

**14TH INTERNATIONAL "BAŞKENT"
CONGRESS ON SOCIAL, HUMANITIES,
ADMINISTRATIVE, AND EDUCATIONAL
SCIENCES PROCEEDINGS BOOK**

DECEMBER 12-14, 2024

ISBN: 978-9952-8541-2-1
DOI: <https://doi.org/10.30546/19023.978-9952-8541-2-1.2024.2041>

EDITORS
ASSOC. PROF. DR. ELİF ÖZLEM ÖZÇATAL
ASSOC. PROF. DR. AYTEKİN ZEYNALOVA

CAUSAL DYNAMICS BETWEEN EXPORT DIVERSIFICATION AND ECONOMIC GROWTH IN TURKIYE

Muhammed Benli¹, Abakar Hassane Mahamat^{2*}

¹ Assoc. Prof., Faculty of Economics and Administrative Sciences, Bilecik Seyh Edebali University,

ORCID ID: <https://orcid.org/0000-0001-6486-8739>

^{2*} Graduate Student, Institute of Graduate Studies, Bilecik Seyh Edebali University,

ORCID ID: <https://orcid.org/0009-0005-2864-809X>

ABSTRACT

This study investigates the causal relationships between export diversification and economic growth in Turkiye over the period 1995-2023, using Directed Acyclic Graphs (DAGs) to identify direct and indirect effects among key economic variables. The analysis incorporates export diversification (measured by the Herfindahl-Hirschman Index - HHI), GDP per capita as a proxy for economic growth, inflation, exchange rate, trade, and foreign direct investment (FDI) inflows. The findings reveal a significant interplay between export diversification and economic growth: GDP per capita directly influences export diversification and trade, while export diversification, in turn, impacts inflation and trade dynamics. Moreover, inflation is found to affect the exchange rate, and FDI plays a critical role in shaping export diversification patterns. These results highlight the complex feedback loops between export diversification and economic growth, emphasizing the importance of diversification as a policy lever to enhance trade resilience and sustainable economic development in Turkey. The study contributes to the literature by providing empirical evidence on the interdependence of export diversification and growth in a developing country context, offering practical insights for policymakers.

Keywords: Export Diversification, HHI, DAGs

INTRODUCTION

In the past century, globalization has become one of the most defining processes shaping the global economy. Rapid advancements in technology, reductions in transportation and communication costs, and the proliferation of international trade agreements have intensified economic interactions between countries (Barrow et al., 2003). As a result of globalization, nations are compelled to compete not only in domestic markets but also in global ones. This has elevated the significance of international trade in economic growth and development processes. For developing countries, globalization offers opportunities to accelerate growth while simultaneously exposing them to vulnerabilities stemming

from fluctuations in global markets. Therefore, the structure of international trade, particularly export strategies, holds critical importance for developing economies.

International trade is a fundamental mechanism that supports a country's economic growth. Increasing exports contributes to economic growth through various channels. Export revenues can be used to improve trade balances and strengthen foreign exchange reserves, while exports also enhance production efficiency. Export-oriented firms must innovate, improve quality standards, and reduce costs to remain competitive in global markets. This dynamic boosts total factor productivity, thereby fostering economic growth. Additionally, the knowledge and technology transfer gained through exports enables countries to enhance their production capacities (Awokuse, 2006; Benli, 2018). However, the impact of international trade and exports on economic growth is not solely determined by volume; the structure and diversity of exports also play a critical role in this process (Benli, 2020; Altun and Benli, 2021).

Export diversification refers to the degree of variety in a country's export portfolio, either in terms of products or markets. Export diversification not only has the potential to stimulate economic growth but also serves as a safeguard against external trade shocks. A country reliant on a single product or sector is highly vulnerable to global price fluctuations or demand declines in that sector (Altun and Benli, 2021). For instance, countries dependent on natural resource exports may experience severe economic crises during sudden commodity price drops. In contrast, countries with diversified export portfolios spread across various products and markets are more resilient to global market fluctuations. In this context, export diversification is considered a mechanism for ensuring the sustainability of economic growth.

Export diversification can also influence growth by fostering technological advancement and innovation. The capacity to produce a wider range of products not only raises a country's technological level but also lays the foundation for the emergence of new sectors (Herzer and Nowak-Lehmann, 2006; Aditya and Acharyya, 2013). For example, transitioning from low-technology goods to high value-added products can enhance a country's competitiveness in global trade and support long-term economic growth.

On the other hand, economic growth also plays a significant role in shaping export diversification. Higher per capita income can diversify both production and consumption patterns. Countries achieving higher income levels tend to develop a broader range of production capabilities (Eum and Lee, 2022). Additionally, economic growth facilitates export diversification by improving infrastructure, increasing capital accumulation, and enhancing workforce skills (Agosin et al., 2012; Elhiraika and Mbate, 2014). This dynamic suggests a bidirectional causality between growth and export diversification. For developing countries, export diversification can be both a tool and an outcome of the economic growth process.

In recent decades, Türkiye has implemented policies aimed at increasing the role of international trade in driving economic growth while making efforts to diversify its export composition (Muratoğlu, 2020; Altay, 2024). Nevertheless, Türkiye's economy remains reliant on a few key sectors and has not yet fully overcome its vulnerability to fluctuations in global markets (Özgüzer, 2020). This study seeks to comprehensively examine the relationship between export diversification and economic growth in Türkiye, with the aim of gaining a deeper understanding of these dynamics.

Using time series data for the period 1995-2023, this study analyzes the causal relationships between export diversification, GDP per capita, inflation, exchange rates, trade volume, and foreign direct investment (FDI) using the Directed Acyclic Graphs (DAGs) methodology. In this context, the study investigates the impact of export diversification on growth and how growth, in turn, shapes export diversification, offering valuable insights for policymakers. The findings will provide a crucial foundation for developing strategies to enhance the contribution of export diversification to economic growth.

DATA AND METHODOLOGY

This study utilizes Turkish time series data for the period 1988–2021 to ascertain inductive causal inference patterns among export diversification and economic growth with respect to other macroeconomic factors. The selection of variables is guided by indicators commonly used in the relevant literature. To reduce skewness in their distributions, all variables were converted into their natural logarithmic forms (Soremekun and Malgwi, 2012). Table 1 provides the definitions and data sources for the variables included in the analysis, while Table 2 summarizes their descriptive statistics.

Table 1. Summary of the Variables

Target Variable	Proxy Variable	Symbol	Definition	Source
Export Diversification	HHI	<i>HHI</i>	Herfindahl-Hirschmann Index (Product HHI), also named concentration index is a measure of the degree of product concentration.	UNCTADSTAT
Economic Growth	GDP per capita	<i>GDPpc</i>	GDP per capita (constant 2015 US\$).	The World Bank (WB) – World Development Indicators (WDI)
Trade	Trade openness	<i>TRADE</i>	Trade is the sum of exports and imports of goods and services measured as a share of GDP.	The WB - WDI
Inflation	Natural logarithm of Consumer Price Index (CPI)	<i>INF</i>	CPI measures changes in the cost incurred by the average consumer to purchase a set basket of goods and services, which may remain constant or be adjusted periodically, such as on an annual basis. Typically, the Laspeyres formula is applied, and the data represent period averages.	The WB - WDI
Foreign Direct Investment	Foreign Direct Investment Net Inflows (% of GDP)	<i>FDI</i>	FDI refers to the net inflows of investments aimed at acquiring a lasting management interest (10% or more of voting shares) in a business operating in a country different from that of the investor. It includes the total of equity capital, reinvested earnings, long-term capital, and short-term capital as recorded in the balance of payments. This measure represents net inflows (new investment inflows minus disinvestment) from foreign investors into the economy and is expressed as a percentage of GDP.	The WB - WDI
Exchange Rate	Official Exchange Rate Against US Dollar	<i>EXCHANGE</i>	Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar).	The WB - WDI

Table 2. Descriptive Statistics

Variables	No. of obs.	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
<i>HHI</i>	29	0.490	0.077	0.373	0.632	0.475	1.954
<i>GDPpc</i>	29	9107.699	2721.145	5702.378	14630.37	0.472	1.976
<i>TRADE</i>	29	52.506	9.418	37.665	81.170	1.219	4.514
<i>FDI</i>	29	1.345	0.841	0.305	3.623	0.905	3.648
<i>INF(CPI)</i>	29	141.184	175.799	1.304	834.593	2.591	10.094
<i>EXCHANGE</i>	29	3.423	5.160	0.046	23.739	2.799	10.537
<i>lnHHI</i>	29	-0.725	0.155	-0.986	-0.459	0.305	1.857
<i>lnGDPpc</i>	29	9.075	0.295	8.649	9.591	0.171	1.695
<i>lnTRADE</i>	29	3.947	0.168	3.629	4.397	0.723	3.550
<i>lnFDI</i>	29	0.084	0.702	-1.186	1.287	-0.371	2.077
<i>lnCPI</i>	29	4.194	1.526	0.265	6.727	-0.971	3.560
<i>lnEXCHANGE</i>	29	0.434	1.406	-3.082	3.167	-0.556	3.574

Note: Authors' Calculations

DIRECTED ACYCLIC GRAPHS (DAGs)

This study employs DAGs to investigate the causal relationships between export diversification and economic growth in Türkiye. DAGs are a statistical and graphical tool used to represent and analyze complex causal structures among variables. Unlike traditional econometric models that often rely solely on correlation or regression analysis, DAGs explicitly identify causal relationships by using both data-driven and theoretical insights. This methodology provides a more subtle understanding of the interdependencies between variables, particularly in dynamic systems such as trade and economic growth.

A DAG is a graphical representation of causal relationships where nodes represent variables (e.g., export diversification, GDP per capita, inflation), edges (arrows) indicate directed causal relationships between variables, and acyclicity ensures that the graph does not contain feedback loops, meaning there are no circular causal pathways.

DAGs are built on the principles of causal inference, wherein the structure of the graph encapsulates causal assumptions about the relationships among variables. This structure allows for distinguishing between direct and indirect effects, as well as identifying potential confounders and mediators in the causal pathways (Pearl, 2011; Law et al., 2012; Elwert, 2013; Lipsky and Greenland, 2022).

Various methodologies, including the Partial Correlation (PC), Greedy Equivalence Search (GES), and Fast Causal Inference (FCI) algorithms, are outlined in the machine learning literature for identifying DAGs (Soremekun and Malgwi, 2012). In this study, we employ the PC method, as it is the most widely used algorithm in the field (Benli, 2018).

The PC algorithm, introduced by Spirtes et al. (2001), is a widely used method particularly for analyzing causal relationships in complex systems with multiple interdependent variables. The process begins with the assumption that all pairs of variables are connected, forming a fully connected undirected graph. In the context of socioeconomic data, this assumes that any economic or demographic variable could potentially influence every other variable. The algorithm then systematically tests each

pair of variables for conditional independence, considering various combinations of other variables. Conditional independence suggests that two variables are not directly causally related if the relationship can be fully explained by other variables. When conditional independence is identified, the algorithm removes the edge between those variables. This iterative process refines the graph by eliminating non-causal connections, leaving only the significant links that reflect plausible causal pathways. Finally, the algorithm orients the remaining edges to establish directed links, specifying the direction of causality between variables.

Monte Carlo simulations suggest that the PC algorithm may incorrectly determine edge directions or include/exclude edges, especially when working with sample sizes under 100 observations (Spirtes et al., 2001; Demiralp and Hoover, 2003; Zhang et al., 2006; Benli, 2018). To address this, Spirtes et al. (2001) recommend using higher significance levels for smaller samples (e.g., 0.2 for fewer than 100 observations) and lower significance levels for larger samples (e.g., 0.1 for sample sizes between 100 and 300). Given our dataset of 29 time series observations (1995–2023), we adopt a 30% significance level, which provides a clear directed structure for most variables in this analysis (Benli, 2018).

FINDINGS

The graph created by the PC algorithm is given in Figure 1.

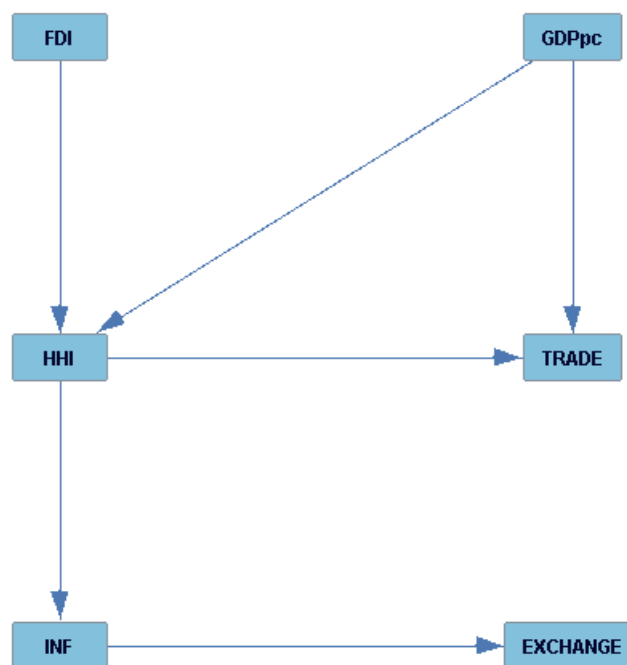


Figure 1. Directed Graph

The findings highlight intricate and interconnected relationships, emphasizing the importance of adopting a carefully tailored policy approach. One of the findings is that GDP per capita, as a proxy for economic growth, significantly affects both export diversification and trade volume. Furthermore, export diversification is found to causally influence inflation and trade, indicating its dual role as a determinant of macroeconomic variables and trade dynamics. Inflation is found to causally influence the exchange rate, indicating its role as a driver in this dynamic, while FDI is identified as a causal factor affecting export diversification, suggesting an external influence on the composition of exports.

The causal pathway from GDP per capita to export diversification implies that economic growth, as measured by per capita income, affects the structure of exports. This could reflect how higher income levels enable a shift toward more complex, diversified production processes. The causal direction shows that economic growth influences diversification, rather than diversification being an inherent precursor to growth.

The direction of causality from FDI to export diversification indicates that external capital inflows have a role in shaping the structure of Türkiye's export portfolio. FDI may enable changes in the composition of exports, either by introducing new sectors or by altering the balance among existing sectors. This causal link suggests that external investments are instrumental in driving diversification efforts.

The direction of causality from export diversification to inflation suggests that changes in the structure of exports can have implications for domestic price levels. This relationship might reflect how diversification affects economic stability, production efficiency, or exposure to external price shocks, thereby influencing inflationary trends.

The causal link from export diversification to trade indicates that shifts in the variety and balance of exported products affect Türkiye's trade dynamics. This causality might be tied to how diversification alters market access, competitiveness, or resilience to global demand changes.

The causal relationship from GDP per capita to trade highlights that the overall economic performance affects the scale or patterns of trade. This suggests that economic growth may be a driver of how much and what Türkiye trades with the rest of the world, influencing trade volumes or structures.

The causality running from inflation to the exchange rate suggests that the dynamics of price levels in the domestic economy influence currency valuation. This could imply that inflationary pressures contribute to changes in the exchange rate, potentially through mechanisms like purchasing power parity adjustments or shifts in investor confidence. The directionality underscores inflation as a driver of exchange rate movements rather than the reverse.

These results collectively provide a causal map of interdependence among key economic variables. GDP per capita is a central causal variable, influencing both export diversification and trade, suggesting its foundational role in shaping economic structures. Moreover, export diversification not only affects inflation and trade but is also shaped by external factors like FDI and GDP per capita, highlighting its position as both a driver and a receiver in the economic system. Finally, inflation's causal influence on the exchange rate underscores the role of domestic stability in external economic variables, while FDI's influence on diversification points to external investments as transformative for economic structures.

CONCLUSION

This study investigates the causal relationships between export diversification and key economic variables in Türkiye from 1995 to 2023, using DAGs to map the directionality of these interactions. The analysis reveals several critical pathways. GDP per capita causally influences export diversification and trade, underscoring the central role of economic growth in shaping trade dynamics. Export diversification emerges as both a driver and a recipient within the economic system, affecting inflation and trade while being influenced by FDI and GDP per capita. Furthermore, inflation is shown to causally affect the exchange rate, highlighting the importance of price stability in macroeconomic management.

These findings provide a deeper understanding of the interdependencies between export diversification and broader economic variables, with important implications for policy design. Export diversification plays a dual role: it not only impacts trade and inflation but is also shaped by external capital inflows

and domestic economic growth. This highlights its strategic importance for fostering sustainable economic development and resilience to external shocks. The results point to several actionable policy recommendations to leverage these dynamics effectively.

Given its central role in influencing inflation and trade, export diversification should be prioritized in Turkey's economic development strategy. Policymakers should focus on encouraging sectoral diversification by supporting industries beyond traditional export sectors, such as agriculture and textiles, and fostering growth in higher value-added areas such as technology, pharmaceuticals, and renewable energy. Strengthening innovation and research and development (R&D) programs is essential to enhance productivity and competitiveness in emerging sectors, while targeted incentives, including tax benefits and subsidies, can further promote diversification within export-oriented industries. These measures will not only diversify Turkey's export portfolio but also bolster economic resilience and sustainable growth.

Since FDI causally influences export diversification, attracting quality foreign investments is crucial for Turkey's economic development. This requires improving the business climate by addressing regulatory inefficiencies, reducing bureaucratic hurdles, and ensuring policy consistency to create a more investor-friendly environment. Efforts should also focus on directing FDI toward strategic industries that have the potential to diversify the export portfolio and facilitate technology transfer. Additionally, fostering stronger linkages between foreign investors and domestic firms can encourage knowledge spillovers and enhance the integration of local companies into global value chains, further boosting Turkey's export competitiveness and economic resilience.

The causal relationship from inflation to the exchange rate underscores the critical need for macroeconomic stability in Turkey. Policymakers should focus on implementing credible monetary policies to control inflation, reduce volatility, and stabilize currency fluctuations, while simultaneously strengthening fiscal discipline to create a stable macroeconomic environment that supports trade and investment. Additionally, tools to mitigate the impact of external shocks, such as building robust foreign exchange reserves and reducing external debt exposure, are essential for enhancing economic resilience and ensuring long-term stability.

As GDP per capita drives both export diversification and trade, policies fostering inclusive and sustainable economic growth will generate cascading benefits across trade and macroeconomic dynamics. Investing in infrastructure, particularly in transport and logistics, is essential to reduce trade costs and improve access to global markets. Expanding access to credit for small and medium enterprises (SMEs) will enable them to scale up production and integrate into international trade networks. Additionally, enhancing workforce skills through education and training programs aligned with the needs of export-oriented industries will strengthen the foundations of economic growth and bolster Turkey's export competitiveness.

Export diversification can mitigate the risks associated with external shocks by reducing dependency on a narrow range of products or markets. Policymakers should focus on expanding trade agreements to diversify export markets, thereby reducing reliance on a limited set of trading partners. Building resilience in supply chains is equally crucial, which can be achieved by fostering partnerships with multiple suppliers and investing in domestic production capabilities for critical inputs. Additionally, monitoring and managing sectoral dependencies, particularly in industries highly exposed to global price volatility, such as energy and raw materials, will further enhance economic stability and sustainability.

While this study identifies the directionality of causal relationships, future research should focus on quantifying the magnitude and nature of these effects. Complementary econometric analyses can provide insights into the strength and sign of the causal links, enabling more precise policy targeting.

Additionally, incorporating institutional factors, regional disparities, and sectoral data can enrich the understanding of how export diversification interacts with broader economic variables.

REFERENCES

- Aditya, A., & Acharyya, R. (2013). Export diversification, composition, and economic growth: Evidence from cross-country analysis. *The Journal of International Trade & Economic Development*, 22(7), 959-992.
- Agosin, M. R., Alvarez, R., & Bravo-Ortega, C. (2012). Determinants of export diversification around the world: 1962–2000. *The World Economy*, 35(3), 295-315.
- Altay, S. (2024). Trade Policy Review of Türkiye. *The World Economy*, 47:3861–3892.
- Altun, M., & Benli, M. (2021). İhracatta ürün çeşitliliği ve Türkiye'nin büyüme performansı. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, (67), 138-158.
- Awokuse, T. O. (2006). Export-led growth and the Japanese economy: evidence from VAR and directed acyclic graphs. *Applied Economics*, 38(5), 593-602.
- Barrow, C. W., Didou-Aupetit, S., & Mallea, J. (2003). Globalisation, Trade Liberalisation, and the Knowledge Economy. In *Globalisation, Trade Liberalisation and Higher Education in North America: The Emergence of a New Market under NAFTA?* (pp. 1-21). Dordrecht: Springer Netherlands.
- Benli, M. (2018). Causal structure of export-productivity nexus in Türkiye. *Journal of Management and Economics Research*, 16(1), 194-203.
- Benli, M. (2020). Export diversification and economic growth: Evidence from emerging economies. *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, (55), 285-298.
- Demiralp, S., & Hoover, K. D. (2003). Searching for the causal structure of a vector autoregression. *Oxford Bulletin of Economics and statistics*, 65, 745-767.
- Elhiraika, A. B., & Mbate, M. M. (2014). Assessing the determinants of export diversification in Africa. *Applied Econometrics and International Development*, 14(1), 147-160.
- Elwert, F. (2013). Graphical causal models. In *Handbook of causal analysis for social research* (pp. 245-273). Dordrecht: Springer Netherlands.
- Eum, W., & Lee, J. D. (2022). Alternative paths of diversification for developing countries. *Review of Development Economics*, 26(4), 2336-2355.
- Herzer, D., & Nowak-Lehmann D, F. (2004). *Export diversification, externalities and growth* (No. 99). IAI Discussion Papers.
- Law, G. R., Green, R., & Ellison, G. T. (2012). Confounding and causal path diagrams. In *Modern methods for epidemiology* (pp. 1-13). Dordrecht: Springer Netherlands.
- Lipsky, A. M., & Greenland, S. (2022). Causal directed acyclic graphs. *JAMA*, 327(11), 1083-1084.
- Muratoğlu, G. D. (2020). Structural Shifts and Patterns in Türkiye's Foreign Trade. In *Comparative Approaches to Old and New Institutional Economics* (pp. 258-281). IGI Global.
- Özgüzer, G. E. (2020). Türkiye'nin İhracatının Yapısı ve Teşvik Politikaları. *International Journal of Public Finance*, 5(1), 127-143.
- Pearl, J. (2011). Aspects of graphical models connected with causality. UCLA Department of Statistics Papers.
- Soremekun, O., & Malgwi, C. A. (2012). Exploring the relationship between foreign direct investment and mobile technology in Africa: An application of directed acyclic graphs. *Case Studies In Business, Industry And Government Statistics*, 5(1), 58-66.
- Spirtes, P., Glymour, C., & Scheines, R. (2001). *Causation, prediction, and search*. MIT Press.
- Zhang, J., Bessler, D. A., & Leatham, D. J. (2006). Does consumer debt cause economic recession? Evidence using directed acyclic graphs. *Applied Economics Letters*, 13(7), 401-407.