Chapter 4

International Commodity Import Price Index and Regional Economic Development: Panel Data Analysis for G7 Countries

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Abstract

The relationship between commodity prices and economic growth is being investigated with increasing interest in economic literature. Various international price indices related to this topic are calculated and published. With the rise of large volumes in global trade, the impact of commodity prices on national economies is also increasing. This study examines the relationship between commodity import prices and economic development for G7 countries. The analysis covers the period between 1962 and 2024. Cross-sectional dependence, homogeneity, unit root, and cointegration tests were used. The AMG approach was preferred as the estimation model. According to the results of the study, commodity import prices do not affect economic growth in the US, UK, and Canada, while they negatively affect it in Japan, Italy, Germany, and France. In addition, common commodity price shocks experienced on a global scale have a strong impact on the development dynamics of G7 economies.

1. Introduction

The relationship between commodity prices and economic growth has been extensively studied in economic literature, particularly since the 1980s. This interest stems particularly from the extreme sensitivity of commodity-dependent countries (CDCs), whose income largely comes from primary commodity exports to the volatility and uncertainty of these incomes. In contrast to the resource blessing hypothesis, which argues that natural resources

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act as a motor for economic development, many empirical studies have put forward the resource curse hypothesis, showing that resource-rich countries grow more slowly than resource-poor countries. The fundamental economic and political mechanisms behind the resource curse are listed as: the "Dutch Disease," which causes the manufacturing sector to lose competitiveness; uncertainty resulting from high volatility in commodity prices, declining levels of education (human capital) and institutional weaknesses such as rent seeking and corruption. Current empirical studies highlight that the impact of commodity price shocks on growth varies significantly depending on the time horizon, commodity type, and the quality of institutional development in countries. For example, in countries with weak corporate governance, it has been seen that booms in non-agricultural commodities, particularly energy and metals, have negative long-term effects on growth and overshadow initial short-term income gains. On the other hand, long-term historical perspectives from the 17th century to the present provide empirical evidence supporting the Prebisch-Singer hypothesis, which argues that primary commodity prices tend to fall in real terms compared to manufactured goods. Theoretical models argue that long-term economic growth rates are independent of permanent changes in commodity prices (super-neutrality), suggesting that price movements only affect growth through short-term transmission dynamics and aggregate factor productivity. Furthermore, China's rapid industrialization and urbanization since the beginning of the 21st century have deepened the financialization of commodity markets and taken the growth-price relationship to a new dimension. In the post-financialization era, the link between economic growth and commodity prices has been found to have at least tripled, making developing countries more vulnerable to global shocks. Finally, it was concluded that the impact of positive and negative shocks in commodity prices on growth is asymmetric, and that growth is primarily negatively affected by negative price shocks in the short term, while price increases have a positive effect on GDP in the long term.

This study examines the impact of international commodity import prices on economic development in different regions. For the G7 countries, analyses were conducted considering the specific characteristics of each country, yielding country-specific results which are then reported.

2. Literature Review

A review of past literature on the subject reveals that while some studies argue that increases in commodity prices and abundant natural resources support economic growth, others suggest that this effectuates a "natural resource curse" that negatively affects growth in the long term. More recent

studies emphasize that the effect depends on countries' institutional structure, level of economic diversification, and the direction of commodity price shocks. Studies arguing for the positive effects of natural resources and commodity prices on economic growth suggest that commodity revenues can stimulate growth through investment, government spending, and infrastructure financing. Sala-i-Martin, Doppelhofer, and Miller (2004), in their study analyzing the determinants of long-term growth, show that natural resources do not have a direct negative impact on growth. Similarly, Brunnschweiler and Bulte (2008) and Alexeev and Conrad (2009) prove that abundance of natural resources can be compatible with economic growth under proper macroeconomic policies and institutional structures. Raddatz (2007) found that commodity price shocks in low-income countries have a positive short-term effect on economic growth. Enilov M. (2024) showed that commodity prices generally have a strong ability to predict future economic growth, but this dependence has increased at least threefold with the financialization of commodity markets and developing countries have become more dependent on commodity prices than developed countries in this process.

In contrast, the literature supporting the natural resource curse hypothesis argues that increases in commodity prices slow economic growth in the long run. Sachs and Warner (2001) and Gylfason, Herbertsson, and Zoega (1999) prove that dependence on natural resources is associated with poor growth performance. The main economic channels of this negative relationship include the Dutch disease, high volatility in commodity prices, and a decline in human capital investment. According to Sachs and Warner (2001), increases in commodity prices lead to an appreciation of the real exchange rate, weakening the competitiveness of the manufacturing sector and limiting economic diversification. Gylfason (2001) argues that natural resource revenues reduce investments in education and human capital.

Volatility in commodity prices is also seen as a significant source of negative impacts on growth. Deaton (1999) states that fluctuations in commodity prices increase income uncertainty and lead to macroeconomic instability, particularly in African economies. Van der Ploeg and Poelhekke (2009) show that commodity price volatility negatively affects investment decisions and puts pressure on growth. Similarly, Venables (2016) emphasizes that the economic development process can be disrupted if natural resource revenues are not managed effectively.

Studies arguing that the impact of commodity prices on growth is decided by institutional structure also hold a significant place in literature. Mehlum, Moene, and Torvik (2006) show that in countries with strong institutions,

natural resource revenues support economic growth, while in countries with weak institutions, they negatively affect growth due to rent-seeking and inefficient public spending. Tornell and Lane (1999) argue that natural resource revenues suppress economic growth through the "voracity effect" by increasing the struggle for distribution among political elites. Collier and Goderis (2012) show that commodity price shocks can support growth in the short term, but this effect can reverse in the long term.

In recent years, literature has focused on the asymmetric effects of commodity price shocks. Dehn (2000) argued that negative commodity price shocks have lasting and strong negative effects on economic growth, while positive shocks have no significant long-term effect. Deaton and Miller (1995) also show that commodity price increases boost incomes in the short term, but this effect is not sustainable. Addison, Ghoshray, and Stamatogiannis (2016) found that the effects of agricultural commodity price shocks on growth in Sub-Saharan Africa were weak and asymmetric. Tahar et al. (2021) found that in commodity-dependent countries, commodity prices have an asymmetric effect on economic growth. In the long run, price increases boost GDP more strongly than price decreases, while in the short run, growth is only negatively affected by negative shocks.

A limited number of studies that examine the commodity-growth relationship from the opposite perspective argue that economic growth can affect commodity prices. Elekdag et al. (2008) and Cheung and Morin (2007) show that global economic growth and especially increased demand in emerging Asian economies are decisive factors in deciding oil and metal prices. Arbatli and Vasishtha (2012) and Roache (2012) prove that economic activity shocks in the US and China lead to significant fluctuations in global commodity prices. Ferraro and Peretto (2018) show that long-term economic growth is independent of changes in commodity prices (super-neutrality), and that prices only affect growth through short-term transmission dynamics.

In summary, the relationship between commodity prices and economic growth has not reached a clear consensus in literature. The direction and size of the effect vary depending on the type of commodity, the direction of price shocks, the institutional structure of the country, and the econometric method used. In this context, it is believed that studies examining the effects of commodity prices on economic growth using advanced and flexible methods will make significant contributions to literature and the policy-making process.

3. Methodology

This study examines the long-term relationship between economic growth and commodity import prices in G7 countries using annual panel data from 1962–2024. Economic growth is represented by the logarithm of real gross domestic product and commodity prices are represented by the logarithm of the Commodity Import Price Index (lncıpı). The Commodity Import Price Index data, calculated by the World Bank, was taken from the IMF database, while the economic growth data was taken from the World Bank database. Given the prominent level of economic and trade integration among G7 countries, cross-sectional dependence and country-specific dynamics have been given consideration in the analysis. First, cross-sectional dependence in the panel was examined using the CD, CDw, CDw+, and CD* tests developed by Pesaran (2015, 2021), Juodis and Reese (2021), Fan et al. (2015), and Pesaran and Xie (2021). After finding the presence of cross-sectional dependence, the stationarity properties of the variables were analyzed using the CİPS unit root test developed by Pesaran (2007). The CIPS test allows for the determination of the degree of integration of the series in the panel, taking cross-sectional dependence into account. The existence of a long-term relationship between variables was investigated using the Westerlund (2007) panel cointegration test, which allows for heterogeneity and cross-sectional dependence. Furthermore, the homogeneity of slope coefficients was assessed through tests developed by Pesaran and Yamagata (2008) and Blomquist and Westerlund (2013). Based on the findings, the AMG (Augmented Mean Group) estimator developed by Bond and Eberhardt (2009) and Eberhardt and Teal (2010), which considers cross-sectional dependence through common dynamic factors and allows the estimation of country specific long-term coefficients, was preferred. The AMG equation analyzed is as follows:

$$lngdp_{it} = a_i + \beta_i lncıpı_{it} + \gamma_i t + \lambda_i \hat{f}_t + \varepsilon_{it} \quad (1)$$

Where:

i denotes countries and t denotes time.

$lngdp_{it}$: represents the natural logarithm of real gross domestic product, serving as a proxy for economic growth in country i at time t.

$lncıpı_{it}$: denotes the natural logarithm of the Commodity Import Price Index, capturing international commodity price movements faced by country i.

a_i : is the country specific intercept, reflecting unobserved heterogeneity across countries.

β_i : represents the country specific long-run elasticity of economic growth with respect to commodity import prices.

t : is a deterministic time trend accounting for long-term structural changes.

$\hat{f}_t$: denotes the unobserved common dynamic factor obtained from the first stage AMG estimation, capturing cross-sectional dependence arising from global shocks.

λ_i : is the factor loading associated with the common dynamic process, allowing the impact of global shocks to vary across countries.

ε_{it} : is the idiosyncratic error term.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
lngdp	441	28.409	.8464642	26.44785	30.74757
lncıpı	441	27.02174	.3909442	26.25491	27.83419

Source: Author' calculations.

Table 1 presents descriptive statistics for the panel dataset covering the period 1962–2024 for G7 countries. There are 441 observations for both variables. The logarithm of real GDP (lngdp) has a mean of 28.41, and a standard deviation of 0.85 shows relatively limited variability between countries and time. The meaning of the lncipi variable is 27.02, and its standard deviation is 0.39; this suggests that commodity import prices have followed a more stable trend over the long term. The difference between the minimum and maximum values of both variables reveals that there are no extreme observations in the panel and that the data exhibits a suitable distribution for long-term analyses.

4. Results

In panel data analysis, finding cross-sectional dependence is crucial as a starting point. Deciding cross-sectional dependence is then a decisive factor in selecting later tests.

Table 2. Testing for Weak Cross-Sectional Dependence

Variables	CD	CDw	CDw+	CD*
lngdp	35.53	15.43	178.23	-104.40
	(0.000)	(0.000)	(0.000)	(0.000)
lncıpı	36.14	15.48	181.10	4.27
	(0.000)	(0.000)	(0.000)	(0.000)

Note: CD, CDw, CDw+, and CD* refer to the cross-sectional dependence tests proposed by Pesaran (2015, 2021), Juodis and Reese (2021), Fan et al. (2015), and Pesaran and Xie (2021), respectively. Source: Author' calculations.

The cross-sectional dependence test results in the table show that the null hypothesis of cross-sectional independence for the variables lngdp and lncıpı is statistically strongly rejected under all tests (CD, CDw, CDw+, and CD*) ($p<0.01$). This finding reveals that economic growth and commodity import prices among G7 countries are interdependent due to common global shocks and cross-country spillover effects. Therefore, second-generation unit root tests that take cross-sectional dependence into account should be used in the analyses. The Pesaran (2007) CİPS test was used to determine the stationarity of the series.

Table 3. Pesaran Panel Unit Root Test

		Level			
Variables	Model	CV %10	CV %5	CV %1	CİPS
lngdp	constant	-2.21	-2.33	-2.54	-1.687
	cons+trend	-2.72	-2.83	-3.04	-2.580
lncıpı	constant	-2.21	-2.33	-2.54	-2.053
	cons+trend	-2.72	-2.83	-3.04	-2.358
		First Difference			
lngdp	constant	-2.21	-2.33	-2.54	-5.550***
	cons+trend	-2.72	-2.83	-3.04	-5.794***
lncıpı	constant	-2.21	-2.33	-2.54	-6.190***
	cons+trend	-2.72	-2.83	-3.04	-6.420***

Note: *** indicates stationarity at the 1% significance level. **Source:** ***Author' calculations.***

Pesaran (2007) CİPS test shows that the variables are stationary in the first difference I (1) for constant and constant+trend models. Subsequently

Pesaran and Yamagata (2008) and Blomquist Westerlund (2013) tests were applied to decide the homogeneity of the slope coefficients in the panel.

Table 4. Testing for Slope Heterogeneity

Pesaran and Yamagata (2008)	Test Statistic	p-value
$\tilde{\Delta}$	[-0.729]	0.466
$\tilde{\Delta}_{adj.}$	[-0.747]	0.455
Blomquist and Westerlund (2013)		
$\tilde{\Delta}$	[-0.501]	0.616
$\tilde{\Delta}_{adj.}$	[-0.514]	0.607

Source: Author' calculations.

The table results show that the null hypothesis that the slope coefficients are homogeneous cannot be rejected in terms of both homogeneity tests. The p-values of the test statistics for the Pesaran and Yamagata (2008) test are 0.466 and 0.455, respectively, and are statistically insignificant. Similarly, the p-values corresponding to the test statistics obtained in the Blomquist and Westerlund (2013) test are 0.616 and 0.607. These findings show that the slope coefficients do not differ significantly among the countries including the panel and that the relationship between the variables shows a statistically homogeneous structure. After this stage, the existence of a cointegration relationship between the variables was analyzed using the ECM (Error Connection Test) panel cointegration test developed by Westerlund (2007).

Table 5. Cointegration tests

Statistic	Value	Z-value	P-value
Gt	-2.638	-2.533	0.006
Ga	-3.763	1.642	0.950
Pt	-6.987	-3.176	0.001
Pa	-3.518	0.424	0.664

Source: Author' calculations.

The Gt statistics based on the group mean ($p = 0.006$) and the Pt statistic based on the panel mean ($p = 0.001$) are statistically significant and show the presence of cointegration. In contrast, the Ga ($p = 0.950$) and Pa ($p = 0.664$) statistics are insignificant and do not support the cointegration hypothesis. In the Westerlund (2007) approach, the significance of the Gt and Pt tests indicates that a long-term equilibrium relationship exists in at least some

cross-sectional units. Consequently, evidence of cointegration was found for at least some cross-sectional units. Therefore, it is necessary to obtain and interpret separate results for each country. Due to cross-sectional dependence, the AMG (Augmented Mean Group) estimator developed by Bond and Eberhardt (2009) and Eberhardt and Teal (2010) were preferred for deciding the long-term relationship between variables on a country-specific basis.

Table 6. Augmented Mean Group Results

Dependent Variable (lngdp)	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]
			United States		
lncıpı	-.0350388	.0272351	-1.29	0.198	-.0884187 .0183411
CDF[1]	1.141175	.0274678	41.55	0.000	1.087339 1.195011
constant	29.72203	.7124728	41.72	0.000	28.32561 31.11845
			United Kingdom		
lncıpı	.0029086	.0330029	0.09	0.930	-.0617759 .0675932
CDF	.8851554	.024064	36.78	0.000	.8379909 .9323199
constant	27.2433	.8796353	30.97	0.000	25.51925 28.96735
			Canada		
lncıpı	.0269986	.0153161	1.76	0.078	-.0030203 .0570176
CDF	1.070216	.0122913	87.07	0.000	1.046125 1.094306
constant	25.68831	.4060747	63.26	0.000	24.89242 26.4842
			Japan		
lncıpı	-.2542343	.0414933	-6.13	0.000	-.3355596 -.172909
CDF	1.238811	.0357752	34.63	0.000	1.168693 1.308929
constant	34.27396	1.095802	31.28	0.000	32.12623 36.42169
			Italy		
lncıpı	-.1698839	.0324507	-5.24	0.000	-.2334862 -.1062817
CDF	.8661099	.0239133	36.22	0.000	.8192406 .9129791

1 CDF: Common Dynamic Factor refers to the AMG augmentation term capturing unobserved common shocks.

constant	31.67625	.8630331	36.70	0.000	29.98473 33.36776
		Germany			
lncıpı	-.0682722	.009544	-7.15	0.000	-.0869782 -.0495662
CDF	.857503	.0079882	107.35	0.000	.8418464 .8731596
constant	29.42656	.2523563	116.61	0.000	28.93195 29.92117
		France			
lncıpı	-.0328056	.0078846	-4.16	0.000	-.0482591 -.017352
CDF	.9556687	.0067388	141.82	0.000	.9424609 .9688765
constant	27.98663	.2083594	134.32	0.000	27.57825 28.395

Source: Author' calculations.

The AMG results presented in Table 6 show that the long-term impact of commodity import prices on economic growth in G7 countries differs among countries. The lncıpı coefficients are statistically insignificant for the US, UK, and Canada. This shows that commodity import prices do not play a decisive role in regional economic development in the long term in these countries. In contrast, the lncıpı coefficients are negative and statistically significant for Japan, Italy, Germany, and France, showing that increases in commodity import prices suppress long-term economic development in these countries. The Common Dynamic Factor (CDF) coefficient is positive and highly significant across all countries, proving that common global shocks have a strong and shared impact on the development dynamics of G7 economies. These findings reveal that the effects of commodity price shocks on growth differ depending on country-specific economic structure and external trade dependency.

5. Conclusion

This study examines the long-term impact of commodity import prices on economic growth in G7 countries during the period 1962–2024 using the Augmented Mean Group (AMG) method, which considers cross-sectional dependence and inter-country heterogeneity. The findings reveal that the effects of commodity import prices on economic growth differ significantly among countries. According to AMG's forecast results, commodity import prices have a negative and statistically significant impact on economic growth

for Japan, Italy, Germany, and France. This show increases in commodity import costs in these countries, in the long- run, increase production costs and limit growth performance. In contrast, the lncıpı coefficients are statistically insignificant for the US, the UK, and Canada. Therefore, it is accepted that commodity import prices do not play a decisive role in long-term growth in these countries. Japan is a heavily reliant economy on imports for energy and raw materials, and increases in commodity import prices raise production costs, negatively affecting growth. In Italy, the high demand for intermediate goods and energy inputs in industrial production means that import commodity price shocks put pressure on economic activity. Germany has a production structure heavily reliant on commodity and energy inputs, particularly in sectors such as automotive, machinery, and chemicals. Therefore, increases in commodity import prices raise production costs, negatively affecting industrial production and so economic growth. Similarly, in France, the production structure's reliance on industrial and energy inputs means that increases in imported commodity prices put pressure on growth through the cost channel. Furthermore, since both countries are dominated by export-oriented growth models, increasing input costs weaken international competitiveness and limit growth performance.

The fact that the Common Dynamics Factor (CDF) is positive and significant for all countries shows that common shocks in global commodity markets and international economic conditions have a significant impact on the growth dynamics of G7 countries. In this context, the findings suggest that policy responses to increases in commodity import prices should be designed on a country-by-country basis, considering the economic structures and levels of external dependence of each country. Especially in countries more dependent on commodities, diversifying supply, increasing domestic intermediate input production, and strengthening protective mechanisms against commodity price volatility appear critical for long-term growth.

Future studies could broaden the scope of research countries, for example, including G20 or developing countries, to examine how the long-term effects of commodity import prices on economic growth vary at distinct levels of economic development. Furthermore, sector-specific analyses, such as those for industry, agriculture, and services, could reveal the impact of commodity price shocks on different sectors of the economy. While the impact of short-term fluctuations and transient shocks can be assessed using models such as VAR or VECM, the inclusion of other macroeconomic variables, such as exchange rates or trade volumes, could provide a more comprehensive understanding of the impact of commodity prices on growth.

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