2.14. Skill-biased technological change

Many economists believe that since the late 1970s, technology has been the dominant cause of rising pay disparity. As technologically driven occupational skill needs have overtaken the workforce's expanding education levels According to the popular "skill-biased technological change" (SBTC) theory, technology boosts demand for educated people, allowing them to command greater compensation, hence increasing wage disparity. Computerization's involvement in expanding employment in both higher-wage and lower-wage occupations, resulting in "job polarization," according to a more current SBTC explanation.

Skill-biased technological change (SBTC), which is connected with developments in personal computers and related information and communication technologies, is sometimes blamed for rising pay disparity (ICT).

This paper aims to find the relationship between whether increasing the minimum rate can increase inequality in Thailand or not. By assuming that theoretically increasing the minimum rate leads to higher inflation rate and finding the relationship between inflation and inequality through several factors that might affect inflation rate. Our research focuses on the impact of inflation. We investigate if inflation has an impact on income distribution in Thailand's economy.

3. Data

3.1. Description

In this section, the data used for analyzing the relationship between income inequality and inflation was presented. Firstly we checked the data by using unit root test whether it is stationarity or not in order to use data for further analysis. To answer the three main questions (Section 1), we gather the following datasets

- OECD (1971-2010). This year's range matches the experiment in Monnin 2014. We use this dataset to reproduce the main results found in Monnin 2014. Note that there are differences in the data sources and some variables.
- Thailand, recent year (2000-2020).

- Thailand, earlier year (1980-1999).
- South-east Asia, recent year (2000-2020).
- South-east asia, earlier year (2000-2020).
- OECD, recent year (1980-1999).
- OECD, earlier year (2000-2020).

The variables of interest included in these datasets are described in the following sections.

3.1.1. Income inequality

The fraction of total pre-tax income earned by the top 10% of earners is our measure of income inequality. The World Top Income Database provided this variable. It covers labor income, capital income, and government payments and is calculated using national tax declarations. It excludes any capital gains.

3.1.2. Inflation

The fraction of total pre-tax income earned by the top 10% of earners is our measure of income inequality. This data comes from Alvaredo, Atkinson, Piketty, and Saez's World Top Income Database (Alvaredo, Atkinson, Piketty, and Saez, 2013). It covers labor income, capital income, and government payments and is calculated using national tax declarations. It excludes any capital gains.

We decomposed the inflation variable for each country into two components: short-term inflation and long-term inflation using Hodrick-Prescott (HP) filter with the smoothing parameter of 100 following a common practice for annual data.

3.1.3. Economic development level and business cycles

The economic development level and business cycles variables are based on GDP per capita. We applied a Hodrick-Prescott (HP) filter with the smoothing parameter of 100 independently on each country's data. The economic development level was the long-term trend and business cycles were the short-term cycles found by the filter. The data came from World Bank open data (2022).

3.1.4. Unemployment

We used the nation's official unemployment rates from World Bank open data (2022). This data was incomplete for many of south-east asia countries. For this reason, we chose only Thailand, Indonesia, Malaysia, Philippines and Vietnam, which had relatively more complete data, as representatives from south-east asia countries.

3.1.5. Openness to international trade

The data was calculated from the ratio of a country's exports and imports over the country's GDP as a proxy for the country's openness to international trade. The information was taken from the World Bank open data (2022).

3.1.6. Unionization

Monnin 2014 suggested labor unionization rate was another important economic factor relating to income distribution. However, the data was hard to obtain for developing countries

in south-east asia. To facilitate fair comparison, we omitted this variable from all of our experiments.

3.1.7. Skill-biased technological change

This variable was to measure the rate of technological development in one's country. However, this variable was hard to observe numerically for each country. Instead, we used the nation's internet penetration rate as a proxy. We gathered the data from the International Telecommunication Union for these indicators (2014). Note that the internet penetration rate was a recent phenomenon. We do not have this data spanning to the earlier years which limits our ability to do longer term comparisons. We used this variable in the study of Thailand in recent years (2000-2020), and found no significant link between this variable and income inequality. Therefore, we did not use this variable in the other experiments.

3.2. Stationarity test

Before the analysis between inflation and inequality, all variables were tested whether they are stationarity or not using Augmented Dickey-Fuller unit root test. The results are provided in Table 1. The test results suggest that most of the variables are non-stationary at a confidence level = 5%. While results presented here are derived from Thailand's data during 2000-2020, it extends to data of other south-east asia countries and OECD countries as well. To properly work with regression models, we differentiated all the variables and used them in all the experiments instead of their original values.

Variable	ADF t-statistic	Mackinnon critical value			P-value	Result	N
		1%	5%	10%			
Income inequality		-3.832	-3.030	-2.655	0.997	non-stationarity	20
Inflation	-3.003	-3.809	-3.021	-2.650	0.052	non-stationarity	20
Economic development level business cycle	-0.639	-3.809	-3.021	-2.650	0.841	non-stationarity	20
Unemployment	-2.408	-3.809	-3.021	-2.650	0.152	non-stationarity	20
Openness to international trade	-0.968	-3.809	-3.021	-2.650	0.744	non-stationarity	20
Skill-biased technological change	5.375	-3.809	-3.021	-2.650	1.000	non-stationarity	20

Table 1. Stationarity Test

4. Methodology

We estimate the following econometric model to analyze the influence of the various factors mentioned above on income inequality.

$$Y = \beta_0 + \beta_1 IFLT + \beta_2 IFC + \beta_3 EB + \beta_4 BC + (\beta_5 UM) + \beta_6 OT + (\beta_7 ST) + \varepsilon \quad (1)$$

Equation 4. Methodology

where Y donated income inequality, IFLT donated Inflation (long-term trend), IFC donated inflation (short-term cycles), EB donated economics development level (GDP per capita long-term), BC donated business cycle (GDP per capita short-term), UM donated unemployment, OT donated openness to international trade, UN donated to unionization, ST donated skill-based technological change, and ε is the residual. Note that terms in parentheses were used only in selected experiments due to limited data availability (see Section 3).

Dependent variable and independent variables were selected based on the literature review (see Section 2). Inequality was used as a dependent variable. Inflation, Economic development level, business cycle, unemployment, openness to international trade, unionization, and skill-based technological change were used as independent variables.

The econometric model was performed as a pooled least-square process in EViews. In each study, we treated the data from the countries in study as a pool disregarding the differences across countries. The results were analyzed and interpreted in the next section.

Before answering the three questions in Section 1, we repeated and confirmed the findings from Monnin (2014) of OECD countries during the years 1971-2010. We tried to replicate most of the important aspects from the work, yet there were still differences in data sources and variables. By confirming the results, it gave grounds for our methodology.

Our main experiments are three-fold. We tried to answer each of three research questions separately. The first question we wanted to answer is to analyze empirical links between independent variables and income inequality in Thailand. To answer this question, we conducted two experiments on the recent years (2000-2020) and the earlier years (1980-1999) of Thailand. The second question is whether the empirical links found in Thailand apply to countries in south-east asia or not. We applied the same methodology on the data from representative countries in south-east asia, i.e. panel data, including Thailand, Indonesia, Malaysia, Singapore, and Vietnam, again, both the recent years (2000-2020) and the earlier years (1980-1999). Note that the selection of these countries were based on the availability of data. Finally, the third question is the study of whether the empirical links found in south-east asia countries are applicable to highly developed OECD countries in the same periods or not. We applied the same methodology on the dataset from ten OECD countries from 2000-2020 and 1980-1999. We describe the results and findings in the following section.

5. Empirical results

5.1. Panel Analysis

5.1.1. OECD (1971-2010)

Table 1 presents the empirical result. The result presents the data from OECD, Thailand, and SEA in different ranges of year. We use least square estimator to run the regression as same as other data that was done in this paper

Table 2: Pooled-regression on income inequality OECD (1971-2010)	
Sample	1971-2010
Number of observations	365
Exogenous variables	
Inflation (long-term trend)	-0.004968
Inflation (cycle)	-0.000673
GDP per capita (long-term trend)	$3.07 \cdot 10^{-7}$
GDP per capita (Business Cycle)	$3.85 \cdot 10^{-7}$
Unemployment rate	-0.000736
Trade openness	0.000592

Table 2 OECD (1971-2010)

Firstly, we try to repeat the experiment using the same data set from Monnin (2014) in order to observe the trend and confirm our methodology. The result turned out to be the following table. We find negative effects from inflation for both long-term trend and inflation cycle. We also find the negative impact from the unemployment rate but the result is not significant. For the GDP per capita in long term trend and business cycle, and Openness to international trade we find positive impact from the regression which the same as the Monnin model (2014)

According to the results after running the regression the equation will be written as following

$$Y = -0.000222 - 0.004968IFLT - 0.000673IFC + 3.07 \cdot 10^{-7}EB + 3.85 \cdot 10^{-7}BC - 0.000736UM + 0.000592OT + \varepsilon \quad (1)$$

5.1.2. Thailand Recent Year (2000-2020)

Table 3 : Pooled-regression on income inequality Thailand Recent Year (2000-2020)	
Sample	2000-2020
Number of observations	20
Exogenous variables	
Inflation (long-term trend)	0.02373
Inflation (cycle)	0.008977
GDP per capita (long-term trend)	$-2.03 \cdot 10^{-5}$
GDP per capita (Business Cycle)	$-5.43 \cdot 10^{-6}$
Unemployment rate	0.013532
Trade openness	-0.001334
Skill-based technology change	-0.001264

Table 3 Thailand Recent year (2000-2020)

After we repeated the experiment from Monnin (2014) we moved to our raeget's sample which is Thailand. Firstly, we used the data set from recent years (2000-2020). In order to know the trend that might happen in the present. We found a negative impact on economics development level, business cycle, openness to international trade, and skill-based technology change.

According to the results after running the regression the equation will be written as following

$$Y = 0.009718 + 0.02373IFLT + 0.008977IFC - 2.03 \cdot 10^{-5}EB - 5.43 \cdot 10^{-6}BC + 0.013532UM - 0.001334OT + \varepsilon \quad (1)$$

5.1.3. Thailand Earlier Year (1980-1999)

Table 4 : Pooled-regression on income inequality Thailand Earlier Year (1980-1999)	
Sample	1980-1999
Number of observations	19
Exogenous variables	
Inflation (long-term trend)	-0.003208
Inflation (cycle)	-0.001575
GDP per capita (long-term trend)	$7.19 \cdot 10^{-5}$
GDP per capita (Business Cycle)	$2.73 \cdot 10^{-6}$
Unemployment rate	-0.000346
Trade openness	0.000247

Table 4 Thailand Earlier Year (1980-1999)

After that we moved to our next target's sample which is Thailand. Firstly, we used the data set from earlier years (1980-1999) in order to find the inverse u curve trend that might have happened. We find out that inflation and unemployment rate have a negative effect on income inequality. Meanwhile, the inflation cycle, economic development level, business cycle, and openness to international trade have positive effects on income inequality.

According to the results after running the regression the equation will be written as following

$$Y = -0.009328 - 0.003208IFLT - 0.001575IFC - 7.19 \cdot 10^{-5}EB - 2.73 \cdot 10^{-6}BC - 0.000346UM + 0.000247OT + \varepsilon (1)$$

5.1.4. OECD (1980-1999)

Table 5: Pooled-regression on income inequality OECD (1980-1999)	
Sample	1980-1999
Number of observations	185
Exogenous variables	
Inflation (long-term trend)	-0.002394
Inflation (cycle)	-0.00011
GDP per capita (long-term trend)	$-2.88 \cdot 10^{-7}$
GDP per capita (Business Cycle)	$-1.33 \cdot 10^{-7}$
Unemployment rate	-0.000672
Trade openness	0.000874

Table 5 OECD (1980-1999)

After finishing with Thailand' data. OECD From earlier year was runned in order to compare the results from developed and developing countries. We found a negative effect on inflation in the long-term trend, inflation cycle, Economics development level, business cycle, and unemployment rate have negative effect on income inequality. While, openness to international trade has a positive effect on income inequality.

According to the results after running the regression the equation will be written as following

$$Y = -0.002029 - 0.002394IFLT - 0.00011IFC - 2.88 \cdot 10^{-7}EB - 1.33 \cdot 10^{-7}BC - 0.000672UM + 0.000874OT + \varepsilon \quad (1)$$

5.1.5. OECD (2000-2020)

Table 6 : Pooled-regression on income inequality OECD (2000-2020)	
Sample	1971-2010
Number of observations	365
Exogenous variables	
Inflation (long-term trend)	-0.004968
Inflation (cycle)	-0.000673
GDP per capita (long-term trend)	$3.07 \cdot 10^{-7}$
GDP per capita (Business Cycle)	$3.85 \cdot 10^{-7}$
Unemployment rate	-0.000736
Trade openness	0.000592

Table 6 OECD (2000-2020)

For OECD in recent years, inflation in the long term trend, inflation cycle, and unemployment rate have a negative effect, while, economics development level, business cycle, and openness to international trade have positive impact on income inequality.

According to the results after running the regression the equation will be written as following

$$Y = 5.61 \cdot 10^{-5} - 0.004968IFLT - 0.000673IFC + 3.07 \cdot 10^{-7}EB + 3.85 \cdot 10^{-7}BC - 0.000736UM + 0.000592OT + \varepsilon \quad (1)$$

5.1.6. South East Asia (2000-2020)

Table 7 : Pooled-regression on income inequality South East Asia (2000-2020)	
Sample	2000-2020
Number of observations	117
Exogenous variables	
Inflation (long-term trend)	-0.003961
Inflation (cycle)	0.000611
GDP per capita (long-term trend)	$2.27 \cdot 10^{-6}$
GDP per capita (Business Cycle)	$-2.59 \cdot 10^{-6}$
Unemployment rate	0.000147
Trade openness	0.000271

Table 7 South East Asia (2000-2020)

In order to compare the results for developed countries, Southeast Asia (SEA) Countries' data was used. From the result, inflation in long-term trend, business cycle, and unemployment rate have negative effect on income inequality and inflation cycle, economic development level, and openness to international trade have positive impact on income inequality. Inflation trend is the one that is significant..

According to the results after running the regression the equation will be written as following

$$Y = -0.02475 - 0.004185IFLT + 0.000671IFC + 2.21 \cdot 10^{-6}EB - 2.83 \cdot 10^{-6}BC - 0.000831UM + 0.000277OT + \varepsilon (1)$$

5.1.7. South East Asia (1980-1999)

Table 8 : Pooled-regression on income inequality South East Asia (1980-1999)	
Sample	1980-1999
Number of observations	81
Exogenous variables	
Inflation (long-term trend)	-0.001642
Inflation (cycle)	-0.000272
GDP per capita (long-term trend)	$2.42 \cdot 10^{-6}$
GDP per capita (Business Cycle)	$-3.34 \cdot 10^{-6}$
Unemployment rate	-0.000336
Trade openness	$-3.02 \cdot 10^{-5}$

Table 8 South East Asia (1980-1999)

Lastly, South east Asia in earlier years was runned. long run inflation, inflation cycle, Business cycle, unemployment rate and trade openness have negative effects on income inequality. while, economic development levels have a positive effect on income inequality.

According to the results after running the regression the equation will be written as following

$$Y = -0.001051 - 0.003961IFLT - 0.000272IFC + 2.42 \cdot 10^{-6}EB - 3.34 \cdot 10^{-6}BC - 0.000336UM - 3.02 \cdot 10^{-5}OT + \varepsilon \quad (1)$$

5.2. Discussion

From the OECD (1971-2010), for inflation, we found a similar link between our founding and the result from Monnin (2014). From the result inflation has a negative effect on income inequality. This confirmed the methodology that was used in this paper. Thus, we moved on to our target data, Thailand. From Thailand we split information into earlier years (1980-1999) and Recent years (2000-2020) in order to find the relationship between inflation and inequality. In recent years Inflation in Thailand has had a positive effect on income inequality and in earlier years inflation in Thailand had a negative effect on income inequality.. However, we found the difference between OECD and Thailand. For OECD Inflation has a negative effect on income inequality, but for Thailand inflation has a positive effect on income inequality. This contradiction can be compared and explained. However, the range of time is still not the same so, we still can not conclude.

This led us to test the data from OECD in earlier years and recent years. To compare in recent years for inflation OECD countries also have a negative impact on income inequality. Differently, Thailand's recent inflation also has a positive impact on income inequality. This might say that inflation has had a different impact on income inequality in recent years. But in earlier years both Thailand and OECD inflation rate had a negative impact on income inequality. This might be because Thailand is too small to represent a sample for a developing country. In this case 5 countries from SouthEast Asia were selected and ran the regression in order to find out the impact from inflation to income inequality.

From the result, the inflation from south east asia countries have a positive impact on income inequity. Which is different from the impact of inflation on OECD countries. So, from the result we can imply that inflation has a different effect on different countries.

However, when we take a look at how it is significant or not for the information for how inflation affects income inequality it turns out that inflation is not significant in OECD countries and SEA countries. But it is significant in Thailand.

6. Conclusion

After testing by using six sets of data from 3 regions, we find out the significantly different impact of inflation to income inequality between OECD countries and Thailand. So, the data from OECD and Thailand in the same range of year was tested in order to find the link. The result turns out that inflation might have a positive or negative impact depending on different countries. In order to confirm the result, six countries from southeast asia were picked and run in the same range of year. The result turns out that inflation has a significantly negative impact on inequality in OECD countries and positive impact in SEA countries.

After analyzing Thailand's result, from the earlier year and recent year, inflation in Thailand has a negative impact on income inequality while, In earlier years, inflation in Thailand had a positive impact on income inequality.

For the south-east asia countries, the business cycle has a negative impact on income inequality. But the result is different in OECD countries. This might explain that the business cycle is different depending on the country.

The data is significant or not might depend on the range of year, For further research, we can use another range of year for running regression in order to improve the significant level of the data.

Moreover, for the policy recommendation, for Inflation in Thailand. In recent years inflation has had a positive impact on income. This means Inflation can be controlled by a contractionary monetary policy in order to reduce inflation.

For trade openness in OECD and SEA trade openness has a positive impact on income inequality. Inequality that might happen from trade openness might be controlled by established progressive tax and transfer systems which is contractionary fiscal policy.

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APPENDIX

The following are the least-square regression outputs from EViews.

Equation: THAILAND2000 Workfile: SEA_OECD::Data\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: D_AY
 Method: Panel Least Squares
 Date: 06/13/22 Time: 18:23
 Sample: 2000 2020 IF COUNTRY="Thailand"
 Periods included: 20
 Cross-sections included: 1
 Total panel (balanced) observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_GDP_CYC	-5.43E-06	1.16E-05	-0.467447	0.6486
D_GDP_TREND	-2.03E-05	4.32E-05	-0.469274	0.6473
D_INFLATION_CYC	0.008977	0.002785	3.223421	0.0073
D_INFLATION_TREND	0.023730	0.034033	0.697260	0.4989
D_INTERNET	-0.001264	0.001269	-0.996255	0.3388
D_TRADE	-0.001334	0.000733	-1.819767	0.0938
D_UNEM_NATION	0.013532	0.012213	1.107946	0.2896
C	0.009718	0.013284	0.731569	0.4785

R-squared 0.549028 Mean dependent var -0.002960
 Adjusted R-squared 0.285960 S.D. dependent var 0.014362
 S.E. of regression 0.012136 Akaike info criterion -5.696045
 Sum squared resid 0.001767 Schwarz criterion -5.297752
 Log likelihood 64.96045 Hannan-Quinn criter. -5.618294
 F-statistic 2.087024 Durbin-Watson stat 3.160053
 Prob(F-statistic) 0.125564

Thailand 2000-2020

Equation: THAILAND1980 Workfile: SEA_OECD::Data\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: D_AY
 Method: Panel Least Squares
 Date: 06/13/22 Time: 18:26
 Sample: 1980 1999 IF COUNTRY="Thailand"
 Periods included: 19
 Cross-sections included: 1
 Total panel (balanced) observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_GDP_CYC	2.73E-06	1.10E-05	0.247084	0.8090
D_GDP_TREND	7.19E-05	5.67E-05	1.269063	0.2285
D_INFLATION_CYC	-0.001575	0.000869	-1.813354	0.0948
D_INFLATION_TREND	-0.003208	0.007596	-0.422305	0.6803
D_TRADE	0.000147	0.000523	0.281756	0.7829
D_UNEM_NATION	-0.000346	0.001604	-0.215879	0.8327
C	-0.009328	0.006520	-1.430547	0.1781

R-squared 0.378991 Mean dependent var -0.000674
 Adjusted R-squared 0.068486 S.D. dependent var 0.008211
 S.E. of regression 0.007925 Akaike info criterion -6.560280
 Sum squared resid 0.000754 Schwarz criterion -6.212328
 Log likelihood 69.32266 Hannan-Quinn criter. -6.501392
 F-statistic 1.220565 Durbin-Watson stat 1.330829
 Prob(F-statistic) 0.360792

Thailand 1980-1999

Equation: OECD1971 Workfile: SEA_OECD::Data\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: D_AY
Method: Panel Least Squares
Date: 06/13/22 Time: 18:48
Sample: 1971 2010 IF COUNTRY_GROUP="OECD"
Periods included: 40
Cross-sections included: 10
Total panel (unbalanced) observations: 356

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_GDP_CYC	3.85E-07	2.31E-07	1.667216	0.0964
D_GDP_TREND	3.07E-07	6.70E-07	0.457668	0.6475
D_INFLATION_CYC	-0.000673	0.000287	-2.341954	0.0197
D_INFLATION_TREND	-0.004968	0.001471	-3.378023	0.0008
D_TRADE	0.000592	0.000184	3.214926	0.0014
D_UNEM_NATION	-0.000736	0.000656	-1.122971	0.2622
C	-0.000222	0.001074	-0.206321	0.8367

R-squared	0.074279	Mean dependent var	0.001209
Adjusted R-squared	0.058364	S.D. dependent var	0.010903
S.E. of regression	0.010580	Akaike info criterion	-6.240162
Sum squared resid	0.039069	Schwarz criterion	-6.163969
Log likelihood	1117.749	Hannan-Quinn criter.	-6.209854
F-statistic	4.667266	Durbin-Watson stat	2.113973
Prob(F-statistic)	0.000139		

OECD 1971-2010

Equation: OECD2000 Workfile: SEA_OECD::Data\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: D_AY
Method: Panel Least Squares
Date: 06/13/22 Time: 18:49
Sample: 2000 2020 IF COUNTRY_GROUP="OECD"
Periods included: 21
Cross-sections included: 10
Total panel (unbalanced) observations: 209

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_GDP_CYC	6.15E-07	1.76E-07	3.492352	0.0006
D_GDP_TREND	2.91E-07	4.65E-07	0.626892	0.5314
D_INFLATION_CYC	-0.000495	0.000743	-0.665456	0.5065
D_INFLATION_TREND	-0.011629	0.008613	-1.350185	0.1785
D_TRADE	0.000509	0.000235	2.164177	0.0316
D_UNEM_NATION	0.001081	0.000948	1.140471	0.2554
C	5.61E-05	0.000818	0.068659	0.9453

R-squared	0.095442	Mean dependent var	0.000494
Adjusted R-squared	0.068573	S.D. dependent var	0.009782
S.E. of regression	0.009441	Akaike info criterion	-6.454696
Sum squared resid	0.018003	Schwarz criterion	-6.342752
Log likelihood	681.5157	Hannan-Quinn criter.	-6.409436
F-statistic	3.552228	Durbin-Watson stat	2.356868
Prob(F-statistic)	0.002292		

OECD 2000-2020

Equation: OECD1980 Workfile: SEA_OECD::Data\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: D_AY
Method: Panel Least Squares
Date: 06/13/22 Time: 18:50
Sample: 1980 1999 IF COUNTRY_GROUP="OECD"
Periods included: 20
Cross-sections included: 10
Total panel (unbalanced) observations: 185

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_GDP_CYC	-1.33E-07	4.32E-07	-0.307151	0.7591
D_GDP_TREND	-2.88E-07	1.61E-06	-0.178629	0.8584
D_INFLATION_CYC	-0.000110	0.000392	-0.279921	0.7799
D_INFLATION_TREND	-0.002394	0.002649	-0.903895	0.3673
D_TRADE	0.000874	0.000328	2.667997	0.0083
D_UNEM_NATION	-0.000672	0.000750	-0.896150	0.3714
C	0.002029	0.002280	0.890026	0.3747

R-squared	0.063292	Mean dependent var	0.003035
Adjusted R-squared	0.031718	S.D. dependent var	0.009352
S.E. of regression	0.009202	Akaike info criterion	-6.501641
Sum squared resid	0.015073	Schwarz criterion	-6.379790
Log likelihood	608.4018	Hannan-Quinn criter.	-6.452258
F-statistic	2.004540	Durbin-Watson stat	2.043340
Prob(F-statistic)	0.067352		

OECD 1980-1999

Equation: UNTITLED Workfile: SEA_OECD::Data\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: D_AY
Method: Panel Least Squares
Date: 06/14/22 Time: 17:07
Sample: 2000 2020 IF COUNTRY_GROUP="SEA"
Periods included: 21
Cross-sections included: 6
Total panel (unbalanced) observations: 117

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_GDP_CYC	-2.59E-06	1.05E-06	-2.462124	0.0154
D_GDP_TREND	2.27E-06	1.70E-06	1.334018	0.1850
D_INFLATION_CYC	0.000611	0.000413	1.480156	0.1417
D_INFLATION_TREND	-0.003961	0.003615	-1.095608	0.2756
D_TRADE	0.000271	0.000103	2.648311	0.0093
D_UNEM_NATION	0.000147	0.001467	0.100473	0.9202
C	-0.002538	0.001800	-1.410257	0.1613

R-squared	0.123467	Mean dependent var	-0.000549
Adjusted R-squared	0.075656	S.D. dependent var	0.013532
S.E. of regression	0.013010	Akaike info criterion	-5.788279
Sum squared resid	0.018618	Schwarz criterion	-5.623020
Log likelihood	345.6143	Hannan-Quinn criter.	-5.721186
F-statistic	2.582398	Durbin-Watson stat	2.347084
Prob(F-statistic)	0.022251		

SEA 2000-2020

REFERENCES



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