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PREZZI GLOBALI DELLE MATERIE PRIME E FLUTTUAZIONI DEL PIL NEI PAESI ASIATICI

GLOBAL COMMODITY PRICES AND GDP FLUCTUATIONS IN ASIAN COUNTRIES

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ABSTRACT

Purpose — This study contributes to the literature on business cycle dynamics in emerging economies by characterising Indonesia's business cycle between 1979 and 2023, examining its regional synchronisation, and investigating its co-movement with global commodity prices in the Oils and Meals group.

Approach — The Bry–Boschan Quarterly algorithm is applied to quarterly real GDP data under both classical and growth-cycle frameworks for Indonesia and eight Asian comparators. Cross-correlation analysis is used to examine regional synchronisation and the contemporaneous and lead–lag co-movement between Indonesia's growth cycle and six Oils and Meals commodity prices across the pre- and post-Asian Financial Crisis sub-periods.

Findings — The growth-cycle framework identifies six cycles for Indonesia versus only two under the classical definition, capturing meaningful below-trend slowdowns that absolute-level approaches miss. Regional synchronisation strengthened considerably after the 1997–1998 crisis. In the post-crisis period, global oils and meals prices are found to lead Indonesia's growth cycle by two to six quarters, with results consistent with an export-revenue channel for palm oil and a cost-push channel for the imported soybean complex.

Practical Implications — Monetary authorities could incorporate commodity price indicators into early-warning frameworks, while fiscal policy should address the procyclical risk embedded in the current export levy system.

Research Limitations — The analysis is confined to the Oils and Meals group and cross-correlation cannot establish causal direction. Future research should apply structural multivariate approaches to formally test the co-movement patterns identified here.

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Introduction

Indonesia stands as one of the most important cases in studying business cycle dynamics in emerging countries. As Southeast Asia's largest economy, with a GDP of approximately $1.4 trillion in 2024 and the fourth most populous nation in the world, Indonesia has maintained remarkable economic growth over the past four decades, interrupted by only a handful of severe downturns. After more than three decades of continuous growth, the Asian financial crisis of 1997 transformed what had been a soft landing into a serious recession, in the first half of 1998, the GDP shrank ending 35 years of continuous expansion. Indonesia lost 13.5% of its GDP that year, making it the hardest-hit economy among the ASEAN nations. More recently, the COVID-19 pandemic caused GDP to decrease by 2.07% in 2020, Indonesia's first annual decline in over two decades. However, this development and expansion narratives hide a more complex pattern of economic cycles, external vulnerabilities, and structural change that continue to shape Indonesia's macroeconomic performance in ways not yet fully understood in the academic literature.

Understanding business cycles in emerging economies like Indonesia is not merely an academic exercise. Identifying cyclical turning points, defining periods of economic growth and decline, and understanding the external factors that affect domestic economic changes are all crucial for macroeconomic policy, fiscal planning, and economic forecasting. In Indonesia, an economy heavily reliant on commodities, income from natural resource exports is a major driver of overall economic activity. In 2023, the agricultural and agro-food sector contributed up to 19% to total merchandise exports. Vegetable oils, with crude palm oil at the forefront, comprised the largest single sub-component. While Indonesia is the world's leading exporter of palm oil and coconut oil, it also imports significant quantities of soybeans and soybean meal. Taken together, commodity and resource-based products account for the majority of Indonesia’s export revenues, meaning that global commodity price cycles are closely linked to domestic income and fiscal fluctuations. Therefore, the ability to distinguish cyclical downturns from temporary growth slowdowns and to understand their external characteristics is essential in order to tailor appropriate policy responses.

Despite its importance, Indonesia's business cycle has received limited attention in the international macroeconomic literature relative to its economic significance to the other economies in the same region. Many of the existing studies on Asian business cycles focus on more advanced economies such as Japan, Korea, and Singapore, or treat Indonesia as part of a broader regional grouping without studying its cyclical dynamics in depth (Moneta and Rüffer, 2009; Dufrénot and Keddad, 2014). This thesis seeks to contribute to filling this gap by providing a systematic and rigorous characterisation of Indonesia's business cycle from 1979 to 2023, situating it within both its regional context and its structural economic characteristics.

Research Objectives and Questions

This study has three analytical goals that are closely related to each other. The first and second are each addressed in a dedicated chapter, while the third spans two chapters. These objectives aim to provide a comprehensive understanding of Indonesia's business cycle dynamics from several perspectives. The first objective is to construct a classical business cycle chronology for Indonesia and a selected group of Asian economies over the sample period from 1979 to 2023. The analysis follows the classical approach which was originally developed by Burns and Mitchell (1946) and applied the Bry-Boschan Quarterly (BBQ) algorithm to identify business cycles as absolute expansions and contractions in the level of aggregate economic activity. This chronology provides the empirical foundation for the subsequent analysis and allows for systematic comparison across economies at different stages of development.

The second objective is to extend this analysis using the growth cycle framework, which examines deviations of output from its long-run trend rather than absolute changes in the level of activity. This approach based on the work of Lucas (1977), implements the Hodrick-Prescott (HP) filter, is particularly well suited to the study of emerging economies where strong trend growth may mask economically meaningful cyclical slowdowns that would not be captured by the classical definition. The degree of business cycle synchronisation between Indonesia and its regional neighbours is also examined with particular focus on how this synchronisation has evolved across the pre- and post-Asian Financial Crisis periods.

The third objective is to examine the co-movement between global commodity price cycles and Indonesia's growth cycle. Given Indonesia's structural dependence on commodity exports, and in particular its dominant and asymmetric position within the global Oils and Meals commodity group, the world's leading exporter of palm oil and coconut oil and a significant importer of soybeans and soybean meal. This study investigates whether Indonesia's growth cycle moves together with global commodity prices, using cross-correlation analysis of seasonal differences of log real GDP and log real commodity prices, and whether the nature of this relationship differs across individual commodities within the group and across the pre- and post-Asian Financial Crisis periods.

Taken together, these three objectives address the following research questions:

1. How do Indonesia's business cycle characteristics in terms of duration, amplitude, and frequency compare with those of other Asian economies under both classical and growth cycle definitions?
2. Has the degree of business cycle synchronisation between Indonesia and its regional neighbours changed over time, and what do the cross-correlation patterns reveal about the timing of regional co-movements?
3. To what extent are Indonesia's growth cycle fluctuations correlated with global commodity price cycles, and what are the timing patterns of this relationship?

Contribution and Relevance

This study makes several contributions to the existing literature. First, it provides one of the few systematic comparative business cycle chronologies for a broad panel of Asian economies, including both advanced economies such as Japan and Singapore and emerging economies such as Indonesia, China, India, and the Philippines, using a consistent methodology across the full sample period from 1979 to 2023. Second, it contributes to the literature on business cycle synchronisation in Asia by documenting the evolution of co-movement patterns across the pre- and post-Asian Financial Crisis periods, confirming the tightening of regional integration in the post-crisis era. Third, it examines the relationship between Indonesia business cycle and global commodity price that reveals structurally different co-movement patterns across the six oils and meals commodities.

The focus on Indonesia is itself a contribution. As a large, commodity-rich emerging economy with a complex institutional environment, including significant government intervention in commodity markets through export levies, domestic market obligations, and price controls.

Indonesia represents an important case study for understanding how commodity price cycles transmit to domestic economic activity in the presence of policy distortions. The findings of this thesis are therefore relevant not only to scholars of Indonesian and Asian macroeconomics, but also to the broader literature on commodity-dependent emerging economies.

Structure of the Thesis

The structure of this study is organised as follows. Chapter 1 introduces the classical and growth cycle definitions of business cycles and constructs chronologies for Indonesia and eight selected Asian economies using the BBQ algorithm applied to quarterly real GDP data from 1979 to 2023, discussing the properties of the identified cycles under both frameworks and evaluating their suitability for fast-growing emerging economies. Chapter 2 examines business cycle co-movements, applying cross-correlation analysis to assess the degree of synchronisation between Indonesia and its regional neighbours before and after the Asian Financial Crisis of 1997–1998. Chapter 3 investigates the relationship between Indonesia's business cycle and global commodity price cycles for the six sub-components of the Oils and Meals group, first constructing commodity price cycle chronologies using the BBQ algorithm. Chapter 4 examines contemporaneous co-movement and lead-lag structures across the pre- and post-crisis sub-periods using cross-correlation analysis of seasonal differences of log real GDP and log real commodity prices. A concluding chapter synthesises the key findings, discusses limitations, and identifies directions for future research.

Chapter 1 - Asian Business Cycles: Definitions and Chronologies

1.1 Classical Business Cycle

The starting point for most discussions of business cycles is the classical definition developed by Burns and Mitchell (1946):

"Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own."

(Measuring Business Cycles, National Bureau of Economic Research, 1946)

Under the classical definition, the business cycle is a pattern seen in a series taken to represent the aggregate economic activity of a nation, although not all the activities necessarily move in perfect synchrony. A key implication of this definition is that recessions are associated with absolute declines in the level of economic activity, rather than deviations from a long-run trend. Consequently, Burns and Mitchell (1946) conceptualized the business cycle as a sequence of economy-wide expansions and contractions measured in levels.

Identification of Turning Points and Chronology

The Burns and Mitchell classical definition of the business cycles still forms the basis of the work by the NBER (National Bureau of Economic Research)[1]. Following the NBER, these fluctuations are conventionally divided into two primary phases: expansions (booms) and recessions

[1] The dating committee of the NBER determines the official business cycles chronology for the United States

(contraction or slumps). An expansion is defined as a period during which economic activity increases in a sustained and widespread manner across multiple sectors of the economy. In contrast, a recession is a significant decline in economic activity that is spread across the economy and that lasts more than a few months. The NBER's classical approach identifies business cycles based on widespread expansions and recessions across many sectors of the economy.

According to the business-cycle dating method introduced by Burns and Mitchell (1946) and commonly used by the NBER, this study applies the "3Ds" criteria to distinguish a true business cycle from minor volatility:

1. Duration: A recession is defined as a significant decline in economic activity that lasts more than a few months. This is often defined as at least two consecutive quarters of negative growth to ensure the decline is continuous.

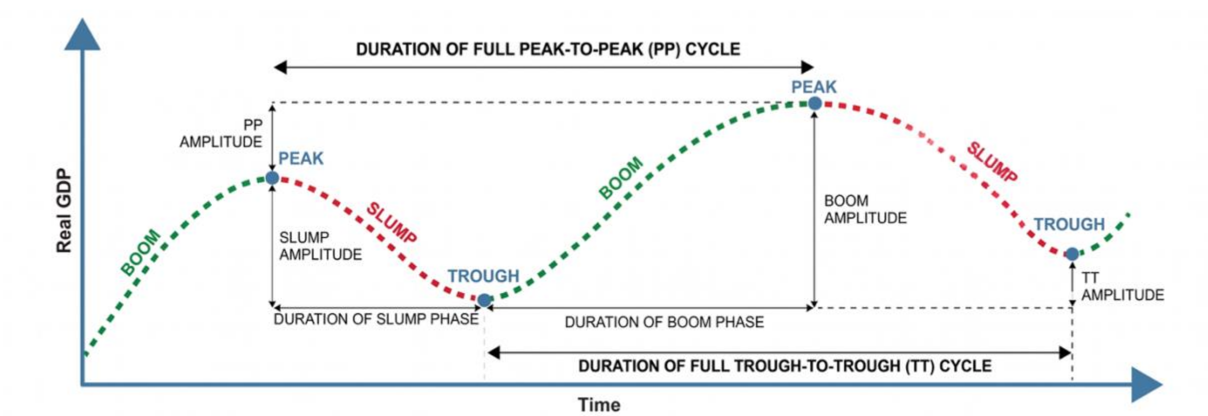
2. Depth: The contraction must be severe enough to be clearly visible in the absolute value of aggregate output.

3. Diffusion: The decline must be widespread across the economy, affecting multiple sectors simultaneously rather than being attributed to a particular industry.

The chronology identifies the dates of peak and trough months in economic activity. According to NBER, the peak is the month in which a variety of economic indicators reach their highest level, followed by a significant decline in economic activity. Similarly, a trough is the lowest point of a contraction and begins to rise again for a sustained period. Following the trough, economic activity enters a revival phase, which evolves slowly into a full expansion, then initiating the next cycle. Importantly, these cycles are recurrent but not periodic, their timing and amplitude of the cycles vary substantially across the period. Consequently, business cycles do not follow a fixed length, however historically the length varies depending on structural factors, policy responses, and external shocks (Burns & Mitchell, 1946).

A complete business cycle is defined as the interval between two consecutive peaks or two consecutive troughs (Burns & Mitchell, 1946). Business cycle chronology can be constructed by dating these turning points systematically. The structural properties of business cycles, such as duration, amplitude, and frequency of expansions and recession, serve as foundational tool for empirical macroeconomic analysis that allow comprehensive comparisons overtime and across countries. Figure 1.1 illustrates these cycle components schematically, where expansions and recessions are referred to as 'booms' and 'slumps' respectively.

Figure 1.1 Illustration of a Business Cycle



Source: Visualization adapted by the author for business cycle theory based on the analytical framework of World Bank commodity cycles.
Note: Slumps (recessions) are periods between a peak and a subsequent trough, while booms (expansions) are periods between a trough and a subsequnt peak. A peak-to-peak (PP) cycle includes a slump followed by a boom; a trough-to-trough (TT) cycle includes a boom followed by a slump. Duration is the time between turning points, and amplitude captures the magnitude of output changes within each phase or full cycle.

Asian Countries Classical Business Cycle Chronology

The following section examines the business cycle chronology for the selected Asian economies based on the classical definition of economic fluctuations. Following the approach of Burns and Mitchell (1946), these cycles are identified as absolute expansions and contractions measured in the levels of aggregate economic activity. To construct the business cycle chronology, this study uses the quarterly real GDP dataset obtained from Mohaddes and Raissi (2024), which are expressed in natural logarithms. The dataset provides a standardized, high-frequency quarterly series from 1979:Q2 to 2023:Q3, which is essential in dating the peaks and troughs that characterize the business cycle. Although economic activity can be measured using a range of indicators, including employment, income, and industrial production, real GDP is utilized here as the primary proxy in this study. According to Harding and Pagan (2002) the turning points in real GDP provide a precise and reliable operationalization of the classical cycle definition established by Burns and Mitchell (1946).

To operationalize the classical definition for the selected Asian economies, this study utilizes the Bry-Boschan Quarterly (BBQ) algorithm. Originally developed by Bry and Boschan (1971) for monthly data, the algorithm was adapted for quarterly GDP data by Harding and Pagan (2002). The core of the BBQ algorithm is the identification of local maxima (peaks) and minima (troughs) in the log level of real GDP, denoted as $\mathcal{Y}_t$ A peak is defined as a quarter *t* where the level of GDP is higher than the two preceding quarters and the two subsequent quarters. Conversely, a trough is identified when the level of GDP is lower than the surrounding two quarters.

Mathematically, the rule for a local peak at time *t* is:

$$\mathcal{Y}_{t-2,} \mathcal{Y}_{t-1} < \mathcal{Y}_t > \mathcal{Y}_{t+1} , \mathcal{Y}_{t+2}$$

And for a trough:

$$y_{t-2}, y_{t-1} > y_t < y_{t+1}, y_{t+2}$$

This "5-quarter window" (k=2) ensures that the identified turning point represents a significant shift in the economy's trajectory rather than momentary noise.

Detecting the local peaks and troughs is only the first step. To align with the classical definition that cycles must be *'persistent'* and *'distinct'* the algorithm applies a series of censoring rules to filter out spurious movements:

1. Alternation: A peak must be followed by a trough, and a trough must be followed by a peak. Two consecutive peaks are impossible, if the raw data suggests two peaks, the algorithm selects the higher of the two.
2. Minimum Phase Duration: Consistent with the "Duration" criterion established earlier, a single phase (expansion or contraction) must last at least 2 quarters (6 months). This ensures that brief, one-quarter declines are not misclassified as recessions. In rare cases, a contraction lasting only one quarter may be classified as a recession if the decline in log real GDP is exceptionally large relative to that country's historical distribution of quarterly GDP changes.
3. Minimum Cycle Duration: In order to satisfy the requirement for "persistence" a complete cycle (from peak to peak or trough to trough) must last at least 5 quarters (15 months).

By applying these constraints, the BBQ algorithm effectively filters the raw GDP data to produce a chronology that is strictly consistent with the Duration and Depth criteria established by the NBER. While the algorithm cannot explicitly measure Diffusion across various sectors, the use of aggregate real GDP, which represents the total value of all goods and services produced, ensures that the fluctuations captured are economy-wide. This makes it the ideal tool for dating business cycles in Asian economies where official dating committees do not exist.

Figure 1.2 - Real GDP of Sample Countries: Classical Business Cycle Definition

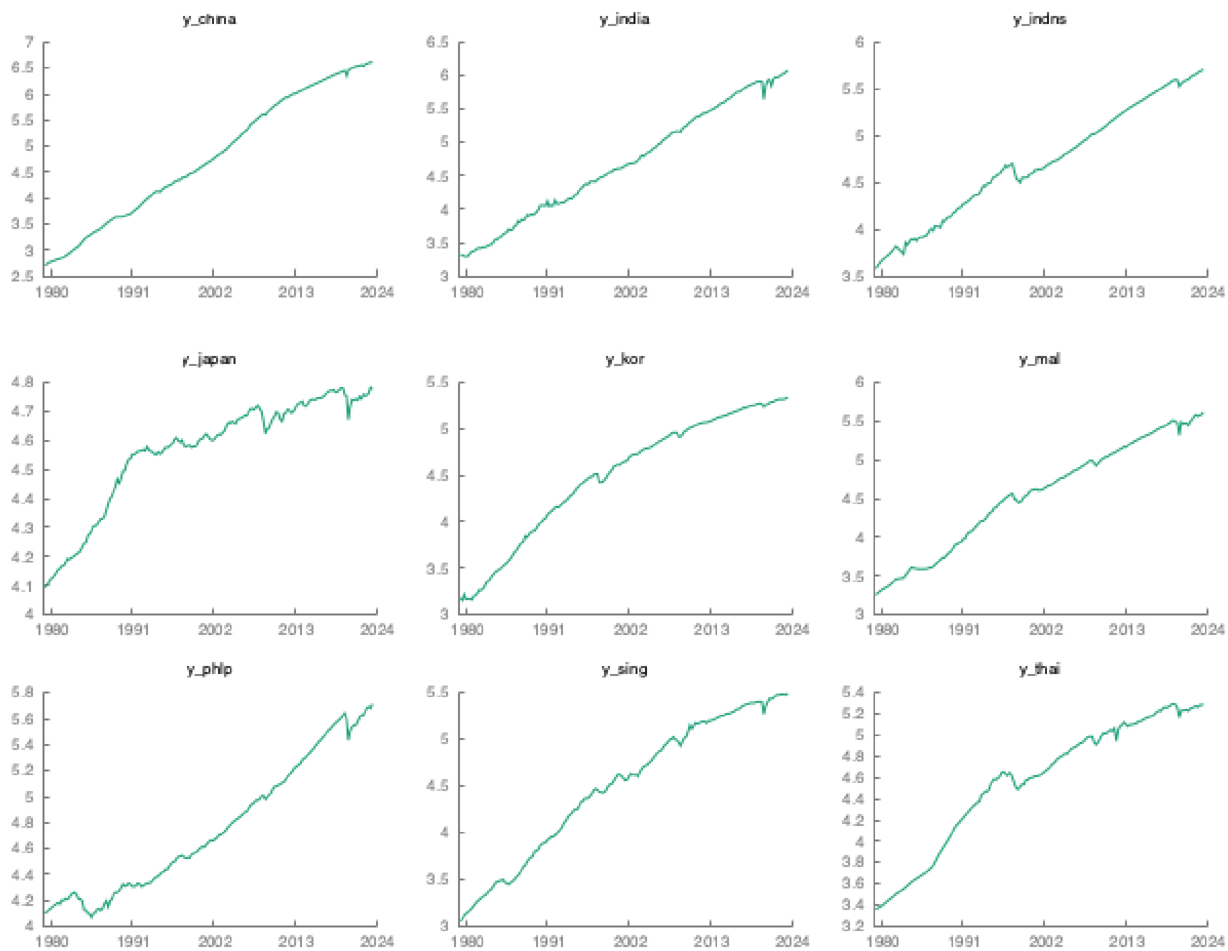


Table 1.1 Classical Business Cycle Chronology for Selected Asian Economies (1979–2023)

Peak Quarter	Trough Quarter	Contraction	Expansion	Cycle	
		Duration, peak to trough	*Duration, trough to peak*	*Duration, trough to trough*	*Duration, peak to peak*
Indonesia					
1982 Q1	1983 Q1	4	—	—	—
1997 Q4	1998 Q4	4	59	63	63
2019 Q4	2020 Q2	2	84	86	88
China					
1994 Q2	1994 Q4	2	—	—	—
2008 Q4	2009 Q1	1*	56	57	58
2019 Q4	2020 Q1	1*	43	44	44
India					
1979 Q2	1980 Q1	3	—	—	—
1991 Q1	1991 Q2	1*	44	45	47
2019 Q4	2020 Q2	2	114	116	115
Japan					
1992 Q3	1994 Q2	7	—	—	—
1997 Q1	1999 Q1	8	11	19	18
2001 Q1	2001 Q4	3	8	11	16
2008 Q1	2009 Q1	4	25	29	28
2010 Q3	2011 Q2	3	6	9	10
2019 Q2	2020 Q2	4	32	36	35
Korea					
1979 Q4	1980 Q4	4	—	—	—
1997 Q3	1998 Q1	2	67	69	71
2008 Q3	2009 Q1	4	42	44	44
2019 Q4	2020 Q2	2	43	45	47
Malaysia					
1984 Q1	1985 Q4	7	—	—	—
1997 Q3	1998 Q3	4	47	51	54
2008 Q1	2009 Q1	4	38	42	46
2019 Q3	2020 Q2	3	20	23	27
Thailand					

1996 Q3	1998 Q3	8	—	—	—
2008 Q1	2009 Q1	4	38	42	46
2011 Q3	2011 Q4	1*	10	11	14
2019 Q4	2020 Q2	3	32	33	36
Singapore					
1985 Q1	1985 Q4	3	—	—	—
1997 Q3	1998 Q3	4	47	51	50
2000 Q4	2001 Q3	3	9	12	13
2008 Q1	2009 Q1	4	26	29	30
2019 Q4	2020 Q2	3	43	46	44
Philippines					
1983 Q2	1985 Q3	9	—	—	—
1997 Q4	1998 Q2	5	48	53	57
2008 Q4	2009 Q1	1*	42	43	45
2019 Q4	2020 Q2	2	43	45	44

**Denotes a one-quarter contraction included based on exceptional depth in log real GDP, defined relative to each country's historical growth distribution.*

The results presented in Table 1.1 provide a comprehensive overview of the business cycle turning points for selected Asian economies from 1979 to 2023. By applying the classical definition, which focuses on absolute expansions and contractions in the levels of aggregate economic activity, the chronology reveals significant variation in how these economies experience fluctuations. A primary observation from the table is the higher frequency of turning points in Japan compared to the other nations in the study. As shown in Table 1.1, among the Asian countries, Japan exhibits frequent turning points in its real GDP level, supporting the applicability of the classical definition for an advanced economy. This is evidenced by the high density of entries in the chronology, with Japan recording five distinct cycles, defined by five pairs of peaks and troughs, between 1979 and 2020.

In academic literature, this is often explained by the interaction between trend growth and cyclical volatility. According to Harding and Pagan (2002), turning points in the level of economic activity are a direct result of the interaction between the long-run trend and the volatility of growth rates. In advanced economies, where long-run trend growth is relatively low, even a minor negative shock can easily push the level of GDP into an absolute decline, resulting in a classical recession. This is particularly evident in Japan, where the trend growth flattened significantly following the structural shifts of the 1990s, leading to frequent *'technical'* recessions and a high density of entries in the chronology.

In contrast, the data on Indonesia and other Asian economies, including China and India, is characterized by a lack of detected turning points. For these nations, the classical approach only captures major systemic shocks, such as the 1997 Asian Financial Crisis and the 2020 COVID-19 pandemic. This scarcity of detected contractions implies that in rapidly growing economies, absolute declines in economic activity are rare occurrences. The table further highlights the existence of exceptionally long expansion phases in emerging markets. For example Indonesia's 84-quarter expansion and India's 114-quarter expansion where no absolute peaks or troughs were identified despite significant global economic shifts. In the classical framework, this indicates these economies remained in a continuous expansion for decades despite significant global economic transformations.

The table suggests that the classical definition may be insufficient for analysing business-cycle dynamics in rapidly growing emerging economies, as the limited number of detected contractions would lead to the false conclusion that these economies rarely experience business cycles. The chronology demonstrates that in developing economies like Indonesia, absolute declines in economic activity are relatively rare. While the classical approach identifies major crises like the 1997 financial crisis or the 2020 pandemic, it does not capture periods of slowdown characterized by positive growth that falls below the trend. In the table, these slowdowns are represented by the absence of peak and trough entries during decades of continuous expansion. To address this and capture the systematic co-movements during periods of strong growth, the study will adopt the Growth Cycle framework in the following section, utilizing the Hodrick-Prescott (HP) filter to examine deviations from long-term trends. This approach offers a more suitable perspective for analyzing the dynamic fluctuations of Asian emerging economies.

1.2 The Growth Cycle

The classical business cycle approach focuses on fluctuations in the level of economic activity. As shown in the previous section, this approach performs well in economies with low trend growth, where cyclical downturns are likely to manifest as declines in output levels. However, in economies experiencing sustained structural growth, the classical approach may fail to capture economically meaningful slowdowns. Strong trend growth can dominate cyclical movements, resulting in continued positive growth rates even during periods of weakening demand or tightening financial conditions.

To address this limitation, the modern literature emphasizes growth cycles, also known as deviation cycles, which analyse fluctuations of output around its long-run trend. Lucas (1977) redefined the study of business cycles by focusing fluctuations around long-run trend growth, rather than absolute expansions and contractions. He suggested that cycles are characterized by systematic co-movements among key macroeconomic variables as they deviate from their potential trend. In this *growth-cycle,* cyclical phases are defined as periods when output is above or below its trend, regardless of whether growth remains positive.

A growth-cycle peak occurs when economic activity reaches a local maximum relative to its long-run trend and subsequently begins to decelerate, while a trough represents the point at which below-trend activity reaches its lowest level before recovery begins. Unlike classical business cycles, growth-cycle turning points do not require an absolute decline in output. Instead, they reflect changes in the momentum of economic activity. This distinction is particularly relevant for fast-growing economies, where output may continue to increase even during periods of cyclical slowdown. As long as the growth rate falls below what is implied by the trend, a slowdown can be captured even if the economy continues to grow. This makes the growth-cycle concept more appropriate for analysing business cycles in emerging economies like Indonesia, where structural growth is strong and negative growth episodes are relatively rare.

Trend–Cycle Decomposition

In order to apply the *growth-cycle* concept, the trend ($\mathcal{T}_t$) and cyclical component ($\mathcal{C}_t$) should be decomposed in macroeconomic time series (($\mathcal{Y}_t = \mathcal{T}_t + \mathcal{C}_t$). In plain terms, the trend component (T_t) represents the economy's smooth long-run growth path, while the cyclical component (C_t) captures shorter-term deviations around it, a positive value means the economy is performing above its long-run potential, and a negative value means it is running below trend. The Hodrick–Prescott (HP) filter, which decomposes a series into a smooth trend and a cyclical component by minimizing a loss function that balances fit and smoothness. The HP filter has become particularly influential in empirical macroeconomics because of its simplicity and transparency. It allows researchers to obtain a growth-cycle measure for output and other macroeconomic variables relatively easily and has been used extensively for both developed and developing countries. At the same time, several authors have noted its limitations, including end-point problems and the fact that its smoothing parameter must be chosen rather than estimated. Despite these issues, it remains a standard benchmark tool in applied work. The extracted cyclical component serves as the basis for identifying growth-cycle turning points, as discussed in the following subsection. The HP filter achieves this decomposition by minimizing a loss function that balances two criteria, fit (how well the trend matches the actual data) and smoothness (how little the trend component changes over time).

The minimization problem is defined as:

$$\min_{\mathcal{T}_t}\left\{\sum_{t=1}^{T}\left(y_t - \mathcal{T}_t\right)^2 + \lambda \sum_{t=2}^{T-1} \left[(\mathcal{T}_{t+1} - \mathcal{T}_t) - (\mathcal{T}_t - \mathcal{T}_{t-1})\right]^2\right\}$$

The first term, minimizes the variance of the cyclical component and ensures the trend fits the data well. The second term, involving the sum of squared second differences of the trend, ensures smoothness by penalizing large variations in the trend's growth rate (Hodrick & Prescott, 1997).

The core of the HP filter's implementation lies in the selection of the smoothing parameter, λ this parameter controls the trade-off between the cyclical component's variability and the trend component's smoothness:

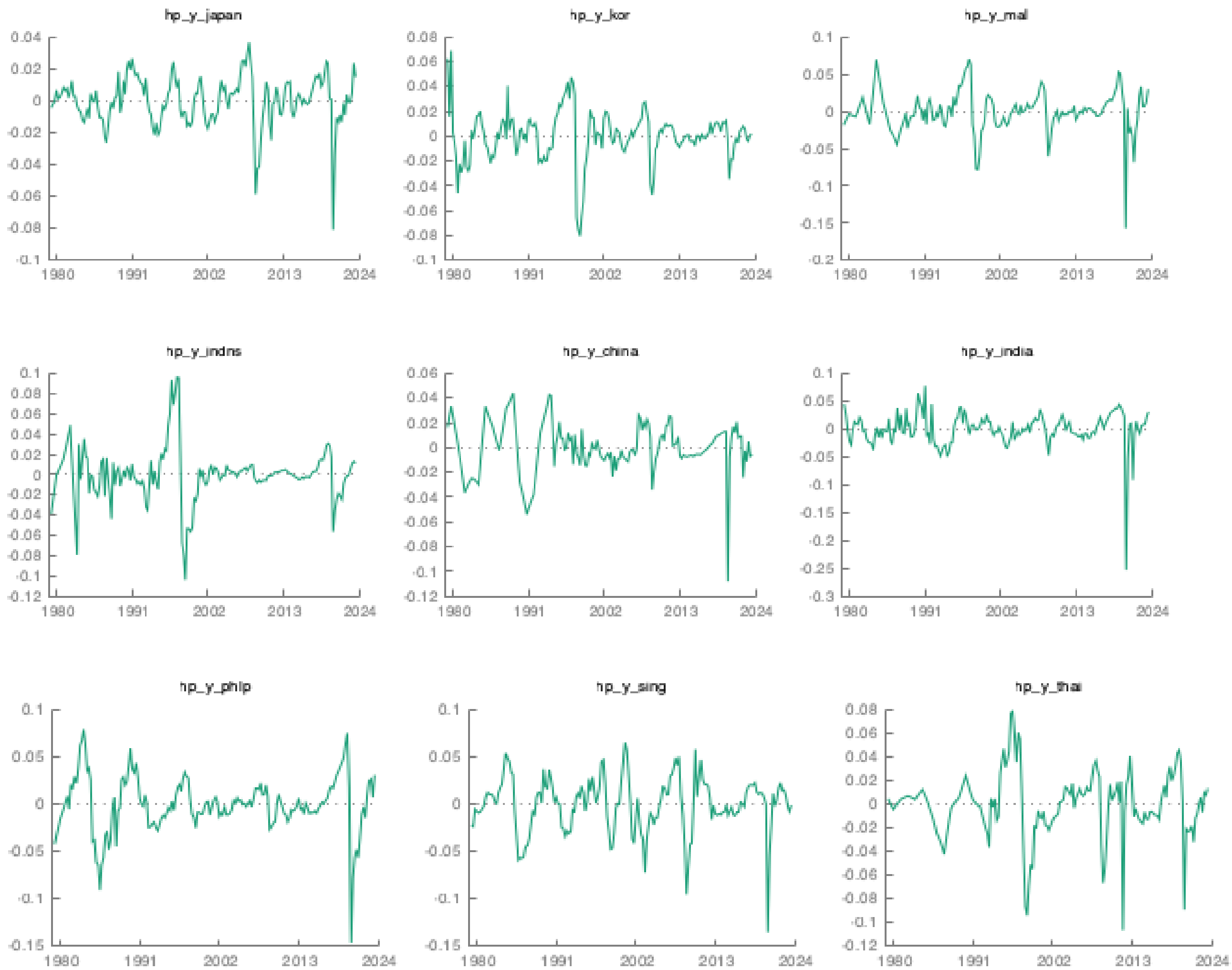
1. Small λ : Allows the trend ($\mathcal{T}_t$) to track the data ($\mathcal{Y}_t$) very closely, resulting in a less smooth trend.
2. Large λ : Heavily penalizes rapid changes in the trend, resulting in a very smooth, almost linear trend.

For quarterly data, the conventional standard parameter established in the literature is $\lambda = 1600$ (Hodrick & Prescott, 1997). For this study, we utilize this standard value to ensure comparability with the majority of international business cycle studies.

Growth-Cycle Dating Methodology

To operationalize the identification of growth-cycle turning points, this section applies the Bry–Boschan Quarterly (BBQ) algorithm to the estimated cyclical component of real GDP. In this context, the algorithm is used to date peaks and troughs in deviations from trend rather than in output levels. A growth-cycle peak is defined as a quarter in which the cyclical component is higher than in the surrounding quarters and is followed by a sustained decline, while a trough is identified when the cyclical component reaches a local minimum and subsequently begins to increase. Consistent with the methodology applied in Section 1.1, the algorithm imposes standard censoring rules to ensure persistence and economic relevance, including minimum phase and cycle length requirements. Applying the same dating procedure to a different underlying series ensures that differences between classical and growth-cycle chronologies arise from the conceptual framework rather than from methodological inconsistencies.

Figure 1.3 - Real GDP of Sample Countries: Growth Business Cycle Definition



Growth Cycle Chronology

Table 1.2 Growth Cycle Chronology for Selected Asian Economies (1979–2023)

Peak Quarter	**Trough Quarter**	**Contraction**	**Expansion**	**Cycle**	
		Duration, peak to trough	*Duration, trough to peak*	*Duration, trough to trough*	*Duration, peak to peak*
Indonesia					
—	1979 Q2	—	—	—	—
1982 Q1	1983 Q1	4	11	15	—
1984 Q1	1986 Q1	8	4	12	8
1987 Q2	1988 Q1	3	5	8	13
1997 Q4	1998 Q4	4	39	43	42

2008 Q3	2009 Q2	3	39	42	43
2019 Q3	2020 Q2	3	41	44	44
China					
1979 Q4	1981 Q4	8	—	—	—
1984 Q4	1986 Q4	8	12	20	20
1988 Q4	1990 Q4	8	8	16	16
1994 Q1	1999 Q3	22	13	35	21
2008 Q2	2009 Q1	3	35	38	57
2011 Q3	2016 Q1	18	10	28	13
2019 Q4	2020 Q1	1*	15	16	33
India					
1979 Q2	1980 Q2	4	—	—	—
1981 Q3	1983 Q3	8	5	13	9
1987 Q1	1988 Q1	4	14	18	22
1991 Q1	1994 Q2	13	12	25	16
1996 Q2	1997 Q3	5	8	13	21
2007 Q4	2009 Q1	3	41	46	46
2019 Q2	2020 Q2	4	41	45	46
Japan					
1982 Q2	1984 Q1	7	—	—	—
1985 Q4	1987 Q2	6	7	13	14
1991 Q1	1994 Q2	13	15	28	21
1997 Q1	1999 Q1	8	11	19	24
2001 Q1	2002 Q1	4	8	12	16
2004 Q1	2005 Q1	4	8	12	12
2008 Q1	2009 Q1	4	12	16	16
2010 Q3	2011 Q2	3	6	9	10
2014 Q1	2014 Q3	2	11	13	14
2019 Q2	2020 Q2	4	19	23	21
Korea					
1979 Q4	1980 Q4	4	—	—	—
1984 Q1	1985 Q3	6	13	19	17
1997 Q2	1998 Q3	5	47	52	53
2002 Q2	2005 Q1	11	15	26	20
2008 Q1	2009 Q1	4	12	16	23
2019 Q4	2020 Q2	2	43	45	47
Malaysia					
1982 Q1	1983 Q1	4	—	—	—
1984 Q1	1987 Q1	12	4	16	8
1997 Q3	1998 Q4	5	42	47	54
2000 Q2	2001 Q4	6	6	12	11

2008 Q1	2009 Q1	4	25	29	31
2019 Q2	2020 Q2	4	41	45	45
Thailand					
1984 Q1	1987 Q1	12	—	—	—
1990 Q1	1993 Q2	13	12	25	24
1996 Q3	1998 Q3	8	13	21	26
2008 Q1	2009 Q1	4	38	42	46
2011 Q3	2011 Q4	1*	10	11	14
2012 Q4	2014 Q3	7	4	11	5
2019 Q3	2020 Q2	3	20	23	27
Singapore					
1984 Q1	1985 Q4	7	—	—	—
1990 Q1	1992 Q2	9	17	26	24
1997 Q3	1998 Q3	4	21	25	30
2000 Q3	2003 Q2	11	8	19	12
2008 Q1	2009 Q1	4	19	23	30
2011 Q1	2013 Q2	9	8	17	12
2019 Q2	2020 Q2	4	24	28	33
Philippines					
1983 Q2	1985 Q3	9	—	—	—
1989 Q4	1993 Q3	15	17	32	26
1997 Q2	1998 Q4	6	15	21	30
2008 Q3	2009 Q1	2	39	41	45
2019 Q4	2020 Q2	2	43	45	45

**Denotes a one-quarter contraction included based on exceptional depth in log real GDP, defined relative to each country's historical growth distribution.*

Table 1.3 - Comparison number of cycles and average duration of cycle of Selected Asian Economies (1979–2023)

Countries	Number of Cycle		Contraction		Expansion	
	Classical	Growth	Classical	Growth	Classical	Growth
Indonesia	2	6	3.33	4.17	71.50	23.17
China	2	6	1.33	9.71	49.50	15.50
India	2	6	2.00	5.86	79.00	20.17
Japan	5	9	4.83	5.50	16.40	10.78
Korea	3	5	3.00	5.33	50.67	26.00
Malaysia	3	5	4.50	5.83	35.00	23.60
Thailand	3	6	4.00	6.86	26.67	16.17

Singapore	4	6	3.40	6.86	31.25	16.17
Philippines	3	4	4.25	6.80	44.33	28.50

Table 1.3 summarizes the main characteristics of classical and growth cycles across selected Asian economies. The results indicate that the growth-cycle approach consistently identifies a larger number of cycles than the classical definition. In the case of Indonesia, the classical approach detects only 2 complete business cycles over the sample period, whereas the growth-cycle approach identifies 6 cycles. This difference reflects the presence of multiple periods of economic deceleration that did not involve absolute declines in output and were therefore not classified as recessions under the classical definition. A similar pattern is observed across other emerging Asian economies. For example, China and India each exhibit only 2 classical cycles, while the growth-cycle approach identifies 6 cycles each. In contrast, more developed economies such as Japan display a higher number of cycles under both definitions, reflecting more pronounced cyclical volatility in output levels. Nonetheless, even for these economies, the number of growth cycles exceeds that of classical cycles, indicating that deviations from trend provide a finer characterization of business cycle dynamics.

In addition to differences in cycle frequency, Table 1.3 also highlights systematic differences in the duration of expansion phases across the two approaches. Across the sample, expansions identified under the classical definition tend to last longer than those under the growth-cycle framework. This pattern holds for Indonesia as well as for other emerging and developed Asian economies, reflecting the fact that classical expansions persist as long as output continues to increase, even during periods of slowing growth. By contrast, growth-cycle expansions are shorter because they are defined relative to deviations from trend and therefore end once growth falls below its long-term path.

Taken together, these findings provide a strong justification for focusing on growth cycles when analysing Indonesia's macroeconomic fluctuations. As an emerging economy with sustained long-term growth, Indonesia has experienced relatively few episodes of negative output growth but has undergone multiple periods of decelerating growth associated with external shocks, financial disturbances, and commodity price fluctuations. By adopting the growth-cycle framework, this study is able to identify these economically significant slowdowns and construct a more informative chronology of cyclical phases. This richer characterization is particularly important for examining the co-movement between external shocks, such as commodity price cycles with domestic economic activity.

Chapter 2 - Asian Business Cycle Co-movements

Having established a growth-cycle chronology for Indonesia and eight comparator Asian economies in Chapter 1, this chapter turns to the question of how these cycles relate to one another. The degree to which national cycles move together, known as business cycle synchronisation, is of central importance for both academic analysis and economic policy. Where cycles are highly synchronised, economies are likely to be exposed to common shocks or bound together through trade and financial channels, which strengthens the case for coordinated macroeconomic policy and, in the limit, for shared monetary arrangements. Where cycles diverge, by contrast, country-specific factors dominate and independent policy responses are more appropriate. For an emerging economy such as Indonesia, measuring the extent and timing of co-movement with its regional neighbours therefore offers insight into how deeply it is integrated into the regional economy and how exposed it is to shocks originating elsewhere in Asia.

A central theme of this chapter is that regional synchronisation in Asia was not constant over the sample period but changed markedly around the 1997–1998 Asian Financial Crisis. The crisis began on 2 July 1997, when Thailand abandoned the baht's peg to the US dollar after months of speculative pressure had drained its foreign-exchange reserves, and it spread rapidly through the region by financial contagion, forcing sharp currency devaluations in Indonesia, Malaysia, the Philippines, and South Korea (Carson & Clark, 2013). Indonesia was among the hardest hit: the rupiah lost the bulk of its value, and output contracted severely in 1998. Beyond these immediate effects, the crisis proved to be a structural turning point for the region. As a result of this, East Asian economies moved from a largely market-led pattern of integration toward more formal, policy-led cooperation, including the ASEAN+3 grouping and the network of bilateral currencyswap arrangements that later became the Chiang Mai Initiative (IMF, 2022). Rana (2007) documents that intra-regional trade integration deepened over this period and was accompanied by a higher degree of business cycle synchronisation across East Asia. This deepening of both real and financial linkages provides the rationale for treating the pre- and post-crisis periods as structurally distinct regimes, an approach followed throughout this chapter and extended to the commodity analysis in Chapter 3.

To examine these relationships, the chapter applies cross-correlation analysis to the growth-cycle components extracted in Chapter 1. Cross-correlation is a statistical technique that measures how strongly two series move together, and whether one tends to move consistently before the other. For each pair of economies, the contemporaneous correlation coefficient measures the strength and direction of co-movement at the same point in time, while the cross-correlation function evaluated across a range of leads and lags identifies the timing of the relationship. Following common practice in the synchronisation literature, a positive coefficient is interpreted as procyclical co-movement and a negative coefficient as countercyclical, while coefficients close to zero are treated as acyclical. In plain terms, procyclical means that two economies tend to expand and contract together, when one is growing strongly, the other tends to be growing too, and when one slows down, the other tends to follow. Countercyclical describes the opposite: one economy tends to be expanding at the same time the other is contracting. Acyclical simply means there is no consistent pattern in either direction, the two cycles move largely independently of one another.

In reporting the results below, correlations below 0.2 in absolute value are described as acyclical, those between 0.2 and 0.5 as modest, and those above 0.5 as strong; a relationship is described as coincident when the peak correlation occurs around lag zero (-1;+1), and as leading or lagging when it is reached at a non-zero lag. The analysis is conducted first over the full sample and then separately for the pre- and post-crisis sub-periods, so that any shift in the degree and timing of synchronisation can be identified directly.

2.1 Indonesia Business Cycle Synchronisation and Regional Co-movement

This section examines the synchronisation between the real GDP series of Indonesia and other Asian countries. The purpose of this comparison is to validate the extracted growth cycles by observing whether they exhibit expected patterns of co-movement with regionally integrated economies. After the growth-cycle component is extracted, the cross-correlation results give a picture of how Indonesia's cyclical position aligns with other Asian economies.

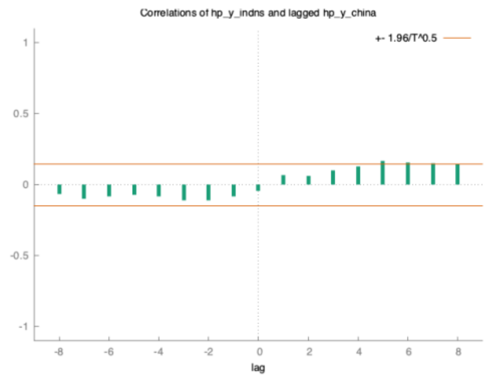
Table 2.1 - Cross-Correlation of Indonesia's Business Cycle with Asian Countries (1979:Q2–2023:Q3)

Country	Direction	Corr. Coeff. at lag 0	Timing	Largest Corr. Coeff.	Lag #
China	acyclical	-0.0440	lagging	0.1695^{**}	5
India	procyclical	0.2748^{***}	coincident	0.2748^{***}	0
Japan	procyclical	0.3451^{***}	coincident	0.3451^{***}	0
Korea	procyclical	0.4773^{***}	coincident	0.5782^{***}	1
Malaysia	procyclical	0.6714^{***}	coincident	0.6714^{***}	0
Philippines	procyclical	0.3972^{***}	coincident	0.3972^{***}	0
Singapore	procyclical	0.3625^{***}	coincident	0.3625^{***}	0
Thailand	procyclical	0.6374^{***}	coincident	0.6744^{***}	1

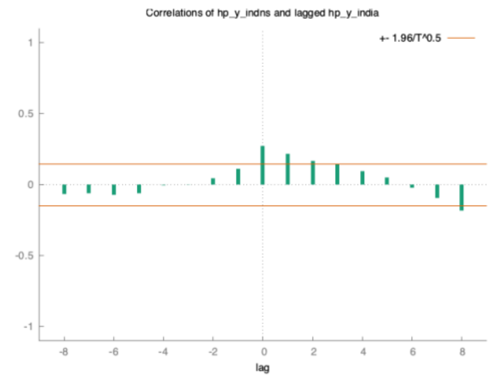
Notes:
* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$ *Statistical significance is based on the cross-correlation coefficient test. Coefficients without stars are not statistically significant at conventional levels.*

Figure 2.1 Cross-Correlation of Indonesia and Asian Countries Business Cycles 1979:Q2 – 2023:Q3

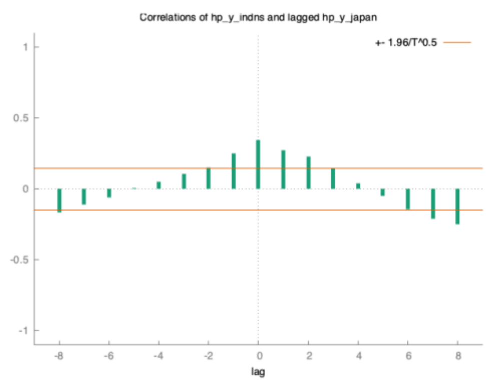
China



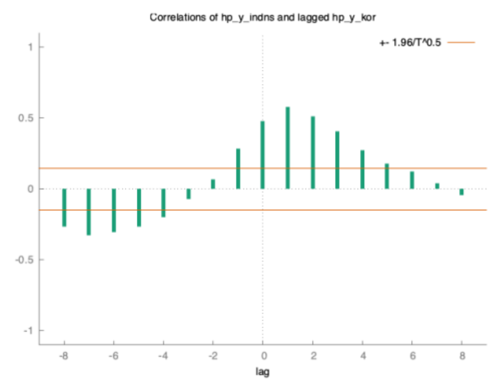
India



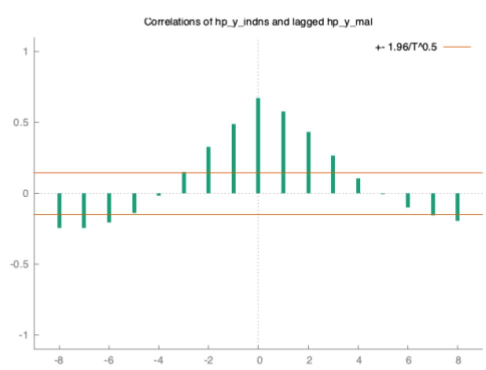
Japan



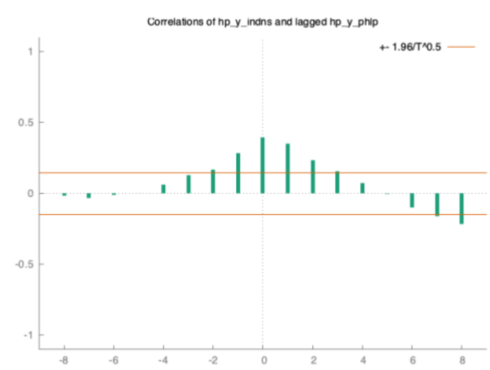
Korea



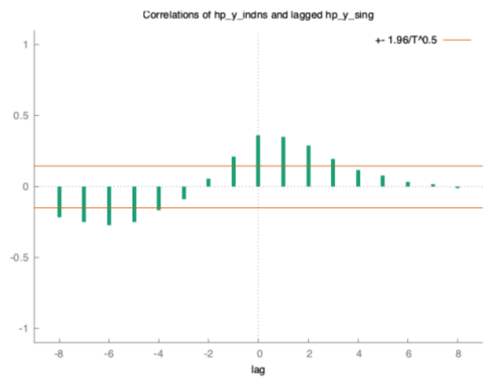
Malaysia

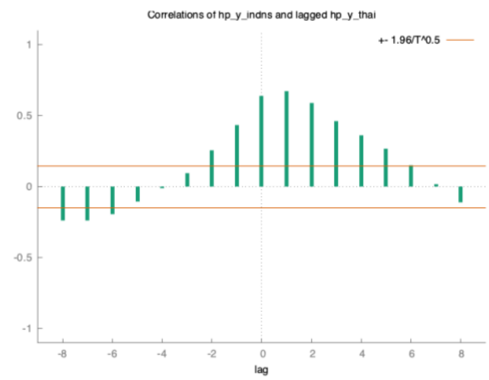


Philippines



Singapore **Thailand**





Looking at the full period (1979:–2023:Q3) as summarized in Table 2.1, Indonesia shows procyclical relationships with most countries, meaning their cycles move in the same direction. The strongest correlations come from Southeast Asian neighbour countries such as Malaysia (0,67) and Thailand (0,64), given their economic structure, regional integration, and shared exposure to commodity and trade shocks. Japan, Korea, and Singapore also move in the same direction, though with more moderate strength. While, China indicated as an exception, its overall correlation with Indonesia is weak and acyclical. To understand how regional integration has evolved, the sample is split into two sub-periods, Pre-Asian Financial Crisis (1979–1997) and Post-Crisis (1998–2023).

Table 2.2 - Cross-Correlation of Indonesia's Business Cycle with Asian Countries 1979:Q2 - 1997:Q4

Country	Direction	Corr. Coeff. at lag 0	Timing	Largest Corr. Coeff.	Lag #
China	acyclical	-0.1152	lagging	0.2689**	8
India	procyclical	0.2732**	coincident	0.2732**	0
Japan	procyclical	0.2444**	lagging	0.3282***	8

Korea	procyclical	0.3215***	coincident	0.4099***	1
Malaysia	procyclical	0.6749***	coincident	0.6749***	0
Philippines	procyclical	0.2778**	coincident	0.2880**	1
Singapore	procyclical	0.4029***	coincident	0.4029***	0
Thailand	procyclical	0.5908***	coincident	0.6703***	1

Notes:
* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$
Statistical significance is based on the cross-correlation coefficient test. Coefficients without stars are not statistically significant at conventional levels.

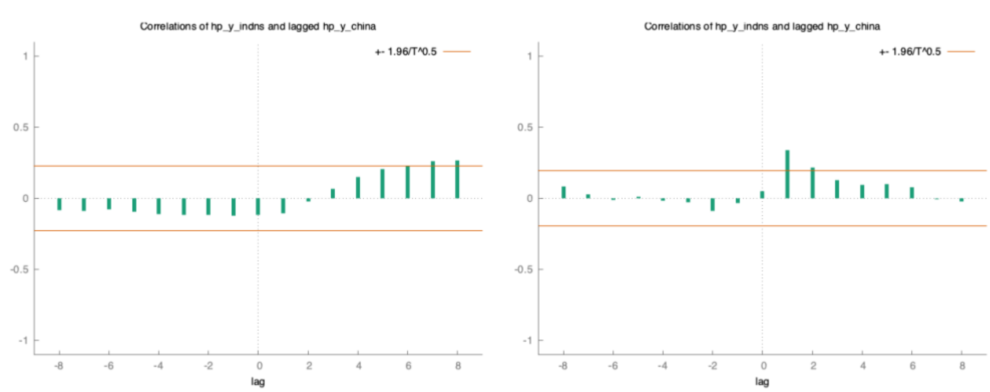
Table 2.3 - Cross-Correlation of Indonesia's Business Cycle with Asian Countries 1998:Q1 - 2023:Q3

Country	Direction	Corr. Coeff. at lag 0	Timing	Maximum Corr. Coeff	Lag #
China	acyclical	0.0510	lagging	0.3387***	1
India	procyclical	0.3093***	coincident	0.3093***	0
Japan	procyclical	0.4578***	coincident	0.4578***	0
Korea	procyclical	0.6409***	lagging	0.7556***	1
Malaysia	procyclical	0.6905***	coincident	0.6905***	0
Philippines	procyclical	0.5722***	coincident	0.5722***	0
Singapore	procyclical	0.3447***	coincident	0.3447***	0
Thailand	procyclical	0.7003***	coincident	0.7003***	0

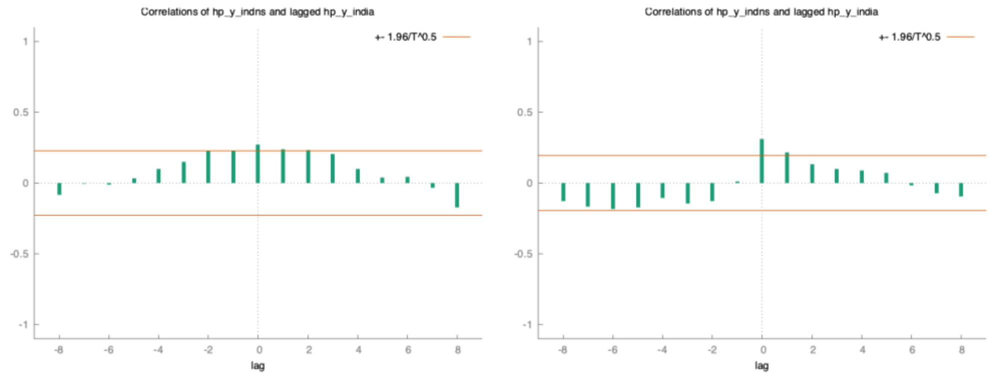
Notes:
* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$
Statistical significance is based on the cross-correlation coefficient test. Coefficients without stars are not statistically significant at conventional levels.

Figure 2.2 Cross-Correlation of Business Cycles: Indonesia and Asian Countries Pre-crisis period (1979:Q2 – 1997:Q4) – Post-crisis period (1998:Q1 – 2023:Q3)

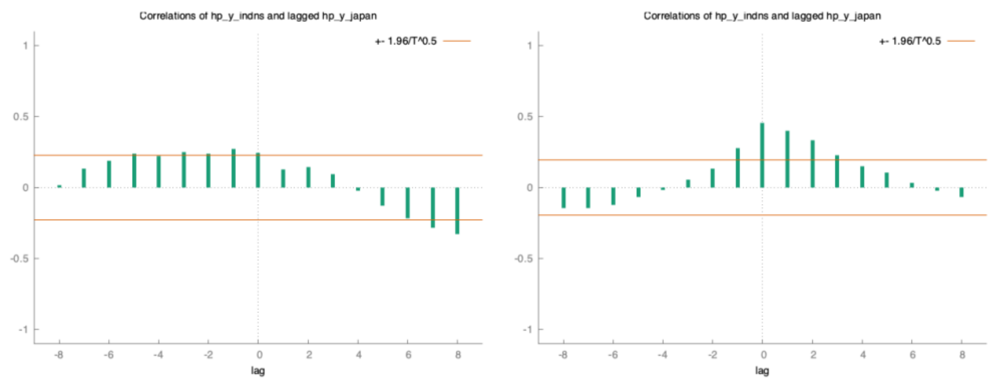
China



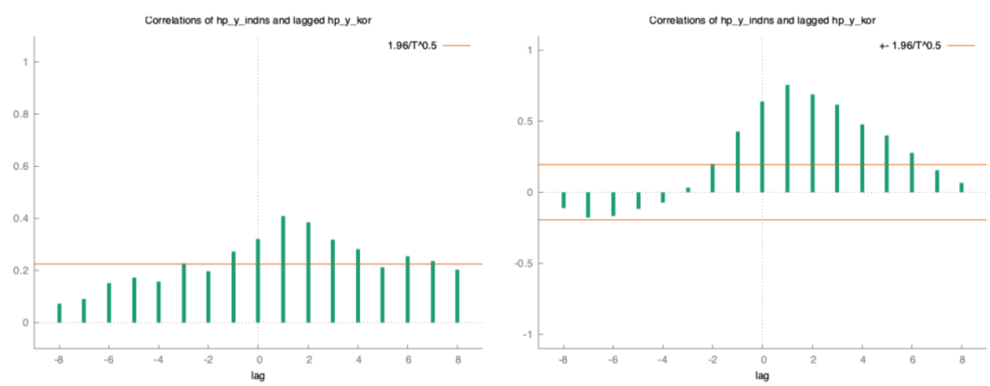
India



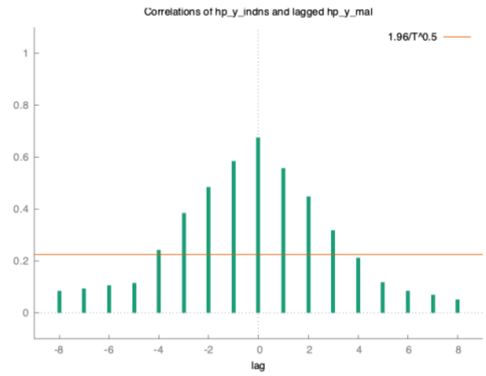
Japan

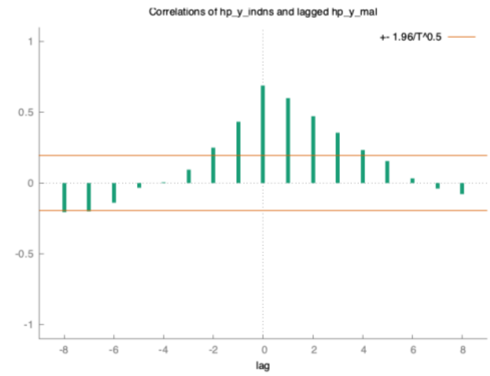


Korea

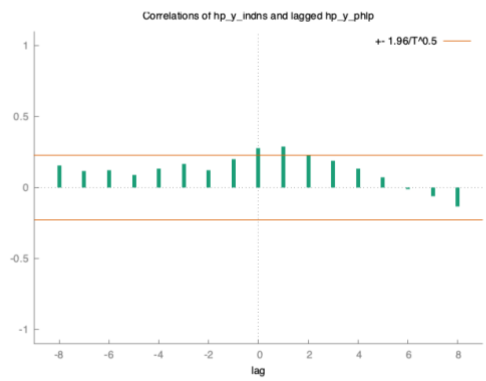


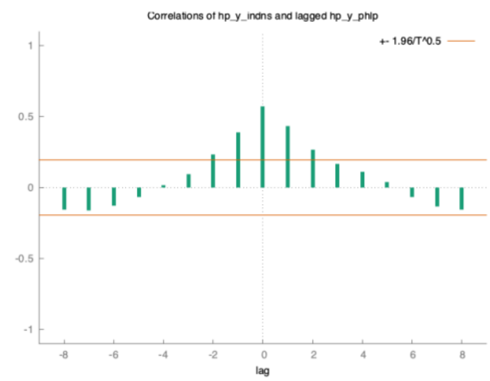
Malaysia



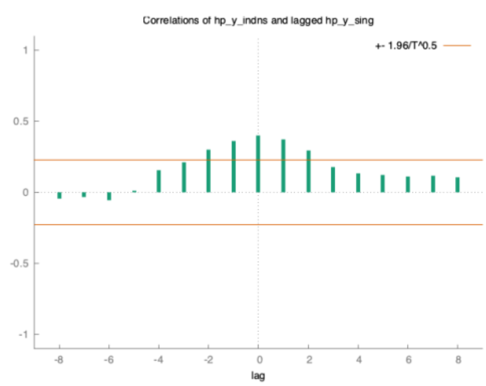


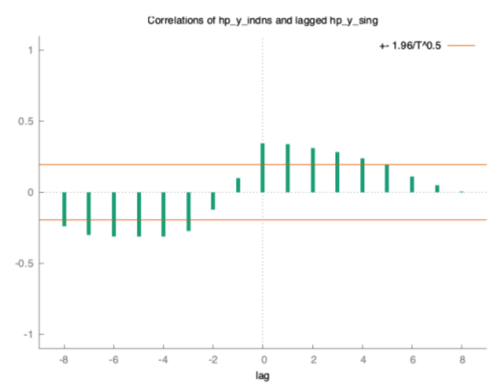
Philippines



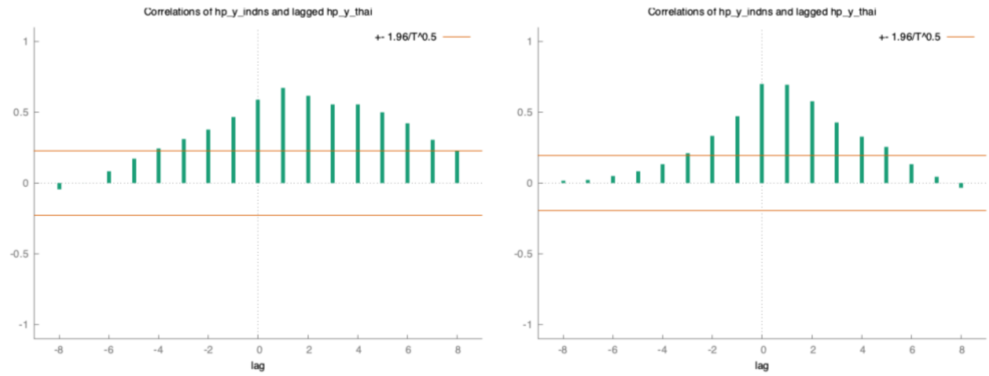


Singapore





Thailand



Splitting the series into pre and post Asian financial crisis periods provides a clearer picture. Before the Asian Financial Crisis in the 1997 as presented in Table 2.2, synchronisation between Indonesia and many Asian economies is generally weak. While Malaysia and Thailand already showing relatively moderate procyclical co-movement with Indonesia, however the relationships with larger regional economies appear less stable. For example, Japan shows only weak correlation, with the strongest association occurring several quarters earlier, suggesting that Japanese cycles tended to precede Indonesia's fluctuations. Overall, the pre-crisis results suggest that regional business-cycle synchronisation in Asia was still relatively limited.

After 1998, however, the rising degree of synchronisation across almost all countries is noticeable as seen in Table 2.3. Indonesia's cycle correlation with Japan's and Korea's became significantly stronger, and even with India shows a clearer coincident pattern. Many of these countries also shift toward coincident timing, indicating tighter regional movement. It suggests that Indonesia's business cycle has become more synchronized with its regional neighbours over the past two decades after the crisis period.

The strong co-movement between Indonesia and its two closest neighbours deserves closer examination of what the "shared exposures" identified in Table 2.1 actually consist of. In the case of Malaysia and Indonesia, the most direct structural channel is their joint dominance of the global palm oil market. Together, the two countries account for approximately 85 percent of world palm oil production and exports, meaning that global demand shocks, price cycles, or regulatory changes such as the European Union's deforestation regulations or fluctuations in biodiesel blending mandates, affect both economies simultaneously and through the same mechanism. This creates a common income shock that transmits to fiscal revenues, rural household incomes, and domestic consumption in both countries at roughly the same time. Beyond palm oil, Malaysia and Indonesia are also both major producers and exporters of natural rubber, cocoa, and tropical timber, giving their growth cycles a structurally similar commodity sensitivity profile. On the trade side, ASEAN remained Malaysia's largest trading bloc, accounting for 27.3 percent of Malaysia's total trade in 2023 (MATRADE, 2024), and bilateral investment ties between the two countries are substantial, with Malaysia historically ranking as the second-largest foreign investor in Indonesia after Singapore. This dense web of intra-industry trade, shared supply chains, and cross-border investment amplifies the synchronisation that arises from common commodity exposure.

Thailand's strong co-movement with Indonesia reflects a partially different but equally coherent set of shared exposures. While Thailand is not a palm oil exporter of comparable scale to Indonesia or Malaysia, it is a significant producer of natural rubber, rice, and processed agricultural goods, and its growth cycle is therefore similarly sensitive to global agricultural commodity price swings and the broader regional demand conditions that drive ASEAN-wide activity (OEC, 2024). Crucially, Thailand and Indonesia share a deep structural exposure to the financial contagion channels that proved so powerful during the 1997 Asian Financial Crisis, when both countries were among the most severely affected. This shared vulnerability to external financial shocks, combined with increasing intra-ASEAN trade integration following the full implementation of the ASEAN Free Trade Area (AFTA), helps explain why the Thailand-Indonesia co-movement, already moderate before 1997 (0.59 contemporaneously), strengthened considerably in the post-crisis era (0.70). The evidence from Rana (2007) that intra-regional trade integration deepened over this period is consistent with this interpretation: before the crisis, intra-ASEAN exports were growing at 29.6 percent, well above the 18.8 percent growth rate for total ASEAN exports (ASEAN, 2002), and the post-crisis institutional architecture of ASEAN+3 and the Chiang Mai Initiative further strengthened the financial and monetary ties between these economies.

China's weak and acyclical correlation with Indonesia (−0.044 contemporaneously over the full sample) is particularly notable in Table 2.1 and deserves closer theoretical interpretation. China is Indonesia's second-largest overall trading partner, and expected to have meaningful co-movement. However, the weakness of the correlation is consistent with several structural features of China's growth cycle that distinguish it fundamentally from that of Indonesia and its Southeast Asian neighbours, where China's growth over the sample period was largely driven by domestic investment, state-directed industrial expansion, and five-year planning cycles (Zha, 2024), none of which are closely tied to Indonesia's cycle. The modest improvement in the post-crisis coefficient (from −0.12 to 0.05, Table 2.3) suggests that trade deepening after 1998 has produced only a marginal increase in co-movement, consistent with the view that the two economies remain structurally distinct in their cyclical behaviour.

Taken together, this chapter suggests that business cycle co-movements within Asia have strengthened considerably in the post-crisis era, though the degree of synchronisation varies substantially across the peers countries. This raises a question of whether these patterns reflect genuine regional integration or simply a shared sensitivity to common global forces, commodity prices in particular. Given Indonesia's position as a major commodity exporter, the next chapter explores global commodity prices and considers whether their fluctuations may help account for the cyclical variations observed in Indonesia's growth cycle throughout the sample period.

Chapter 3 - Oils and Meals Commodity Price Cycles: Chronologies and Characteristics

3.1 Introduction

The growth-cycle chronology constructed in Chapter 1 identified six complete business cycles in Indonesia between 1979 and 2023, while the cross-correlation analysis in Chapter 2 demonstrated that Indonesia's growth cycle is increasingly synchronized with several of its regional neighbours after the 1997 Asian Crisis. In this context, a natural question is whether such co-movement pattern stems from a common exposure to global determinants. One candidate is the global commodity price cycle, given the fact that many of the region’s economies share a similar status as major commodity exporters.

The importance of commodity prices as drivers of business cycle dynamics in resource-exporting economies is well established in the international macroeconomic literature. The vulnerability of emerging markets and developing economies (EMDEs) to global economic fluctuations is highlighted by their heavy dependence on primary commodities, which amplify EMDE sensitivity to shocks in commodity prices. A study by Fernández et al. (2017) finds that changes in commodity prices can explain a significant share of output fluctuations in emerging economies that rely heavily in commodity production. Drechsel and Tenreyro (2018) also suggest that commodity price shocks are an important determinant of the business cycle in commodity-exporting emerging economies, explaining much of output, consumption and investment volatility. Furthermore, Juvenal and Petrella (2024) also confirms that shocks to the prices of commodities that raise the prices in exports are associated with higher domestic GDP in emerging market and developing economies. This leads to higher export revenues and lower country risk spreads, which continue to reduce the borrowing costs while supporting growth.

Conversely, many studies recognized that emerging market and developing economies (EMDEs) are vulnerable to the adverse effects of commodity import shocks. Adler, Magud, and Werner (2017), studying 150 advanced and emerging countries, found that sharp increases in the costs of imported agricultural inputs and energy act as a negative terms-of-trade shock for countries that import more than they export. This leads to a contemporaneous weakening of external balances and a lagged depreciation of the local currency, driven primarily by a contraction in domestic demand. Avalos et al. (2025) suggests that for an importing country, supply-driven commodity price increases function as an external economic burden. This situation simultaneously drives up domestic inflation and reduces total national income. Furthermore, the Ruta (2022) highlighted that for nations reliant on agricultural imports and fertilizers, global price increases compel substantial contractions in both corporate profit margins and household purchasing capacity, consequently restricting domestic consumption and often precipitating cyclical economic downturns.

These contrasting literatures, specifically the positive impact on export revenues and the negative impact on import costs, highlight the importance of examining how Indonesia's domestic growth cycle co-moves with global commodity price, and whether the direction and timing of this relationship reflects its asymmetric position as both a major exporter and a net importer within the oils and meals complex. The particular "Oils and Meals" commodity group represents a theoretically coherent unit of analysis for this purpose, as the commodities within it constitute an internationally integrated price complex in which processors, manufacturers, and importers continuously substitute between oils and meals in response to relative price differentials, generating co-movement across the group as a whole (Bentivoglio et al., 2018; World Bank, 2024). The agricultural and agro-food sector accounts for approximately 19 percent of Indonesia's total merchandise exports in 2023 (Observatory of Economic Complexity [OEC], 2024). In this particular sector, the export of vegetable oils is the main contributor to the country's trade balance Indonesia is the global leader in palm oil, accounting for over 50% of global exports and contributing approximately 11% to the country's total merchandise export revenues. Furthermore, Indonesia ranks as the world's largest exporter of coconut oil in 2024 (OEC). Conversely, Indonesia remains a net importer for the soybean and soybean meal. In 2024, Indonesia imported $2.13 billion worth of soybean meal and $1.39 billion in raw soybeans to support domestic production industries (OEC, 2026). This dual exposure, as a dominant exporter of tropical oils and a net importer of soybean products might create vulnerability to fluctuations across the oils and meals commodity group, and means that price movements are likely to co-move with Indonesia's economic activity simultaneously through export revenues and import costs. Analysing the full commodity group rather than a single commodity therefore provides a richer comparative basis for identifying which co-movement patterns reflect commodity-specific institutional features and which constitute broader macroeconomic dynamics. Given this context, the co-movement between the global oils and meals price and Indonesia's business cycle emerges as a particularly well-motivated empirical question.

3.2 Indonesia and the Oils and Meals Commodity Group

3.2.1 Palm Oil Industry: an Overview

Palm oil holds an important role in Indonesia's economy. Palm oil is the country's most important agricultural export commodity and one of the major contributors to rural income, employment, and government revenues. Palm oil is extracted from the fruit of the oil palm Elaeis Guineensis, which is originally from West Africa. The first commercial plantations established in Sumatra in the early twentieth century during the Dutch colonial period in Indonesia. Since then, the sector has experience substantial growth in the past century, transforming Indonesia into the dominant force in global palm oil markets (Directorate General of Estate Crops, 2022). The reason for the substantial growth is due to its productivity (per unit of land) where it yields substantially more oil per hectare, compared to the other alternatives such as soybean, rapeseed, or sunflower. On top of that, Indonesia's tropical climate and vast land endowments, particularly on the islands of Sumatra and Kalimantan has made palm oil consistently cheaper to produce than competing vegetable oils. Given the lower price of the palm oil, its penetration spread across a various end-use markets, from its traditional role as an edible cooking oil to processed food manufacturing, cosmetics, oleochemicals, and increasingly as a feedstock for biodiesel production (Bentivoglio et al., 2018).

Indonesia has been the world’s largest producer and exporter of crude palm oil (CPO) since 2007, currently accounting to 58 percent of total global supply (United States Department of Agriculture, 2025). Oil palm cultivation and processing is estimated to contribute between 3 and 9 per cent of Indonesia’s total GDP. Furthermore, the sector is a substantial driver to the rural employment, directly and indirectly employing an estimated 16 to 20 million workers across the supply chain (ILO, 2025; GAPKI, 2024). The sector's export performance has been substantial, though subject to considerable year-to-year volatility driven by both price and volume fluctuations. The average international palm oil price fell by 28.7 percent in 2023 compared to 2022, causing total palm oil export value to decline from USD 39.07 billion in 2022 to USD 30.32 billion in 2023. The fluctuations in the export revenue highlight how Indonesia's foreign exchange income is tied to the swings of global commodity prices. This vulnerability is a common thread among developing economies that rely heavily on natural resources.

Geographical Distribution and Production Structure

The oil palm plantations in Indonesia are not evenly spread across the country territory, concentrated on 2 islands, Sumatera and Kalimantan which account roughly 96% of the country production. The plantations are about 55% percent located in the Sumatera island, while the remainder is on the island of Kalimantan. Production is also clustered in certain provinces within these islands, where Riau is the leading producer, followed by Central Kalimantan, West Kalimantan, North Sumatra, and East Kalimantan (Directorate General of Estate Crops, 2022). Papua has recently started to develop as a new expansion area, however it contributes only a small share of total production. This geographic concentration has important effects on how the sector operates. Rural communities in those provinces rely heavily on palm oil as a source of income and livelihoods (Supriatna, 2024). As a results, fluctuations on the commodity prices and production conditions can significantly affect their well-being, more than it affect the overall national economy.

The structural organization of Indonesia's palm oil sector is characterized by a dual structure of large corporate plantations and a substantial smallholder segment. Smallholders account for approximately 40 percent of total planted area and around 33.6 percent of total CPO production, with approximately

2.6 million smallholder farming households engaged in oil palm cultivation (Directorate General of Estate Crops, 2022). The corporate segment is divided between state-owned enterprises, which play a relatively modest role, and large private companies such as Wilmar International, Golden Agri-Resources, and Astra Agro Lestari, that operate vertically integrated plantation-to-refinery operations (Grand View Research, 2023).

The smallholder segment itself is internally heterogeneous. Scheme smallholders (*plasma* farmers) operate within formal contractual arrangements with palm oil company, where the company provide the farmers with high-quality seeds, fertilizer, and training. In exchange, the farmers sell all their harvested Fresh Fruit Bunches (FFB) directly back to the company at a guaranteed fair price. Independent smallholders, by contrast, operate outside such formal arrangements, selling their FFB through a network of local collectors and intermediary traders who then supply independent mills. This distinction matters since the price received by independent smallholders, who represent the majority of the smallholder population depends not only on international CPO prices but also on the margins extracted at each stage of a multi-step intermediary chain comprising collectors, transporters, independent mills, and refiners before the commodity reaches export markets. According to research by Euler et al. (2017), adoption of oil palm by smallholders, relative to alternative crops, boosts household incomes by around 25 percent, indicating that participation in the palm oil value chain carries significant welfare benefits at the household level, even where the price transmission chain is lengthy.

The Export Levy System and the BPDPKS

A key part of Indonesia's palm oil system is the export levy, which has been in place since 2015, managed by the Oil Palm Plantation Fund Management Agency, known by its Indonesian acronym

BPDPKS (*Badan Pengelola Dana Perkebunan Kelapa Sawit*). The BPDPKS was established mainly to fund Indonesia's domestic biodiesel subsidy programme and to support smallholder replanting, research, and promotion activities (Nurfatriani et al., 2022). The levy is charged on CPO and various processed palm oil derivative products at the point of export. The rate determined by a reference price methodology set by the Ministry of Trade. The CPO reference price used to determine the levy rate is calculated as a weighted average of the FOB CPO price on the Indonesian exchange (60 percent), the FOB CPO price on the Malaysian exchange (20 percent), and the CIF Rotterdam price (20 percent), meaning that the levy effectively tracks international market movements, rising when global prices are high and falling, or being suspended, when prices are low.

The levy structure has been revised several times to reflect changes in the market conditions and the government's priorities. In December 2018, for example the formulation shifted from a flat-rate structure to a progressive price-based structure in response to declining CPO prices. As prices continued to fall in 2019, the government temporarily suspended the levy collection altogether, consequently the BPDPKS did not receive new revenue in that year (USDA, 2020). In contrast, during the price surge of 2021 and 2022, the progressive structure generated record revenues. The estimated levy collected in 2021 alone was IDR 71.6 trillion, more than the total collected from 2015 to 2020 combined, while in 2022, revenues reached IDR 34.59 trillion despite a temporary export ban (PwC Indonesia, 2022). By 2023, total BPDPKS revenues also eased to approximately IDR 32 trillion as international prices stabilized (PwC Indonesia, 2023). Most recently, following an adjustment to 10% in mid-2025, the Ministry of Finance further increased the CPO export levy to 12.5% of the reference price in March 2026 to secure the estate crop fund in order to meet the growing biodiesel subsidy obligations under the B40 mandate and national replanting targets.

The levy revenues are disbursed primarily as a subsidy to biodiesel producers, covering the price differential between biodiesel and fossil diesel at the pump. The BPDPKS disburses funds based on the spread between the fossil diesel market index price and the biodiesel index market price, meaning that the size of the subsidy and therefore the fiscal drain on the CPO fund varies inversely with international CPO prices. When CPO prices are high, biodiesel is expensive to produce, requiring larger subsidies, when CPO prices are low, the spread narrows and subsidy requirements ease. Between 2015 and 2022, the BPDPKS distributed IDR 144.59 trillion in biodiesel subsidies covering 42.98 million kilolitres of biodiesel (BPDPKS, 2022), the number illustrates how the fluctuations on the global palm oil prices is passed on to domestic energy consumers.

The Domestic Market Obligation

In addition to the export levy, under the authority of Ministry of Trade, the government employed a second instrument as a direct market intervention which is the Domestic Market Obligation (DMO). This policy requires palm oil producers and exporters to allocate some portion of their output to the domestic market at a government-set price in order to obtain export permits. The DMO was implemented during the 2022 in order to response cooking oil crisis. In January 2022, as the cooking oil prices surged in the domestic market, the government required producers to allocate 20 percent of their planned exports to the domestic market as a measure of price control. As the situation worsened, partially as a result of global vegetable oil supply disruptions following the Russia-Ukraine conflict, the required allocation was increased to 30 percent in March 2022. When these measures proved insufficient to stabilise supply, the government escalated the response by imposing a temporary export ban on crude palm oil (CPO) and key derivatives in late

April 2022. Even though the ban was lifted one month later, it significantly disrupted the global vegetable oil markets and contributed to further increase of the global prices.

Following the crisis, the DMO was retained in a more institutionalised form. Producers are now required to supply a fixed volume of cooking oil to the domestic market at subsidised prices in exchange for export permits, with allocation levels adjusted over time. More recently, however, the role of the DMO has evolved beyond short-term price stabilisation. As Indonesia expands its biodiesel programme, the policy is increasingly used to secure domestic palm oil supply for energy production. In practice, the DMO operates alongside the export levy to create a layered regulatory environment. Producers must balance domestic supply obligations, price controls, and export-linked levies, all of which ultimately shape the revenues they are able to realise.

Export Markets and Trade Flows

Indonesia's palm oil exports are spread across a wide range of global markets shaped by both international regulations and domestic policy. India remained the largest destination 2024, with export values of USD 4.52 billion, followed by China at USD 4.25 billion (WITS, 2024). However, this strong performance in Asian markets contrasts with the conditions in the European Union (EU) market. Exports to the EU declined from 4.13 million tons in 2022 to 3.70 million tons in 2023 (GAPKI, 2023). This decline is linked to tightening regulatory requirements, particularly the EU Deforestation Regulation (EUDR), which introduces stricter traceability and due diligence standards for commodities associated with deforestation (USDA, 2024). Indonesia has responded by challenging EU measures at the World Trade Organization and by intensifying its efforts to diversify export relationships toward markets in Asia and Africa, where sustainability requirements are currently less stringent (GAPKI, 2024). This ongoing reorientation of export geography adds a further layer of complexity to the relationship between internationally quoted CPO benchmark prices and the actual revenues received by Indonesian producers and exporters.

The rapid expansion of Indonesia's palm oil sector has generated significant environmental consequences that have increasingly shaped both domestic policy and international trade relationships. Over the past 20 years, the expansion of oil palm plantations through deforestation has been the major contributor in Indonesia accounting for approximately one third, around 3 million hectares of the country's loss of old-growth forest, with associated peatland drainage and fires contributing to global climate change and biodiversity loss. Four provinces in Kalimantan accounted for 72 percent of all deforestation attributable to palm oil in Indonesia between 2018 and 2022 (Benedict & Heilmayr, 2024). In response to these pressures, the Indonesian government established the Indonesian Sustainable Palm Oil (ISPO) certification system in 2011, which was subsequently made mandatory for all plantation operators. Research by Pasimura et al. (2022) found that the implementations of ISPO certification are able to change the company's environmental behaviour to reduce forest conversion in concession areas and increase conservation areas as a fulfilment of ISPO principles and criteria. Nevertheless, measurable implementation gaps persist. The high certification costs, complexity of compliance have limited ISPO adoption among smallholders, also the limited technical expertise further hinder their ability to integrate into the certification system. There are also reported instances of certified companies failing to comply with the environmental standards the certification is intended to enforce, pointing to persistent weaknesses in monitoring and enforcement capacity. Despite these challenges, The Tree Map (2025) reported that, Indonesia has reduced overall deforestation rates in 2024, forest conversion to industrial palm oil plantations declined by 9 percent, from 34,353 hectares in 2023 to 31,314 hectares in 2024.

3.2.2 Coconut Oil Industry: an overview

Coconut oil represents Indonesia's second top vegetable oil export within the oils and meals commodity group. Coconut oil is extracted from the dried meat of mature coconuts (copra). For centuries, coconut oil has been a significant component of the agricultural economy of the country and continues to be important both for subsistence purposes and commercial activities. Indonesia is the world's largest exporter of coconut oil, accounting for approximately 37 percent of global coconut oil exports in 2024, with the Philippines as its closest competitor (OEC, 2024; FAO, 2024). The coconut oil end-use applications are also diverse, for instance as edible oil for food manufacturing, cosmetics, personal care products, and until oleochemical production. More recently, the global demand for coconut oil has increased due to growing consumer interest in health and wellness products in Western markets, where it is positioned and marketed as a functional food ingredient.

Despite Indonesia's position as the top exporter in the global market, the coconut oil sector has a structurally different position in the Indonesian economy compared to palm oil. Total coconut oil export revenues were approximately USD 1.2 billion in 2023, representing a considerably smaller share of the country's trade balance than palm oil (OEC, 2024). Production is predominantly organized through smallholder farming, with an estimated 98 percent of Indonesia's 3.4 million hectares of coconut cultivation managed by smallholder households, the majority of whom farm plots of less than two hectares (Directorate General of Estate Crops, 2022). Due to the majority of the smallholders, in contrast to the more dualistic structure of the palm oil sector, shapes both the industry's productivity profile and its responsiveness to international price signals.

Production Structure and Geographic Distribution

Coconut cultivation in Indonesia is geographically dispersed across the archipelago, in contrast to the Sumatra-Kalimantan concentration characteristic of oil palm. The major producing provinces include North Sulawesi, Riau Islands, North Maluku, and parts of Java. North Sulawesi is historically the most prominent production center and the origin of much of Indonesia's copra and coconut oil export activity, with the port of Bitung serving as the primary export hub (Directorate General of Estate Crops, 2022). This geographic dispersion means that price shocks in the coconut oil market have a more spatially diffuse economic impact across different islands and provincial economies, compared to the more spatially concentrated effects of palm oil price movements.

The predominance of smallholder producers, many of whom operate aging coconut groves with limited access to improved planting material, fertilizers, and replanting support, has contributed to yield stagnation in recent decades. Indonesia's average coconut yield per hectare is considerably below its agronomic potential, reflecting underinvestment at the farm level and the absence of a vertically integrated corporate sector comparable to that in palm oil. As a consequence, Indonesia's share of global coconut oil exports has faced competitive pressure from the Philippines, where plantation-scale operations and cooperative structures have enabled more consistent quality and supply. These structural constraints mean that the sector's export revenues are particularly sensitive to volume variability driven by weather events, pest outbreaks, and the aging age-structure of existing coconut groves, in addition to international price fluctuations (Koltiva, 2025; Tanago & Kaluge, 2019; Zainol et al., 2023).

3.2.3 Groundnut Oil Industry: an Overview

Groundnut oil is derived from the pressing of peanuts *(Arachis hypogaea),* occupies a modest but analytically relevant position within Indonesia's oils and meals commodity profile. Indonesia is a relatively minor participant in global groundnut oil trade compared to the dominant exporters of Argentina, China, and Senegal. Indonesian groundnut production is oriented primarily toward domestic consumption rather than export, with the bulk of output channelled into the domestic edible oil and food processing markets, particularly in the traditional food sector where groundnut oil is used as a cooking medium and in the manufacture of peanut-based sauces and snack products (FAO, 2023). Export volumes of groundnut oil from Indonesia are comparatively small, and the commodity does not feature among the country's primary agricultural export earners.

Based on trade data from WITS (2024), Indonesia remains a net importer of groundnut oil, though trade volumes are relatively insignificant in a global context. Total groundnut oil imports in 2024 amounted to approximately US$56.96K (5,612 kg), with the United States serving as the dominant supplier across both crude and refined categories, followed by Singapore and Switzerland. On the export side, outflows were negligible at approximately US$5.02K (1,006 kg) in total, directed primarily to Papua New Guinea and Singapore. This results in a net import position of roughly US$51.94K, confirming Indonesia's role as a consumer rather than a producer of groundnut oil for international markets. These limited figures highlights that groundnut oil is not a primary agricultural export commodity for Indonesia. Instead, global price changes primarily affect Indonesia through the costs of imports and domestic price fluctuations, since the food industry needs to supplement domestic production with imported peanuts and oils to meet increasing demand (American Peanut Council, 2024; USDA FAS, 2025).

Production and Domestic Market Dynamics

The cultivation of groundnuts in Indonesia is primarily concentrated in Java. Recent data reveals that production in Java constitutes over 75 percent of the total national yield. While the remainder are in areas like Sulawesi and Nusa Tenggara (Ministry of Agriculture, 2024). The industry consists solely of smallholders, and groundnuts specially in West Java are often cultivated in seasonal rotation with rice, corn or soybeans. Due to competition for agricultural land from more profitable crops, limited adoption of superior varieties, and a lack of policy support for groundnut productivity enhancement initiatives, groundnut production in Indonesia has drastically stagnated in recent decades (American Peanut Council, 2024; Wiraguna et al., 2023).

Domestic groundnut oil prices in Indonesia are influenced by a combination of international price signals transmitted through import parity pricing, domestic supply conditions, and the competitive dynamics of the broader domestic edible oil market in which palm oil occupies a dominant position. Because palm oil is significantly cheaper per unit and more abundantly available domestically, its price level effectively sets an upper bound on how far domestic groundnut oil prices can rise before processors and consumers substitute toward palm oil alternatives. This competitive relationship means that Indonesia's domestic groundnut oil market is doubly exposed to global price movements: directly through import parity effects and indirectly through the substitution dynamics with palm oil, whose price is itself shaped by international CPO markets. Within the oils and meals commodity complex analyzed in this chapter, groundnut oil therefore functions as a secondary price follower, with its movements largely driven by the leading vegetable oils rather than constituting an independent source of price impulse for the Indonesian economy.

3.2.4 Soybean Oil Industry: an Overview

Soybean oil is among the widely consumed vegetable oils globally and holds important role in the international oils and meals pricing structure. It is generated as a co-product of soybean crushing in conjunction with soybean meal, indicating that the availability of soybean oil is intrinsically connected to the demand for protein meal in the livestock feed sector. Argentina, Brazil, and Netherlands are the leading global exporters of soybean oil, collectively representing the bulk of international trade volumes (OEC, 2024). Indonesia is not a major industrial producer of soybean oil; however, the commodity remains pertinent to the Indonesian economy as an import, a domestic food ingredient, and a pricing benchmark that affects the relative competitiveness of locally produced palm oil in global markets.

Indonesia’s soybean industry is characterized by a significant reliance on international markets, as domestic production is not sufficient for the growing demand for protein and oil. According to the IISD (2024), the availability of soybean oil is intrinsically connected to the demand for protein meal in the livestock sector. Indonesia's trade balance illustrates that in 2023, the nation imported $43.9 million in refined soybean oil for food production, while its soybean meal imports exceeded $2 billion, positioning it as the world's second-largest importer of this product (OEC, 2024). Due to its significant reliance on both raw and processed soy products, Indonesia is a price-taking importer that is extremely vulnerable to fluctuations in the world's commodity markets.

Price Linkages and Substitution Dynamics

The relationship between soybean oil and palm oil prices is one of the most extensively documented bilateral commodity price linkages in the agricultural economics literature. Because soybean oil and palm oil are close substitutes in many end-use applications, including cooking, food processing, and biodiesel production, a price increase in one oil tends to stimulate demand for the other, transmitting price impulses across the complex. Research by Bentivoglio et al. (2018) confirms statistically significant long-run price co-integration between palm oil, soybean oil, and other vegetable oils, with evidence of bidirectional price transmission, suggesting that neither commodity is a pure price leader in all circumstances and across all time periods.

Indonesia, as a net importer of soybean oil and raw soybeans, is exposed to global soybean oil price increases as an import cost shock, which raises production costs in the domestic food manufacturing sector and exerts upward pressure on domestic food price inflation (Khumairah et al., 2025). Global soybean oil price movements also influence the competitive position of Indonesian palm oil in export markets. Indonesian palm oil becomes relatively more appealing to foreign consumers when soybean oil prices rise in relation to CPO, enhancing export volumes and producer revenues. Conversely, when soybean oil prices fall sharply due to, for example, bumper crop conditions in South America, palm oil exporters face increased competitive pressure, which could lower export volumes and revenues (CME Group, 2017). This cross-commodity competitive dynamic is one of the mechanisms on how global oils and meals price cycles are transmitted to Indonesian economic conditions via the palm oil sector, even when the initial price change happens in soybean markets instead of palm oil markets (Jena, 2016).

3.2.5 Overview of Soybean Demand in Indonesia

Raw soybeans constitute one of Indonesia's most important agricultural import commodities. Unlike palm oil, coconut oil, or the other vegetable oils discussed in this chapter, Indonesia is not a significant soybean producer, and local production covers only a small fraction of the country consumer needs. Indonesia's soybean production has been declining as farmers shift toward more profitable crops, also linked to the continued land conversion to develop urban infrastructure such as housing and highways. In 2023, total domestic production was approximately 0.3 million metric tons, while the country's annual consumption needs of approximately 2.5 to 3 million metric tons (USDA, 2025; FAO, 2024). This structural deficit renders Indonesia a systematically price-taking importer in the global soybean market.

The main products processed from imported soybeans in Indonesia are tempe and tofu, those are two protein staples that form a central component of the Indonesian diet across all income groups and regions. Tempe and tofu combined comprise approximately 90 percent of domestic soybean consumption, while the remainder used in other food products (USDA, 2024). In the consequence of this demand structure, soybean price fluctuations have a direct and socially significant transmitted effect on the prices of basic food commodities consumed by a large proportion of the Indonesian population, including lower-income households where tempe and tofu represent an affordable primary protein source.

Import Dependency and Price Transmission

In 2024, Indonesia imported soybeans primarily from the United States, Canada and Argentina (OEC, 2026). The global soybean market exhibits significant price volatility influenced by production conditions in key exporting nations, especially weather-related supply disruptions in South America, and demand variations from China, which consumes the majority of internationally traded soybean quantities (Gale et al., 2019). In 2024, Indonesia imported approximately USD 1.39 billion worth of raw soybeans, positioning it as a major importer in Southeast Asia (OEC, 2026).

Tempe and tofu industry is dominated by micro, small, and medium enterprises (MSMEs) with limited capacity to absorb input cost increases without passing them on to consumers, therefore the rising of soybean import prices translate into higher production costs for the manufacturers. Transmission from global soybean prices to domestic retail prices can be rapid and substantial, leaving the local protein staple industry highly vulnerable to global market volatility. This vulnerability was clearly demonstrated during the 2008 food price crisis, when local soybean input costs surged by 154.9%, jumping from Rp 4,550 to Rp 7,050 per kilogram. This severe supply disruption forced MSME artisans to reduce their production volumes by over half and resulted in a nearly 40% decline in their total revenue, which raised social concern about the affordability of protein staples (Murwanti & Sholahudin, 2009).

3.2.6 Overview of Soybean Meal in the Indonesian Economy

Soybean meal is a by-product of soybean oil extraction and is the main source of protein in feed for livestock and aquaculture around the world. Despite being sold as a distinct commodity, its price is closely linked to that of raw soybeans and soybean oil through the crushing margin relationship. Its own supply-demand dynamics driven primarily by the global animal protein and aquaculture industries. Indonesia is a substantial net importer of soybean meal, primarily to supply its rapidly growing poultry and aquaculture sectors, which have expanded considerably in line with rising domestic protein consumption driven by income growth and urbanization. In 2024, Indonesia imported approximately USD 2.13 billion worth of soybean meal, which is one of the biggest soybean meal imports in the country's agricultural trade account (OEC, 2026).

The main consumers of the imported soybean meal are the manufacturers of poultry feed, which typically are large-scale company, commercially integrated sectors supplying protein to both domestic consumers and regional export markets. The price of soybean meal is a major input cost for poultry farmers in Indonesia, where it typically makes up 20–30% of all commercial feed productions (USDA, 2024). Similarly, in the aquaculture sector, particularly shrimp and catfish farming, also relies on soybean meal as a key protein ingredient in commercial feeds.

Import Dependency and Interventions

The transmission of global soybean meal price shocks to the Indonesian domestic economy occurs primarily through the livestock feed cost. The increase in global soybean meal prices results in feed manufacturers incurring increased input costs, with various lags and degrees of completeness, to poultry and aquaculture producers. These producers compressed profit margins or attempt to recover costs through higher prices for live poultry and fish. The retail price of chicken, eggs, and farmed fish, which are among the most widely consumed animal proteins in the Indonesia, shows sensitivity to global soybean meal price movements. Specially during periods of sharp international price increases such as in the 2020-2022 commodity cycle and the supply disruptions linked to drought conditions in South American soybean-producing regions.

The concerns of Indonesia's structural reliance on imported soybean meal have long been acknowledged by the government, and subsequent administrations have implemented measures to reduce this vulnerability. Since 2014, the government has been working to attain domestic soybean self-sufficiency through a four-pronged strategy that includes increased productivity, planting area expansion, marketing system reforms, and farmer assistance mechanisms (Harsono et al., 2021). However, domestic soybean output covered less than 25% of the country's demand, leaving the feed producers and the poultry sector vulnerable to fluctuations in global prices (OECD, 2023). The long-term constraints of supply-side policy solutions are highlighted by the longevity of this import dependency, which also emphasizes the inherent structural vulnerability to global cycles in the price of soybean meal.

Taken together, the six commodities in this section, palm oil, coconut oil, groundnut oil, soybean oil, soybeans, and soybean meal, define the scope of Indonesia's exposure to the global oils and meals price complex. The asymmetry between Indonesia's dominant export position in tropical vegetable oils and its import dependence in soybean complex commodities creates a layered and partially offsetting set of macroeconomic transmission channels. Understanding these channels individually establishes the essential institutional and structural basis for the empirical examination of the co-movement between the global oils and meals price cycle and Indonesia's economy cycle, as discussed in the next sections of this chapter.

3.3 Dating Oils and Meals Commodity Price Cycles

Conceptual Framework

The identification of turning points in commodity price series is the methodological foundation of the empirical analysis in this chapter. As noted by Cashin, McDermott, and Scott (2002), commodity prices behave fundamentally differently from GDP. Where GDP in growing economies exhibits a persistent upward trend that makes classical cycle dating inappropriate, as demonstrated for the Asian economies in Chapter 1 , commodity prices are characterised by sharp and frequent fluctuations with no pronounced long-run trend. This statistical property means that turning points can be identified directly in the price level, without prior detrending, making a classical cycle-dating approach both appropriate and methodologically consistent with the existing literature.

A boom phase is defined as the period between a trough and a subsequent peak, during which real prices rise. Conversely, a slump phase runs from a peak to the subsequent trough, during which real prices fall. Together, a boom and a slump constitute a complete price cycle. Amplitude measures the magnitude of price change within each phase, which is expressed as the log-difference between the turning-point prices. The result is then multiplied by 100 to approximate a percentage change. This measurement approach, which follows Cashin et al. (2002) and Balatti (2025) that employed log-differences rather than simple percentage changes. This provide a symmetric and more consistent measure of proportional changes, ensuring that increases and decreases of the same magnitude are treated equivalently.

The Bry-Boschan Quarterly Algorithm

The dating algorithm used in this chapter is based on the Bry-Boschan (1971) framework as adapted for quarterly data by Harding and Pagan (2002), with the specific calibration introduced by Balatti (2025) for commodity price series and replicated in the World Bank Commodity Markets Outlook (April 2025). The procedure operates in applied to the log real price series as below:

First, candidate turning points are identified as local maxima and minima within a symmetric window of k = 2 quarters on each side. A peak at quarter t requires the log price to exceed the two preceding and the two subsequent observations. A trough requires it to fall below them.

Second, the alternation rule is implemented to guarantee that the sequence of peaks and troughs is strictly maintained. If the algorithm detects two consecutive peaks or troughs, it retains the higher peak or the lower trough and discards the other.

Third, a minimum phase length restriction of 4 quarters (equivalent to 12 months) is imposed simultaneously with a minimum amplitude restriction of 15 percent in log-difference terms. Both conditions must be satisfied for a turning point to be retained. The minimum amplitude criterion, which is the key feature distinguishing the Balatti (2025) algorithm from earlier implementations, prevents the classification of trivial price fluctuations as genuine cyclical phases. This is particularly important for agricultural commodity price series where short-term noise and seasonal harvest-related fluctuations can be substantial.

Fourth, a minimum complete cycle length of 12 quarters (36 months) is applied to ensure the identified turning points represent economically meaningful medium-term cycles rather than high-frequency volatility. These rules are calibrated specifically for commodity price series and are different from the rules applied in Chapters 1 and 2 for GDP dating, where the standard Harding and Pagan (2002) parameters of minimum phase 2 quarters and minimum cycle 5 quarters are used. The stricter minimum phase and cycle length requirements for commodity prices reflect the higher frequency volatility inherent in price data, including seasonal fluctuations in agricultural markets that would otherwise generate spurious turning points. The 15 percent amplitude floor has no direct analogue in GDP dating because GDP does not exhibit the same type of short-term noise and is, by nature, a smoother quantity variable.

Data

The Oils and Meals commodity price data are sourced from the World Bank Pink Sheet, deflated using the United States Consumer Price Index to real price series, in line with Cashin et al. (2002) and Balatti (2025). The six price series - palm oil, coconut oil, groundnut oil, soybeans, soybean oil, and soybean meal - are observed at quarterly frequency with the sample period from 1979:Q2 to 2023:Q3, yielding 178 quarterly observations per series. All series are expressed in natural logarithms prior to the application of the dating algorithm, and the algorithm is implemented in R following the procedure described above.

3.4 Characteristics of Oils and Meals Commodity Price Cycles

Turning Points and Cycle Frequency

The resulting cycle chronologies are presented in Table 3.1 below, reporting the trough and peak quarter for each identified cycle together with the duration of each contraction and expansion phase and the complete cycle durations measured both trough-to-trough and peak-to-peak.

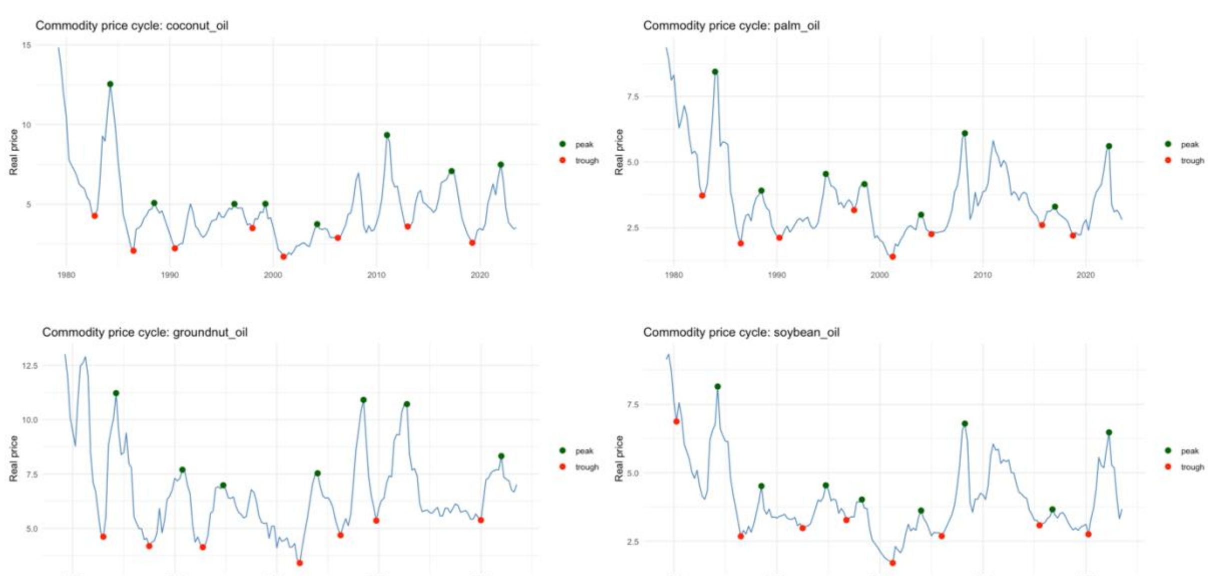
Table 3.1 Commodity Price Cycle Chronology — Oils and Meals Group (Quarterly, 1979:Q2–2023:Q3)

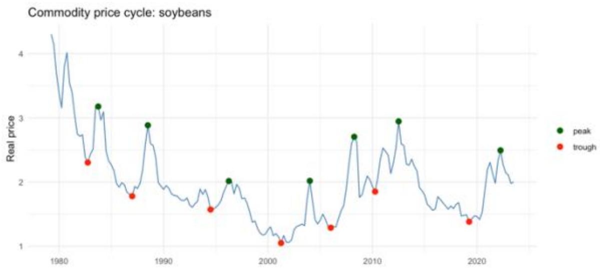
Commodity / Cycle	Trough Quarter	Peak Quarter	Contraction (Duration, peak to trough)	Expansion (Duration, trough to peak)	Cycle Duration (in quarters)	
					Trough to trough	Peak to peak
Palm Oil						
Cycle 1	1982 Q4	1984 Q1	—	5	—	—
Cycle 2	1986 Q3	1988 Q3	10	8	15	18
Cycle 3	1990 Q2	1994 Q4	7	18	15	25
Cycle 4	1997 Q3	1998 Q3	11	4	29	15
Cycle 5	2001 Q2	2004 Q1	11	11	15	22
Cycle 6	2005 Q1	2008 Q2	4	13	15	17
Cycle 7	2015 Q4	2017 Q1	30	5	43	35
Cycle 8	2018 Q4	2022 Q2	7	14	12	21
Coconut Oil						
Cycle 1	1982 Q4	1984 Q2	—	6	—	—
Cycle 2	1986 Q3	1988 Q3	9	8	15	17
Cycle 3	1990 Q3	1996 Q2	8	23	16	31
Cycle 4	1998 Q1	1999 Q2	7	5	30	12
Cycle 5	2001 Q1	2004 Q2	7	13	12	20
Cycle 6	2006 Q2	2011 Q1	8	19	21	27
Cycle 7	2013 Q1	2017 Q2	8	17	27	25
Cycle 8	2019 Q2	2022 Q1	8	11	25	19
Groundnut Oil						
Cycle 1	1983 Q1	1984 Q2	—	5	—	—
Cycle 2	1987 Q3	1990 Q4	13	13	18	26
Cycle 3	1992 Q4	1994 Q4	8	8	21	16
Cycle 4	2002 Q2	2004 Q1	30	7	38	37
Cycle 5	2006 Q2	2008 Q3	9	9	16	18
Cycle 6	2009 Q4	2012 Q4	5	12	14	17
Cycle 7	2020 Q1	2022 Q1	29	8	41	37
Soybeans						
Cycle 1	1982 Q4	1983 Q4	—	4	—	—
Cycle 2	1987 Q1	1988 Q3	13	6	17	19
Cycle 3	1994 Q3	1996 Q2	24	7	30	31
Cycle 4	2001 Q2	2004 Q1	20	11	27	31
Cycle 5	2006 Q1	2008 Q2	8	9	19	17
Cycle 6	2010 Q2	2012 Q3	8	9	17	17
Cycle 7	2019 Q2	2022 Q2	27	12	36	39

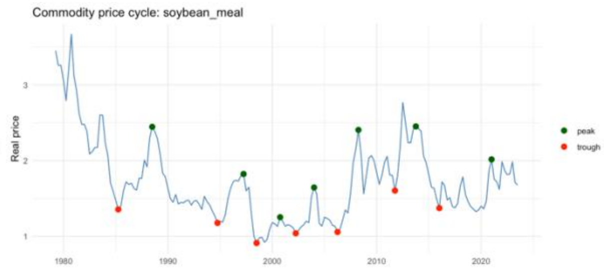
Soybean Oil						
Cycle 1	1980 Q2	1984 Q2	—	16	—	—
Cycle 2	1986 Q3	1988 Q3	9	8	25	17
Cycle 3	1992 Q3	1994 Q4	16	9	24	25
Cycle 4	1996 Q4	1998 Q2	8	6	17	14
Cycle 5	2001 Q2	2004 Q1	12	11	18	23
Cycle 6	2006 Q1	2008 Q2	8	9	19	17
Cycle 7	2015 Q3	2016 Q4	29	5	38	34
Cycle 8	2020 Q2	2022 Q2	14	8	19	22
Soybean Meal						
Cycle 1	1985 Q2	1988 Q3	—	13	—	—
Cycle 2	1994 Q4	1997 Q2	25	10	38	35
Cycle 3	1998 Q3	2000 Q4	5	9	15	14
Cycle 4	2002 Q2	2004 Q1	6	7	15	13
Cycle 5	2006 Q2	2008 Q2	9	8	16	17
Cycle 6	2011 Q4	2013 Q4	14	8	22	22
Cycle 7	2016 Q1	2021 Q1	9	20	17	29

Source: Author's calculations. Turning points identified using the BBQ algorithm following Cashin, McDermott and Scott (2002) and Balatti/World Bank (2025): k=2, minimum phase duration 4 quarters, minimum cycle length 12 quarters, 15% log-difference amplitude floor, applied to quarterly real commodity price levels. Duration is measured in quarters. '—' indicates the turning point has no preceding counterpart within the sample.

Figure 3.1 - Commodity Price Turning Points — Oils and Meals Group (Quarterly, 1979:Q2–2023:Q3)







Several common features emerge across the six commodity chronologies. The early 1980s trough, visible in virtually all series, coincides with the global commodity price collapse that followed the sharp oil price increases of the late 1970s and the subsequent global demand contraction. The late 1990s trough, visible in most series, corresponds to the combined effects of the Asian Financial Crisis of 1997–1998 and the broader global commodity price deflation of that period. The most synchronised boom across the sample occurs in 2007–2008, when food and energy commodity prices surged simultaneously driven by strong demand growth from emerging economies, supply disruptions, and rising biofuel mandates in major economies. Lastly, sharp boom and bust cycle is visible across all series in the 2020–2022 period, reflecting the post-pandemic demand recovery, global supply chain disruptions, and the sharp commodity price spike that followed Russia's invasion of Ukraine in February 2022.

The features of the chronology are also worth highlighting from Indonesia's perspective. For palm oil, the prolonged Cycle 7 slump of 30 quarters coincides with the period of most significant BPDPKS revenue compression, while the Cycle 8 boom captures the price surge that generated record levy revenues by 2021. For coconut oil, the exceptionally long Cycle 3 expansion of 23 quarters reflects the slow supply-response dynamics of perennial tree crops discussed in Section 3.2, standing in contrast to the shorter and more volatile palm oil cycles. Groundnut oil's chronology bears little structural relationship to Indonesia's domestic economy given its limited participation in global groundnut trade. For the soybean complex, the most notable feature is the prolonged parallel slumps of Cycle 3 across soybeans and soybean meal, lasting 24 and 25 quarters respectively. The same phase in the chronology across all six series during 2007–2008 and again in 2020–2022 is also notable, as these episodes feature prominently in the co-movement analysis that follows.

Duration of Boom and Slump Phases

Table 3.2 presents the average duration and amplitude of boom and slump phases for each commodity, together with the pooled averages across the full commodity group.

Table 3.2 . Duration and Amplitude of Commodity Price — Oils and Meals Group (Quarterly, 1979:Q2–2023:Q3)

Commodity	No. of Complete Cycles	Boom (Trough → Peak)			Slump (Peak → Trough)		
		Avg Duration (quarters)	Avg Amplitude (% log-diff)	Range (min – max, %)	Avg Duration (quarters)	Avg Amplitude (% log-diff)	Range (min – max, %)
Palm Oil	8	9.8	69	23.9 – 99.6	11.4	72.9	28.4 – 149.1
Coconut Oil	8	12.8	85.9	36.3 – 117.8	7.9	90.1	26.3 – 180.3
Groundnut Oil	7	8.9	68.4	43.7 – 88.8	15.7	70	47.5 – 98.6
Soybeans	7	8.3	50.1	24.9 – 74.2	16.7	57.1	37.9 – 75.7
Soybean Oil	8	9	50.3	17.1 – 92.7	13.7	58.3	28.5 – 111.1
Soybean Meal	7	10.7	49	31.8 – 82.2	11.3	50.6	18.6 – 73.1
Average	**7.5**	**9.9**	**62.1**	**29.6 – 92.6**	**12.8**	**66.5**	**31.2 – 114.7**

The mean duration of boom and slump in the Oils and Meals commodities group is 9.9 and 12.8 quarters, respectively. The duration asymmetry, in which downward phases typically exceed upward phases, aligns with the findings of Cashin, McDermott, and Scott (2002) for 36 commodities, as well as with the World Bank (2025), which found average slump durations of 52 months compared to 38 months for booms across 27 commodities. This pattern is explained by the structural characteristics of commodity supply, where booms are frequently initiated by abrupt supply disruptions or demand surges that can be sharp and relatively short-lived, whereas the return to equilibrium during slumps is generally gradual as producers are reluctant to decrease output, build up the inventories, and markets adjust over prolonged durations.

However, this pooled average masks considerable heterogeneity at the individual commodity level. For coconut oil, the duration asymmetry is strikingly reversed where boom phases average 12.8 quarters, nearly twice the average slump duration of 7.9 quarters. This pattern is directly consistent with the supply rigidity of coconut production described in the previous section, coconut require five to ten years to reach full production maturity, meaning that supply cannot respond rapidly to price signals. Once a price recovery begins it tends to be sustained over a longer horizon, while slumps can be relatively sharp when triggered by demand-side shocks. Soybeans exhibit the opposite pattern, with slumps averaging 16.7 quarters against booms of only 8.3 quarters, reflecting the capacity of the major exporting countries to rapidly scale annual crop production during boom periods, bringing prices back down more quickly than is possible for perennial tree crops. Groundnut oil also displays a notable duration asymmetry, with slumps lasting an average of 15.7 quarters against booms of 8.9 quarters, consistent with its segmented and relatively thin global market structure which is prone to sharp price spikes from weather shocks followed by extended periods of excess supply as production recovers.

Amplitude of Price Movements

The amplitude findings in Table 3.2 validate that price fluctuations within this commodity group are significant during the sample period. The mean amplitude of boom phases is 62.1 percent, while that of slump phases is 66.5 percent, both calculated as absolute log-differences multiplied by 100. The minor disparity between boom and slump amplitudes indicates a general symmetry in the extent of upward and downward price fluctuations at the group level, aligning with the World Bank's (2025) conclusion of statistically identical average boom and slump amplitudes across the wider 27 commodities.

At the individual commodity level, coconut oil exhibit highest amplitudes with average boom amplitude of 85.9 percent and average slump amplitude of 90.1 percent. The maximum slump amplitude of 180.3 percent, following the sharp price collapse following the 1984 peak. Palm oil and groundnut oil exhibit more moderate but still substantial amplitudes, with averages around 69–73 percent for palm oil and 68–70 percent for groundnut oil across phases. The soybean commodities (soybeans, soybean oil, and soybean meal) display noticeably lower average amplitudes, from 49 until 58 percent. This is consistent with the deeper and more liquid market structures for these commodities, where production across a larger number of major exporting countries provides greater supply resilience and limits the magnitude of price extremes.

Chapter 4: Commodity Price and Growth Cycle Linkages: Evidence from Indonesia and Asian Economies

4.1 Co-movement between Commodity Prices and Asian Growth Cycles

Having characterised the dynamics of the six oils and meals commodity price cycles in Section 3.4, this section examines the extent to which these prices co-move with the growth cycles of Indonesia and the eight comparator Asian economies identified in Chapters 1 and 2. The analysis begins with contemporaneous correlations between the growth rate of real GDP and the real commodity prices, computed over the full sample period 1979:Q2–2023:Q3. Contemporaneous correlations show how tightly each economy's growth position is aligned with global oils and meals price movements as presented in Table 4.1 below.

Table 4.1 Contemporaneous correlation of GDP Growth & Global Commodity Price (1979:Q2 - 2023:Q3)

Commodity	Indonesia	China	India	Japan	Korea	Malaysia	Philippines	Singapore	Thailand
Palm Oil	0.0408	0.0472	0.1555**	0.0985	-0.0962	0.0505	-0.1642**	0.1368	-0.0775
Coconut Oil	0.0869	0.0322	0.1701**	0.1056	-0.0189	0.1332	-0.1184	0.1927**	-0.0299
Groundnut Oil	0.2142***	-0.1378	0.0960	0.0596	-0.2162***	0.0589	-0.1502**	-0.0146	-0.0543
Soybeans	0.2714***	-0.0697	0.1172	0.2977***	0.0524	0.2122***	-0.0261	0.2167***	0.1645**
Soybean Oil	0.1250	0.0023	0.1587***	0.1291	-0.1081	0.0966	-0.1336	0.1033	-0.0116
Soybean Meal	0.3307***	-0.1666**	0.0321	0.2297***	0.0066	0.1973***	0.1074	0.1477	0.1395

Notes:
** $p < 0.05$ (critical value: 0.1488) *** $p < 0.01$ (critical value: 0.1948). *Critical values based on two-tailed test, n = 174 observations*

Over the full 44 year sample, the contemporaneous relationship between Indonesia's growth cycle and the global oils and meals price cycles appears unexpectedly mixed. Among the six commodities, palm oil exhibits a near-zero contemporaneous correlation with Indonesia's growth cycle (0.04), despite its central role as Indonesia's leading agricultural export. Coconut oil and soybean oil display similarly modest correlations of 0.09 and 0.13 respectively, while the strongest alignment is observed for soybean meal (0.33), followed by soybeans (0.27) and groundnut oil

(0.21). Across the broader regional sample the pattern is heterogeneous and, in several cases, counter-intuitive. Thailand and the Philippines exhibit predominantly negative correlations with the oils and meals complex, while China and Korea show weak or sign-inconsistent relationships across commodities during the sample period. Japan, Singapore and Malaysia display generally positive but moderate correlations.

The weakness and inconsistency of these full-sample correlations are difficult to reconcile with the theoretical expectation, set out in Section 3.1, that commodity price cycles should co-move strongly with the growth cycles of commodity-dependent emerging economies (Fernández et al., 2017; Drechsel & Tenreyro, 2018). However, this full-sample average is potentially deceptive, as it imposes a constant correlation over a period that spans several structurally distinct phases of regional and global integration. If the underlying relationship shifted over time, the full-sample coefficient will simply average across heterogeneous regimes and understate the true degree of co-movement in any one of them. Therefore, the sample is divided into two sub-periods around the 1997–1998 Asian Financial Crisis. This event is widely recognised in the literature as a structural turning point that fundamentally altered patterns of regional trade integration, financial openness, and commodity market linkages across Asia (Rana, 2007; Moneta & Rüffer, 2009).

The crisis period and its recovery phase (1997–1999) are excluded from sub-samples. The 1997–1998 Asian Financial Crisis severely disrupted both output and commodity markets, regional commodity prices fell by approximately 10–15 per cent from mid-1997 (UNCTAD, 1998). This disruption to output and commodity prices suggests that the crisis altered the nature of the commodity price–business cycle relationship in Southeast Asia, providing substantive justification for treating the pre- and post-crisis periods as structurally distinct regimes. Although most

Southeast Asian economies returned to positive growth by late 1998 or early 1999, the recovery process was only fully consolidated by 2000, with regional GDP growth stabilising at above 6.5 per cent from that year onward (FAO, 2001). The post-crisis sub-period therefore begins in 2000:Q1. The contemporaneous correlations are accordingly recomputed separately for the pre-crisis period (1979:Q2–1996:Q4) and the post-crisis period (2000:Q1–2023:Q3), and the results are presented in Tables 4.2 and 4.3 below.

Table 4.2 - GDP and Commodity Prices Contemporaneous Correlations (1979:Q2 - 1996:Q4)

Commodity	Indonesia	China	India	Japan	Korea	Malaysia	Philippines	Singapore	Thailand
Palm Oil	0.0587	0.1134	0.0570	-0.0065	-0.3487***	-0.0607	-0.3172***	0.0592	-0.4412***
Coconut Oil	0.0579	0.2603**	0.0584	-0.0143	-0.2524**	0.0140	-0.3761***	0.1224	-0.3361***
Groundnut Oil	0.2572**	-0.2900**	0.1731	0.0788	-0.3936***	-0.0328	-0.3609***	-0.0334	-0.3140***
Soybeans	0.0808	-0.1094	-0.0217	0.2948**	-0.3676***	-0.0992	-0.0448	0.1527	-0.2600***
Soybean Oil	0.0441	0.0646	0.0256	0.0335	-0.3886***	-0.1158	-0.4296***	-0.0195	-0.4260***
Soybean Meal	0.0861	-0.2112	-0.0865	0.3115**	-0.3406***	-0.0494	0.2064	0.2172	-0.1827

Notes:
** $p < 0.05$ (critical value: 0.2404) *** $p < 0.01$ (critical value: 0.3126). *Critical values based on two-tailed test, n = 67 observations*

Table 4.3 - GDP and Commodity Prices Contemporaneous Correlations (2000:Q1 – 2023:Q3)

Commodity	Indonesia	China	India	Japan	Korea	Malaysia	Philippines	Singapore	Thailand
Palm Oil	0.2203**	-0.0175	0.2473**	0.0431	-0.1138	0.1334	0.1261	0.1355	-0.0545
Coconut Oil	0.1624	-0.1341	0.2372**	0.0829	-0.0975	0.1682	0.1657	0.1792	0.0798
Groundnut Oil	0.1360	-0.0494	0.0475	0.0269	-0.3979**	0.0371	0.0428	-0.0741	-0.1053
Soybeans	0.2393**	-0.1316	0.2140**	0.0533	-0.2324**	0.1567	0.1630	0.0507	0.0593
Soybean Oil	0.2509**	-0.0684	0.2400**	0.0475	-0.1922	0.1664	0.1727	0.0930	-0.3540**
Soybean Meal	0.1365	-0.2473**	0.1174	0.0451	-0.3080**	0.0516	0.0972	-0.0873	-0.1328

Notes:
** $p < 0.05$ (critical value: 0.2017) *** $p < 0.01$ (critical value: 0.2631). *Critical values based on two-tailed test, n = 95 observations*

The two sub-periods display markedly different patterns of co-movement, with the post-crisis period exhibiting substantially stronger and more uniformly positive associations between commodity price and Asian growth cycles. In the pre-crisis period (1979:Q2–1996:Q4), virtually all of Indonesia's commodity correlations fall below the 0.2 threshold and must be classified as acyclical. Palm oil (0.06), coconut oil (0.06), soybean oil (0.04), soybeans (0.08), and soybean meal (0.09) all show correlations that are too small to constitute a meaningful co-movement between global price movements and Indonesia's growth cycle. The one exception is groundnut oil (0.26), which crosses into modest procyclicality, though given Indonesia's limited participation in global groundnut oil trade this may reflect common global demand conditions rather than a direct structural linkage. The overall picture for the pre-crisis period is therefore one of near-total disconnection: Indonesia's growth cycle operated largely independently of global oils and meals price movements. This is consistent with the structural characteristics of the Indonesian economy in this era: the financial system was relatively closed, the palm oil sector was still in an early phase of export expansion, biofuel policy did not yet exist, and government controls on domestic food and energy prices partially insulated the domestic economy from global commodity price signals. The export-revenue feedback channel, through which rising commodity prices are associated with fiscal windfalls and domestic spending booms, had not yet matured into a dominant macroeconomic transmission mechanism.

The post-crisis period (2000:Q1–2023:Q3) reveals a pronounced regime shift in Indonesia's relationship with global commodity markets. While the pre-crisis era was characterised by near-universal acyclicality, the post-crisis period sees three of the six commodities cross the 0.2 threshold into modest procyclicality. Palm oil rises from acyclical (0.06) to modestly procyclical (0.22), soybean oil from acyclical (0.04) to modestly procyclical (0.25), and soybeans from acyclical (0.08) to modestly procyclical (0.24). This is a meaningful shift, even if none of the commodities yet reaches the 0.5 threshold for a strong relationship. For the export side, palm oil's move into modest procyclicality is particularly significant. By the 2000s, Indonesia had consolidated its position as the world's largest palm oil exporter, and the BPDPKS export levy system had created a tight institutional link between CPO prices, government revenues, and domestic spending capacity. When global palm oil prices rise, Indonesia’s fiscal position improves, plantation incomes increase, rural consumption expands, and the domestic growth cycle accelerates, a chain that the post-crisis correlation pattern is consistent with.

Three commodities, however, remain acyclical in the post-crisis period. Coconut oil (0.16) and groundnut oil (0.14) both fall just below the 0.2 threshold, suggesting that while the direction of co-movement is now positive, the magnitude of co-movement is still too limited to constitute a reliable procyclical relationship. Soybean meal (0.14) similarly remains acyclical, which is somewhat surprising given Indonesia’s rapidly growing dependence on imported soybean meal for its poultry and aquaculture sectors. This may reflect the buffering role of the large, commercially integrated poultry companies that absorb feed cost shocks rather than transmitting them immediately to output and income. The overall picture for Indonesia in the post-crisis period is therefore a partial integration: the export-revenue channel for palm oil and the import-cost channel for soybeans and soybean oil have strengthened sufficiently to appear in the data as modest procyclicality, but several commodities remain acyclical, indicating that the relationship with the domestic growth cycle is still incomplete and uneven across the oils and meals complex.

A potential explanation for the relatively low correlation coefficients between vegetable oil prices and Indonesia's GDP growth cycle lies in the structural role of crude petroleum in the Indonesian economy. Although Indonesia is one of the world's leading exporters of vegetable oils, it has undergone a fundamental shift in its petroleum sector. As a founding member of OPEC, Indonesia was historically a major crude oil exporter. However, domestic production has declined by approximately 56% over recent decades, falling from roughly 850,000 barrels per day to around 500,000 barrels per day. As a result, Indonesia became a net crude oil importer in 2004, due to the declining output from maturing wells and rapidly growing domestic demand, which reached 1.7 million barrels per day in 2024 (Thiruverkadu, 2026). This structural shift may have important implications for the interpretation of our correlation results. This matters because crude oil and vegetable oil prices tend to co-move, particularly through biofuel and energy market linkages. Crude oil functions as a universal cost input in agricultural commodity markets, influencing transportation and logistics costs for vegetable oil exports as well as fertiliser prices, which are petroleum-derived. Consequently, rising vegetable oil prices may partly reflect upstream crude oil price increases rather than independent demand-side dynamics. Furthermore, when global oil prices rise, Indonesia simultaneously faces higher energy import costs, constraining the GDP growth. These two opposing forces vegetable oil export revenues on one side, and crude oil import costs on the other may partially offset each other, weakening the observable co-movement between vegetable oil prices and the Indonesian growth cycle.

The same pattern is visible across most regional peers, though the pattern and magnitude differ in ways that are informative when compared to Indonesia's experience. In the pre-crisis period, several economies displayed moderate negative correlations, between −0.2 and −0.5 across multiple commodities. Thailand reached −0.44 for palm oil and −0.43 for soybean oil, while the Philippines reached −0.32 for palm oil and −0.43 for soybean oil. Korea was similarly in moderate negative territory, including −0.35 for palm oil and −0.39 for soybean oil. These negative co-movements are consistent with the dominant role of the import-cost channel for net agricultural-input importers during a period when domestic capital markets, biofuel mandates, and export-revenue feedback mechanisms had not yet developed across the region. In the post-crisis period, the picture shifts but the degree of shift varies considerably across peers. Malaysia's palm oil correlation moves from −0.06 to 0.13, which while directionally positive still falls in acyclical territory under the 0.2 threshold. India is the regional peer that comes closest to matching Indonesia's post-crisis shift, with palm oil reaching 0.25 and soybean oil 0.24, both modestly procyclical, reflecting India's growing palm oil import dependence and agricultural commodity exposure. Thailand and the Philippines, which had displayed moderate negative correlations in the pre-crisis period, see those attenuate substantially in the post-crisis sample, but the Philippines' palm oil correlation of 0.13 and Thailand's −0.05 remain acyclical, meaning the shift has not been strong enough to constitute procyclical co-movement. China and Korea remain acyclical or negatively correlated in both regimes, with Korea's palm oil correlation moving from −0.35 to −0.11, persisting in the negative range. This persistent decoupling reflects the more diversified industrial composition of these two economies and their lower structural exposure to the oils and meals complex. What distinguishes Indonesia within this regional picture is that it is one of the very few economies in the sample to achieve modest procyclicality across multiple commodities in the post-crisis period, and the only one for which both the export and import sides of the oils and meals complex contribute simultaneously to the relationship. No other economy in the sample combines export dominance in tropical vegetable oils with significant import dependence in the soybean complex to the same degree, making Indonesia's macroeconomic exposure to the oils and meals complex uniquely layered.

These results are consistent with several reinforcing developments documented in the literature on commodity–macro linkages, and they have particular resonance for Indonesia. First, the deepening of regional and global trade integration in the post-crisis period intensified the export-revenue channel through which commodity price movements transmit to producer income and fiscal balances in commodity-exporting economies (Fernández et al., 2017; Juvenal & Petrella, 2024). For Indonesia specifically, the rapid expansion of palm oil production and exports over the 2000s meant that a growing share of national income, government tax receipts, and rural household welfare became directly sensitive to CPO price movements, a structural deepening that is directly reflected in palm oil's shift from acyclical to modestly procyclical between the two sub-periods. Second, the creation and expansion of Indonesia's biodiesel programme, financed through the BPDPKS export levy described in Section 3.2, created a structural and institutional link between palm oil prices, domestic energy policy, and government revenue that simply did not exist in the pre-crisis era. This mechanism amplifies the macroeconomic impact of palm oil price cycles on Indonesia in ways that do not apply to any other economy in the regional sample, and helps explain why Indonesia's palm oil correlation reaches modest procyclicality while Malaysia's remains acyclical despite their shared export structure. Third, the financialisation of commodity markets and the increasing co-movement between agricultural and energy prices have amplified the macroeconomic relevance of commodity price shocks for both exporters and importers (Juvenal & Petrella, 2024). For Indonesia, this matters on both sides of its commodity trade position: rising oil prices tend to be correlated with rising CPO prices, boosting export revenues, while simultaneously driving up import costs for soybeans and soybean meal. Together, these factors help explain why three of the six commodities have crossed from acyclical into modest procyclicality for Indonesia in the post-crisis period, even though no commodity has yet reached the 0.5 threshold for a strong relationship. The contemporaneous correlation evidence therefore characterises Indonesia's post-2000 macro-commodity linkage as real but partial strong enough to be economically significant in the context of fiscal and export dynamics, but still far from the tight coupling that would make commodity price cycles a highly reliable contemporaneous indicator of the domestic growth cycle. To provide a visual, time-continuous complement to the static sub-period results above, the rolling correlation figures below trace how the relationship between Indonesia's growth cycle and each commodity group evolved across the full sample.

Time-Varying Evidence: Rolling Correlations

Figure 4.1 Rolling Correlation 24-quarter window for Vegetable Oils and Indonesia's GDP

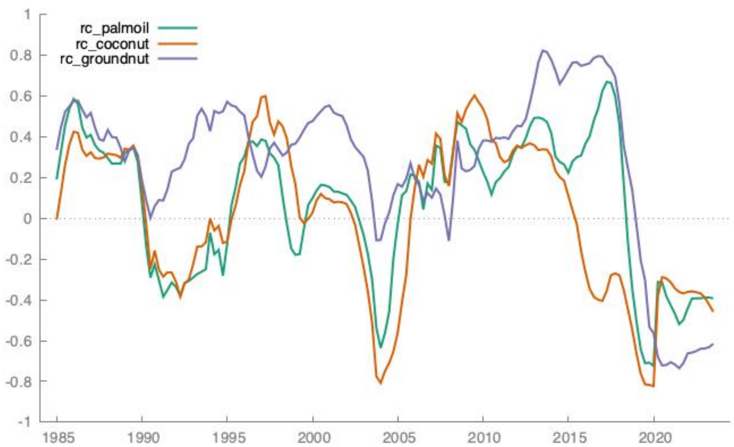
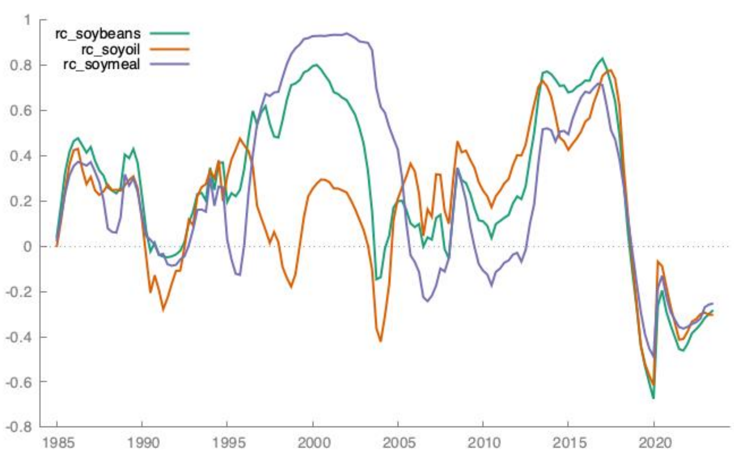


Figure 4.2 Rolling Correlation 24-quarter window for Soybean Complex and Indonesia's GDP



Figures 4.1 and 4.2 present 24-quarter rolling correlations between Indonesia's growth cycle and the six commodity price series, grouped by commodity type. The trailing window convention means the value plotted at quarter t reflects the correlation estimated over the preceding 24

quarters. Together, the two figures provide time-varying evidence that is consistent with the structural shift identified in Tables 4.2 and 4.3.

For the export oils group (Figure 4.1), palm oil and coconut oil track each other closely throughout the sample, moving almost in parallel. Both series display strongly negative rolling correlations during the window spanning approximately 1997–2007, reaching as low as −0.6 to −0.8, before reversing sharply and rising to 0.8–0.9 during the post-2010 commodity boom. This pattern visually confirms the regime shift from the pre-crisis acyclicality to post-crisis procyclicality reported in Table 4.2 and Table 4.3. Groundnut oil follows a distinctly different trajectory, remaining near zero or positive even during the period when palm oil and coconut oil are most negative, consistent with its limited structural linkage to Indonesia's domestic economy discussed in Section 3.2.

For the soybean complex (Figure 4.2), the three series, soybeans, soybean oil, and soybean meal move together closely, reflecting their shared pricing structure through the crushing margin relationship. Notably, the soybean complex does not exhibit the same deep negative trough seen in the export oils during the early 2000s window; instead, correlations remain closer to zero before rising positively from approximately 2006 onward. This milder pre-crisis pattern is consistent with the argument that Indonesia's import-side exposure to the soybean complex operates through a different and more buffered channel than the direct export-revenue mechanism associated with palm oil. This sets up the motivation for the lead-lag analysis in the following section, where the timing dimension of the movement is examined to assess whether commodity prices may serve as leading indicators even where contemporaneous co-movement remains modest.

4.2 From Contemporaneous Co-movement to Lead–Lag Dynamics

The post-crisis findings establish that Indonesia's growth cycle and the global oils and meals price cycles now move together to a substantially greater extent than during the pre-crisis era. However, contemporaneous correlations alone cannot identify the direction or timing of the relationship between commodity prices and domestic economic activity. They are silent on whether commodity price movements precede, coincide with, or lag changes in Indonesian output, and on the average horizon over which any co-movement occurs. This distinction is central to the policy interpretation of the results: if commodity prices systematically lead Indonesia's growth cycle, they may serve as useful leading indicators for fiscal and monetary policy planning; if they lag, the implication is that domestic activity itself helps drive the price dynamics observed in tropical oil markets, where Indonesia is a dominant producer.

Given the strong post-2000 contemporaneous alignment, the critical question therefore becomes one of timing: do global commodity price cycles lead Indonesia's domestic growth cycle, acting as a leading macroeconomic indicator, or do they lag? To untangle this co-movement mechanism, the analysis now turns to the lead–lag cross-correlation structures between Indonesia's growth cycle and each of the six oils and meals commodities, computed over the pre- and post-crisis period. The next section identifies, for each commodity, the lag at which the absolute correlation with Indonesia's growth cycle is maximised, and characterises the resulting co-movement patterns.

Table 4.4 Cross-Correlation of Indonesia's Business Cycle with Oil and Meals Commodity Price 1979:Q2 – 1996:Q4

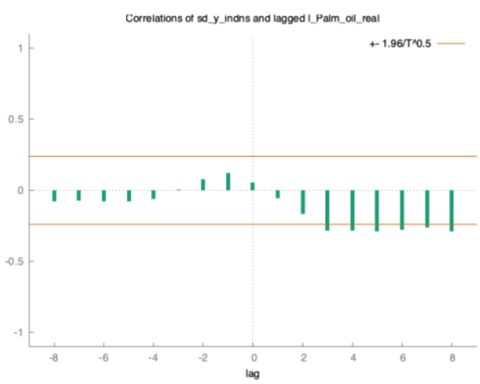
Commodity	Direction	Corr. Coeff. at lag 0	Timing	Largest Corr. Coeff.	Lag #
Palm Oil	acyclical	0.0587	Lagging	-0.2856^{**}	8
Coconut Oil	acyclical	0.0579	Lagging	-0.2964^{**}	5

Groundnut Oil	procyclical	0.2572**	Lagging	-0.4256***	6
Soybeans	acyclical	0.0808	Lagging	-0.4310***	8
Soybean Oil	acyclical	0.0441	Lagging	-0.3500***	8
Soybean Meals	acyclical	0.0861	Lagging	-0.4140***	8

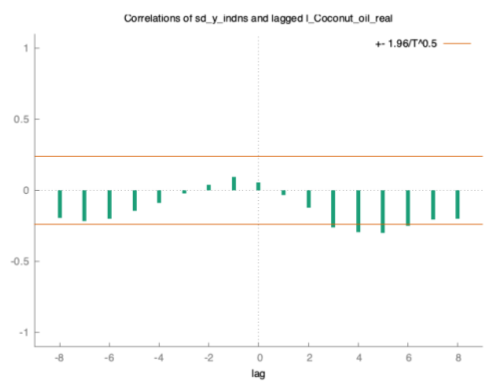
Notes:
* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$ *Statistical significance is based on the cross-correlation coefficient test. Coefficients without stars are not statistically significant at conventional levels.*

Figure 4.3 Cross-Correlation of Indonesia's Business Cycle with Oil and Meals Commodity Price 1979:Q2 – 1996:Q4

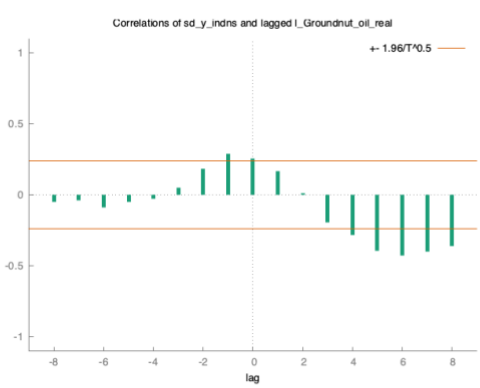
Palm Oil



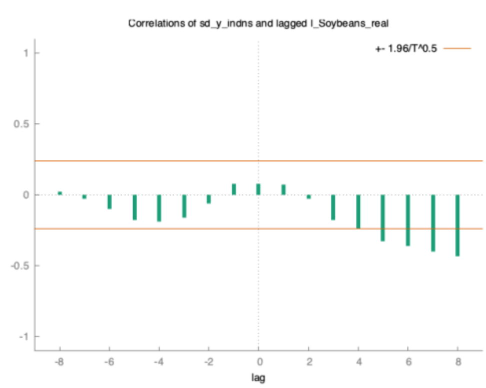
Coconut Oil



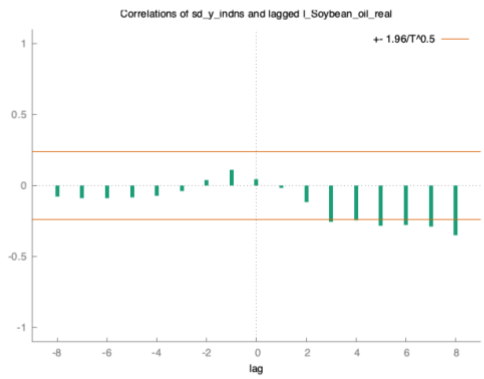
Groundnut Oil



Soybeans



Soybean Oil **Soybean Meal**



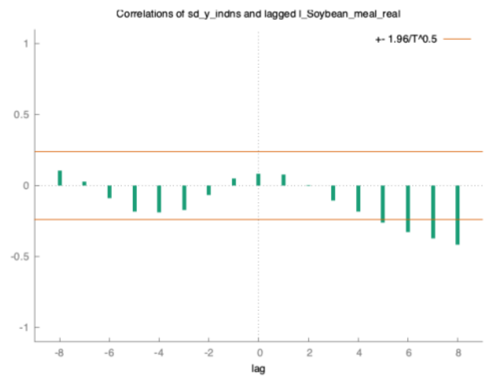


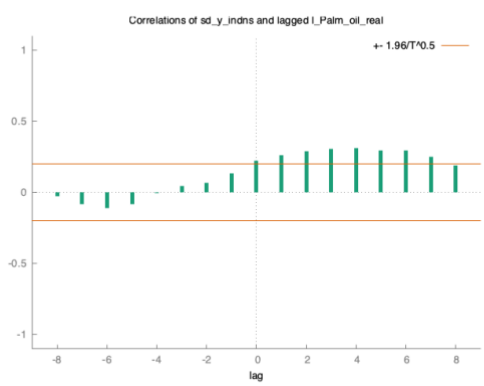
Table 4.5 Cross-Correlation of Indonesia's Business Cycle with Oil and Meals Commodity Price (2000:Q1 - 2023:Q3)

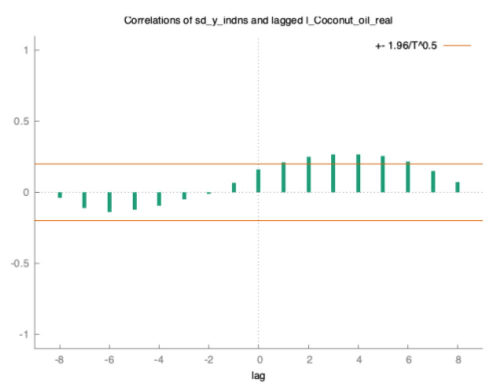
Commodity	Direction	Corr. Coeff. at lag 0	Timing	Largest Corr. Coeff.	Lag #
Palm Oil	procyclical	0.2203**	Lagging	0.3122***	4
Coconut Oil	acyclical	0.1624	Lagging	0.2691***	4
Groundnut Oil	acyclical	0.136	Lagging	0.2135**	6
Soybeans	procyclical	0.2393**	Lagging	0.2795***	2
Soybean Oil	procyclical	0.2509**	Lagging	0.2687***	2
Soybean Meals	acyclical	0.1365	Lagging	0.2001*	2

Notes:
* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$ *Statistical significance is based on the cross-correlation coefficient test. Coefficients without stars are not statistically significant at conventional levels.*

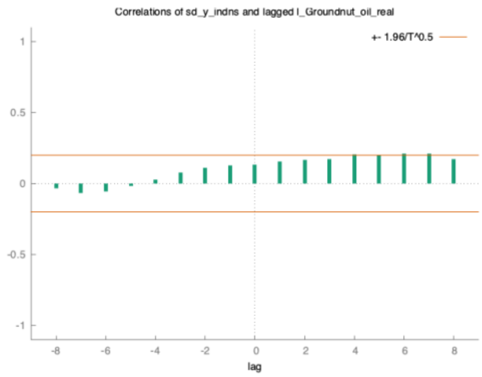
Figure 4.4 Cross-Correlation of Indonesia's Business Cycle with Oil and Meals Commodity Price (2000:Q1 - 2023Q3)

Palm Oil **Coconut Oil**

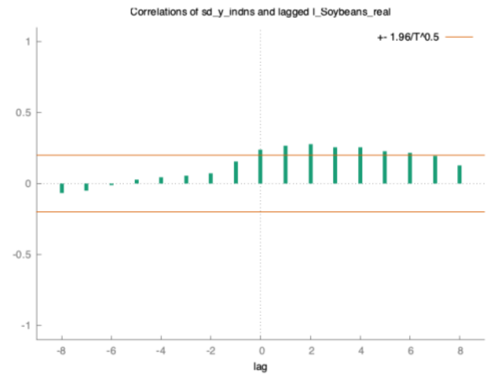




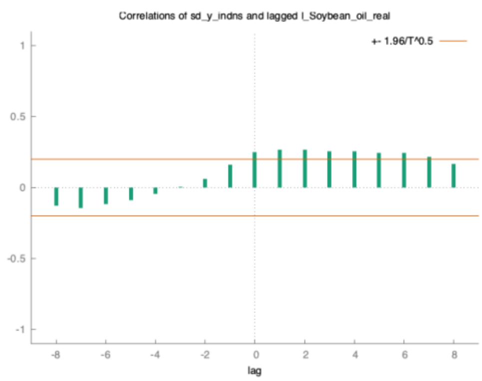
Groundnut Oil



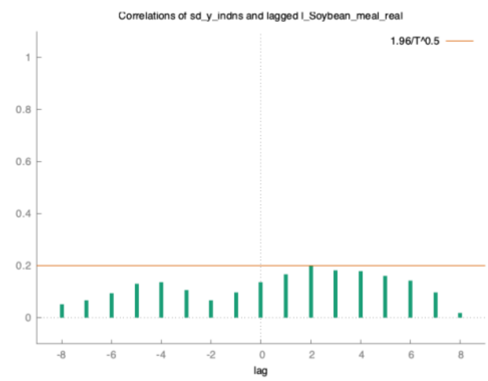
Soybeans



Soybean Oil



Soybean Meal



The lead–lag cross-correlation results follow a consistent convention throughout: because GDP is placed first in the cross-correlogram, a positive lag indicates that the commodity price leads Indonesia's GDP by that number of quarters, while a negative lag indicates that GDP leads the commodity price. In the pre-crisis period (1979:Q2–1996:Q4), all six commodities show a positive lag at which the peak correlation is reached, ranging from lag 5 for coconut oil to lag 8 for palm oil, soybeans, soybean oil, and soybean meal. Under the convention used here, positive lags mean that commodity prices lead Indonesia's GDP: a global commodity price movement is followed by a response in Indonesia's GDP several quarters later. However, the peak correlations in this period are all negative, ranging from −0.29 for palm oil to −0.43 for soybeans. This negative sign requires careful interpretation. It means that the strongest detectable relationship between commodity prices and Indonesia's GDP in the pre-crisis era is a countercyclical one: when global oils and meals prices rise, Indonesia's growth cycle tends to weaken 5 to 8 quarters later, and vice versa. This is consistent with Indonesia's economic structure during this period, when it was still a net importer or minor participant in several of these commodity markets and its domestic economy was highly exposed to import cost pressures. Rising global agricultural prices at that time would have squeezed household purchasing power, raised production costs, and potentially worsened the trade balance, creating a drag on the growth cycle with a lagged effect of roughly 6 to 8 quarters. Importantly, the contemporaneous correlations in this period are all acyclical, meaning the countercyclical lead relationship only emerges with a significant delay. The growth cycle chronology in Table 1.2 identifies Indonesia's pre-crisis downturns at 1982Q1 and 1997Q4, neither of which corresponds closely to a turning point in the oils and meals price series in Table 3.1, an absence of chronological overlap that is consistent with the cross-correlation finding of a weak and largely acyclical pre-crisis relationship. This suggests the pre-crisis co-movement pattern was indirect and slow-moving rather than immediate, which is consistent with the relatively undeveloped financial system and limited commodity market integration of that era.

The post-crisis period (2000:Q1–2023:Q3) produces the most analytically important results and marks a fundamental change from the pre-crisis pattern. All six commodities show positive lags with positive peak correlations, meaning that global oils and meals prices lead Indonesia's GDP growth cycle, and the relationship is now procyclical rather than countercyclical. Palm oil and coconut oil lead by four quarters (one year), with peak correlations of 0.31 and 0.27 respectively, both in the modest procyclical range. Soybeans, soybean oil, and soybean meal each lead by two quarters (six months), with correlations of 0.28, 0.27, and 0.20. Groundnut oil leads by six quarters (one and a half years) with a correlation of 0.21. This means that when global oils and meals prices rise, Indonesia's GDP tends to strengthen 2 to 6 quarters later, depending on the commodity. The shift from countercyclical to procyclical, and from the commodity prices being a negative leading signal to a positive one, is consistent with the structural transformation of Indonesia's commodity position over the 2000s.

For the export commodities, particularly palm oil, rising global prices are associated with higher export revenues, expanded fiscal space through the BPDPKS levy, higher incomes for the millions of smallholder farmers and estate workers in the sector, and increased rural consumption, all of which consistent with the domestic growth cycle over the following year. The Cycle 8 palm oil boom (2018:Q4–2022:Q2, Table 3.1) overlaps closely with the expansion phase preceding Indonesia's 2019:Q3 growth cycle peak in Table 1.2, a timing pattern consistent with the four-quarter lead identified in the cross-correlation. The four-quarter transmission horizon for palm oil is consistent with the time needed for export revenue gains to work through government budgets, firm investment decisions, and household income channels.

While for the soybean complex, where Indonesia is a net importer, the two-quarter lead is faster and reflects a different mechanism: rising soybean prices are associated with higher import costs for the feed and food manufacturing sectors relatively quickly, which feeds into inflation, compresses household real incomes, and eventually weighs on domestic demand. The two-quarter lag suggests this cost-push channel operates faster than the export-revenue channel. This shorter co-movement horizon is also legible in the dated chronologies. The 2008:Q3 growth cycle peak for Indonesia (Table 1.2) occurs within two quarters of the soybean and soybean oil price peaks in Table 3.1, 2008:Q2 for both, a timing pattern consistent with the interpretation that import cost pressures from the 2007–2008 commodity supercycle reached Indonesian domestic activity relatively rapidly. The two-quarter lead identified in the cross-correlation therefore maps onto a specific dated episode in both chronologies simultaneously, though whether this reflects a cost-push mechanism or a common global demand shock affecting both series cannot be determined from the present analysis alone.

Among the remaining commodities, soybean meal offers the most visible chronological parallel, though its correlation of 0.20 warrants caution in interpretation. The Cycle 7 soybean meal boom (2016Q1–2021Q1, Table 3.1) precedes Indonesia's 2019Q3 growth cycle peak in Table 1.2 by approximately two quarters at its end, a timing pattern compatible with the two-quarter lead identified in the cross-correlation. Given the marginal nature of the correlation, however, this overlap is noted as suggestive rather than as evidence of a robust co-movement pattern.

The post-crisis finding that commodity prices consistently lead Indonesia's growth cycle is entirely consistent with the theoretical framework set out in Section 3.1. This is also consistent with the characterisation of Indonesia as a commodity-cycle driven economy in the post-Asian Financial Crisis era. Where global price signals in the oils and meals complex may serve as a leading indicator of domestic economic conditions, with a transmission horizon of roughly two to six quarters depending on the commodity.

Chapter 5 - Conclusion

This thesis has provided a systematic characterisation of Indonesia's business cycle between 1979 and 2023, situating it within both its regional context and its structural dependence on commodity exports. Three connected questions were addressed in turn: how Indonesia's business cycle behaviour compares with that of other Asian economies under alternative definitions of the cycle, how its cycle co-moves with those of its regional neighbours, and how global commodity price in the oils and meals complex co-move with its domestic growth cycle. Bringing the three strands together allows a number of broader conclusions to be drawn.

Summary of Findings

The comparison of classical and growth-cycle chronologies in Chapter 1 demonstrated that the choice of business cycle definition is far from neutral for a fast-growing emerging economy. Under the classical definition, the Bry-Boschan Quarterly algorithm identified only two complete cycles for Indonesia over the entire sample, corresponding to the 1997–1998 Asian Financial Crisis and the 2020 COVID-19 contraction, leaving decades of continuous expansion in which no turning points were detected. The growth-cycle framework, based on deviations from a Hodrick–Prescott trend, identified six cycles and captured several episodes of below-trend slowdown that never involved an absolute decline in output. Because Indonesia's strong trend growth tends to mask cyclical weakness in the level of activity, the growth-cycle approach offers a more informative basis for analysing its fluctuations, and it was adopted for the remainder of the study.

Chapter 2 showed that Indonesia's growth cycle is broadly procyclical with those of its Asian neighbours, with the strongest co-movement found among its Southeast Asian partners, in particular Malaysia and Thailand, while China remained a notable exception with a weak and largely acyclical relationship. The cross-correlation evidence further revealed that this synchronisation is not static: regional co-movement was relatively limited before the 1997 crisis but tightened considerably afterwards, with many relationships shifting toward coincident timing. This strengthening of regional integration in the post-crisis era raised the question of whether the increased synchronisation reflects intra-regional trade alone or a shared exposure to common external shocks, which motivated the commodity price characterisation in Chapter 3 and the co-movement analysis in Chapter 4.

Chapter 3 and 4 provided the study's central finding. Chapter 3 dated and characterised the price cycles of the six oils and meals commodities. Building on this, Chapter 4 examined their co-movement with Indonesia's growth cycle and revealed a pronounced structural break around the Asian Financial Crisis. In the pre-crisis period the relationship was essentially one of disconnection: contemporaneous correlations were acyclical, and the only detectable lead–lag relationship was a weak countercyclical one operating with a long delay, consistent with an economy still relatively closed and exposed mainly through import costs. In the post-crisis period the relationship was transformed. Palm oil, soybean oil, and soybeans became modestly procyclical, and across all six commodities global prices came to lead Indonesia's growth cycle by roughly two to six quarters. The results are consistent with two distinct channels: for palm oil, the four-quarter lead is consistent with an export-revenue channel operating through fiscal receipts, the BPDPKS levy, and rural incomes; for the soybean complex, the shorter two-quarter lead is consistent with a faster cost-push channel acting through import prices and domestic food manufacturing costs. Coconut oil and groundnut oil, by contrast, remained acyclical in both sub-periods, consistent with their more limited direct linkage to Indonesia's macroeconomic transmission channels. Establishing these channels formally would require multivariate structural analysis beyond the scope of this study. Taken together, these results are consistent with the characterisation of Indonesia as an economy whose growth cycle is meaningfully sensitive to commodity price developments in the post-crisis era, and that its dual position as a dominant exporter of tropical vegetable oils and a significant importer of soybean products makes its exposure to the oils and meals complex unusually layered relative to its regional peers.

Contributions to Knowledge

This thesis makes contributions at three levels: methodological, empirical, and conceptual. Each addresses a gap in the existing literature on business cycles in emerging and commodity-dependent economies.

The methodological contribution lies in the systematic comparison of classical and growth-cycle frameworks applied to a fast-growing emerging economy over a long sample spanning four decades. While the distinction between the two approaches is well established in the theoretical literature, it has rarely been applied to an economy like Indonesia, where sustained trend growth routinely obscures cyclical dynamics in level-based chronologies. The demonstration that the growth-cycle framework substantially enriches the characterisation of Indonesian fluctuations, identifying episodes of macroeconomic stress that the classical approach would leave undetected, provides a practical template for researchers working on other high-growth developing economies in which the same masking problem is likely to arise.

The first empirical contribution is the analysis of regional synchronisation extends the literature on Asian business cycle integration by documenting not only the cross-sectional pattern of co-movement but also its evolution over time, showing that the 1997–1998 Asian Financial Crisis marked a structural shift toward tighter and more coincident regional linkages. Second, and more centrally, the commodity price analysis provides the first systematic evidence, to the author's knowledge, that global oils and meals price cycles lead Indonesia's growth cycle by a quantitatively meaningful margin in the post-crisis period, and that the leading relationship is consistent with two economically distinct channels with different co-movement lags.

The conceptual contribution is the characterisation of Indonesia as a dually exposed commodity economy, one whose macroeconomic cycle is shaped simultaneously by its dominant position as a palm oil exporter and by its structural dependence on soybean imports. This dual exposure, which generates procyclical revenue effects and cost-push pressures that partially offset one another, distinguishes Indonesia from commodity-dependent economies that face exposure through a single channel, and it suggests that standard frameworks for commodity-cycle transmission require modification to capture the Indonesian case adequately.

Policy Implications

The findings of this thesis carry several implications for macroeconomic policy and commodity governance in Indonesia, while also offering broader lessons for commodity-dependent emerging economies. For macroeconomic stabilisation, the evidence that global oils and meals prices lead Indonesia's growth cycle by two to six quarters implies that commodity price developments contain advance information about domestic economic conditions that is relevant to monetary and fiscal policy. Bank Indonesia could in principle incorporate commodity price indicators into its early-warning framework, treating sustained upswings or downswings in the oils and meals complex as leading signals of domestic demand and inflationary pressure rather than purely contemporaneous cost-push shocks. The four-quarter lag associated with the palm oil export-revenue channel is long enough that a policy response initiated when international prices turn could be calibrated to arrive when the domestic impulse is near its peak.

For fiscal management, the export-revenue channel identified in Chapter 4 highlights the procyclical risk embedded in Indonesia's current commodity revenue architecture. When palm oil prices rise, fiscal receipts from the export levy and the BPDPKS fund expand, stimulating government expenditure and rural incomes at a point when the economy may already be operating above trend. A more explicit commodity revenue stabilisation mechanism, that saves a larger share of surplus levy receipts during price booms and draws them down during troughs would reduce the amplification of global commodity cycles through the fiscal channel and support the broader objective of countercyclical macroeconomic management.

For commodity policy specifically, the domestic market obligation and the biodiesel mandate, both of which redistribute palm oil between export and domestic uses, interact directly with the transmission channels identified in this study. The results suggest that these instruments, while motivated by food security and energy diversification objectives, also have cyclical stabilisation properties that have not been formally evaluated. A fuller assessment of their macroeconomic effects, incorporating the feedback from international prices to domestic production incentives and rural incomes, would allow policymakers to calibrate them with a clearer understanding of their stabilisation and amplification implications.

More broadly, the finding that commodity price integration deepened sharply after the Asian Financial Crisis, a period that also saw major structural reforms, trade liberalisation, and exchange-rate flexibility suggests that the strength of commodity price movement is not fixed but responds to the institutional and policy environment. Economies considering similar reform trajectories should anticipate that greater openness is likely to strengthen the pass-through of global commodity cycles to domestic growth, making the design of stabilising fiscal and monetary frameworks more, not less, important.

Limitations and Directions for Future Research

Several limitations qualify these findings, each of which points to a concrete direction for future research.

First, the commodity analysis covers the sample period 1979–2023 and is confined to the oils and meals group, and therefore does not capture other commodities, such as coal, energy, and mineral products that are also significant to the Indonesian economy. Future research should extend the analysis to these sectors to provide a more complete picture of Indonesia's overall commodity exposure and to test whether the structural break identified around the Asian Financial Crisis holds across a broader commodity base.

Second, the empirical analysis is descriptive rather than structural: cross-correlation captures the strength and timing of association but cannot isolate causal transmission or control for confounding influences such as the global financial cycle, exchange-rate movements, or domestic monetary policy. Therefore, multivariate and structural approaches such as vector autoregressions or factor models are needed to establish the direction of causality and to disentangle the export-revenue and import-cost channels under more stringent identifying assumptions.

Third, the 1997–1998 break date used throughout this study is imposed on the basis of historical reasoning rather than formally tested. Future research could apply the Chow test for a fixed break date, or the Bai–Perron procedure to allow for unknown multiple structural breaks, to assess whether the pre- and post-crisis regimes identified here are statistically distinct and to determine whether additional structural shifts have occurred within the sample period.

Fourth, the use of aggregate real GDP does not allow the diffusion of cyclical movements across sectors to be observed directly. More disaggregated, sector-level data would therefore allow the transmission of commodity price shocks to be traced through the production and income accounts, giving a more granular account of the mechanisms identified in Chapter 4.

Finally, the policy instruments described in Chapter 3 as institutional background, the export levy, the domestic market obligation, and the biodiesel mandate were not modelled explicitly. Incorporating them into a formal structural model would clarify how far government intervention amplifies or dampens the transmission of global price shocks, and would allow their stabilisation and amplification properties to be evaluated jointly. Pursuing these extensions would deepen the understanding of how commodity price cycles shape macroeconomic fluctuations in Indonesia and in commodity-dependent emerging economies more broadly.

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