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THE RELATIONSHIP BETWEEN OPENNESS AND INFLATION IN TÜRKİYE'S MANUFACTURING INDUSTRY: A PANEL DATA ANALYSIS

Abstract

This study examines the effect of trade openness on inflation at the sub-sector level of Türkiye's manufacturing industry over the period 2003–2023 using panel data methods. The analysis includes 16 sub-sectors for which complete data are available, and the Domestic Producer Price Index (D-PPI) is used as the indicator of inflation. Trade openness is measured through six different indicators based on the ratios of exports, imports, and total foreign trade to production value and value added. In the study, second-generation econometric methods that account for cross-sectional dependence and heterogeneity are employed, and long-run coefficient estimators are applied. The findings reveal a strong cointegration relationship between the variables and indicate that trade openness generally has a reducing effect on inflation. The indicators representing the ratio of exports and total foreign trade to value added show a more pronounced effect. However, the results also indicate that the relationship is not homogeneous across sectors and that the effects vary depending on sectoral characteristics. Overall, the findings support the Romer hypothesis at the sectoral level and suggest that trade openness can serve as an important policy tool in combating inflation.

Keywords: Türkiye, Manufacturing Industry, Panel Data, Romer Hypothesis, Inflation, Trade Openness.

TÜRKİYE İMALAT SANAYİSİNDE DIŞA AÇIKLIK VE ENFLASYON İLİŞKİSİ: PANEL VERİ ANALİZİ

Öz

Bu çalışma, Türkiye imalat sanayinin alt sektörleri düzeyinde ticari dışa açıklığın enflasyon üzerindeki etkisini 2003–2023 dönemi için panel veri yöntemleri kullanarak incelemektedir. Analizde, eksiksiz veriye ulaşılabilen 16 alt sektöre yer verilmiş ve enflasyon göstergesi olarak Yurt İçi Üretici Fiyat Endeksi (Yİ-ÜFE) kullanılmıştır. Ticari dışa açıklık; ihracat, ithalat ve toplam dış ticaretin üretim değeri ile katma değere oranlarına dayanan altı farklı gösterge aracılığıyla ölçülmüştür. Çalışmada, yatay kesit bağımlılığını ve heterojenliği dikkate alan ikinci nesil ekonometrik yöntemler kullanılmış ve uzun dönem katsayı tahmincilerinden yararlanılmıştır. Bulgular, değişkenler arasında güçlü bir eşbütünleşme ilişkisinin bulunduğunu ve ticari dışa açıklığın genel olarak enflasyonu azaltıcı bir etkiye sahip olduğunu ortaya koymaktadır. İhracatın ve toplam dış ticaretin katma değere oranını temsil eden göstergelerin daha belirgin bir etkiye sahip olduğu görülmektedir. Bununla birlikte, sonuçlar ilişkinin sektörler arasında homojen olmadığını ve etkilerin sektörel özelliklere bağlı olarak farklılaştığını göstermektedir. Genel olarak bulgular, sektörel düzeyde Romer hipotezini desteklemekte ve ticari dışa açıklığın enflasyonla mücadelede önemli bir politika aracı olarak kullanılabileceğine işaret etmektedir.

Anahtar kelimeler: Türkiye, İmalat Sanayi, Panel Veri, Romer Hipotezi, Enflasyon, Ticari Dışa Açıklık.

INTRODUCTION

With the acceleration of the globalization process, economic integration among countries has deepened, trade volumes have expanded, and the degree of trade openness has increased significantly. These developments have necessitated a reassessment of their effects on macroeconomic indicators. In particular, the relationship between inflation, one of the fundamental indicators of economic stability, and trade openness has long been among the important issues discussed in the economics literature. In this context, the Romer Hypothesis, which seeks to explain the effect of trade openness on inflation, suggests that increasing trade integration may play a role in reducing it. According to the hypothesis, policymakers in more open economies tend to act more disciplinarily, while international competitive pressures emerge as a factor constraining price increases.

Following the liberalization policies implemented after the 1980s, the Turkish economy became more integrated into the global economy and experienced substantial increases in trade volume. During this process, inflation dynamics also underwent significant transformations. Particularly since the 2000s, macroeconomic stabilization policies have contributed to a relative decline in inflation rates; however, global shocks and domestic dynamics have continued to influence inflation. In this framework, examining the relationship between trade openness and inflation in Türkiye is important both for policymakers and for the academic literature.

A review of the existing literature reveals that studies on Türkiye have largely been conducted at the macro level using aggregated data. However, there are significant differences across manufacturing sub-sectors in terms of production structures, cost components, dependence on foreign trade, and levels of competition. This suggests that the impact of trade openness on inflation may vary across sectors. Therefore, findings obtained from aggregated data may lead to misleading conclusions by overlooking heterogeneity across sectors. The main objective of this study is to analyze the impact of trade openness on inflation at the level of Turkish manufacturing sub-sectors. For this purpose, panel data analysis was conducted for 16 sub-sectors using annual data covering the period 2003–2023. Trade openness was measured using different indicators to provide a multidimensional analysis. Furthermore, considering the nature of panel data and potential issues such as cross-sectional dependence and heterogeneity, second-generation econometric methods were employed. In this respect, the study aims to contribute to the literature in two ways. First, by examining the effect of trade openness on inflation at the sectoral level, it reveals the heterogeneous structure that has largely been neglected in previous studies. Second, by employing advanced panel data techniques, the study seeks to provide more reliable and consistent findings. The results are expected to offer policy implications for the Turkish economy and contribute to testing the validity of the Romer Hypothesis at the sectoral level.

LITERATURE REVIEW

The pioneering empirical study examining the Romer hypothesis was conducted by David Romer in 1993. In that study, cross-sectional data covering 114 countries for the period 1973–1988 were utilized. Inflation was represented by changes in the Consumer Price Index (CPI) and the GDP deflator, while trade openness was measured by the share of imports in gross domestic product (GDP). Real income per capita and several dummy variables were also included as control variables. The estimated regression results were reported under four different model specifications, and in all specifications the coefficient of trade openness was found to be negative and statistically significant. These findings indicated that smaller and more open economies tend to experience relatively lower inflation rates.

A review of the related literature reveals a substantial number of studies supporting the Romer hypothesis. Lane (1997) revisited David Romer's analysis within the framework of a two-market small-country model consisting of tradable and non-tradable sectors. In this study, imperfect competition and nominal price rigidities, particularly in the non-tradable sector, were incorporated into the model. The findings based on panel data analysis indicated a negative relationship between trade openness and inflation for both the full sample of 114 countries and the OECD subsample. Bleaney (1999) investigated the openness–inflation relationship for more than 100 countries. Two periods, namely 1973–1988 and 1989–1998, were analyzed following Romer (1993) and Lane (1997). The relationship was examined using cross-sectional analysis, where the GDP deflator represented inflation and imports-to-GDP represented openness. The findings showed a negative relationship for 1973–1988; however, this relationship disappeared in the later period. Gruben and McLeod (2004) employed a dynamic panel data approach for the period 1971–2000. Five-year averages of inflation and import shares were used, while imports as a share of GDP represented trade openness. Their findings indicated that the negative openness–inflation correlation strengthened during the 1990s across all country groups. One of the early panel data studies examining the openness–inflation relationship was conducted by Sachsida et al. (2003), using data from 152 countries covering 1950–1992. Imports-to-GDP and the GDP deflator were used as proxies for openness and inflation, respectively. The findings confirmed a negative relationship and suggested that it was not confined to a particular group of countries or time period. Lin (2010) tested the openness–inflation relationship using panel data for 106 countries over the period 1970–2007. Annual data were employed, with inflation measured as GDP growth and openness represented by imports as a share of GDP. The results indicated that trade openness had a negative and statistically significant effect on inflation in countries experiencing high inflation. Another panel study by Özyıldız et al. (2018) examined 19 emerging market economies for the period 1992–2016. Inflation was measured by CPI, while trade openness was represented by the ratio of exports plus imports to GDP. The Westerlund (2007) cointegration approach was employed, and panel results showed that the coefficient of trade openness was negative and statistically significant, consistent with theoretical expectations. Binici et al. (2012) investigated manufacturing sectors across 12 OECD countries using annual data from 1970 to 2008. Trade openness was measured using import openness (imports/total output) and an import penetration index [imports/(total output + imports − exports)]. Static and dynamic panel data analyses were employed. The static panel results generally suggested that greater openness was associated with lower inflation, whereas dynamic panel estimates indicated that trade openness was not a significant determinant of inflation.

Contrary to Romer (1993), several studies have reported a positive relationship between trade openness and inflation. Alfaro (2005), following Romer (1993) and Lane (1997), focused on the post-Bretton Woods system period of 1973–1998. Using panel data analysis for 130 developed and developing countries, inflation was represented by the GDP deflator. Two measures of openness were employed: imports-to-GDP and exports-to-GDP ratios. The findings suggested a positive relationship between trade openness and inflation. Ashra (2002) conducted a panel study for 15 developing countries covering the period 1980–1997. Two openness measures were used: exports-to-GDP and imports-to-GDP ratios, while CPI represented inflation. The findings indicated that imports-to-GDP reduced inflationary pressures, whereas exports-to-GDP increased inflationary pressures. Benita (2013) examined the role of market competition and trade openness in determining inflation across 15 manufacturing industries in Mexico during 1990–2009. Trade openness was measured using sectoral import openness and an import penetration index. Empirical findings did not support the conventional view of a negative relationship between trade openness and inflation. Yiheyis (2013) investigated 31 African countries over the period 1980–2008 using panel data analysis. Inflation was represented by GDP deflator growth, while openness was measured using both trade volume-to-GDP and imports-to-GDP ratios. The regression results failed to provide evidence supporting the proposition that increasing openness reduces inflation. In a static framework, openness was found to have a positive effect on inflation. Sepehrivand and Azizi (2016) tested the Romer hypothesis for D-8 countries using panel data for the period 2001–2013. Trade openness was measured as the ratio of exports plus imports to GDP. Their findings showed that the coefficient of trade openness was positive and statistically significant. Mercan and Göçer (2014) examined the economic effects of trade openness for Central Asian countries, including Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. Annual data covering 1990–2010 were analyzed using the Pedroni panel cointegration approach. Trade openness was measured as the ratio of trade volume to GDP, while inflation was represented by the logarithmically transformed CPI. Cointegration results indicated that the variables were cointegrated and that the relationship between trade openness and inflation was positive.

DATA AND METHODOLOGY

The aim of this study is to examine the effect of trade openness on inflation in the Turkish economy at the level of manufacturing sub-sectors. In this context, the study seeks to answer, at the sectoral level, the question raised within the framework of the Romer Hypothesis: *"Does inflation decrease as trade openness increases?"*

The analysis includes 16 manufacturing sub-sectors in Türkiye for which complete data are available. Annual data covering the period 2003–2023 are utilized, and all variables are obtained from the databases of the Central Bank of the Republic of Türkiye and the Turkish Statistical Institute. Two main variables are employed in the study: inflation and trade openness. At the sectoral level, the Producer Price Index (PPI) series (2003=100 base year) is used as the indicator of inflation. Trade openness measures are defined as export-to-GDP, import-to-GDP, and (export + import)-to-GDP ratios. However, due to the unavailability of sector-level GDP data, value added at factor cost and production value series are used as proxies instead of GDP. Accordingly, six different indicators of trade openness are constructed. Based on these indicators, six alternative models are established, and the empirical analysis is conducted within this framework:

Model 1: ENF = f(DA1A)
Model 2: ENF = f(DA1B)
Model 3: ENF = f(DA2A)
Model 4: ENF = f(DA2B)
Model 5: ENF = f(DA3A)
Model 6: ENF = f(DA3B)

The abbreviations of the variables given above are presented in Table 1.

Table 1.

Description of Variables Used in the Study

Variables Used	**Description**
ENF	Lpt -Lpt-1
DA1A	Exports / Production Value
DA1B	Exports / Value Added at Factor Cost
DA2A	Imports / Production Value
DA2B	Imports / Value Added at Factor Cost
DA3A	(Exports + Imports) / Production Value
DA3B	(Exports + Imports) / Value Added at Factor Cost

In this study, panel data methods are employed to analyze the potential effects of trade openness on inflation. Panel data analysis is a powerful econometric approach that enables the simultaneous examination of cross-sectional differences and dynamic changes over time, owing to its data structure incorporating both time and cross-sectional dimensions. In panel data analysis, whether coefficients are homogeneous or heterogeneous, as well as the existence of cross-sectional dependence across units, plays a critical role in determining the appropriate testing and estimation methods. Therefore, in order to select suitable econometric techniques, cross-sectional dependence and slope heterogeneity must first be tested (Yerdelen Tatoğlu 2020). Another important issue in panel data analysis is the stationarity of the series, since the use of non-stationary variables may lead to the problem of spurious regression. In this context, second-generation unit root tests that account for cross-sectional dependence and heterogeneity are employed. Specifically, the Cross-sectionally Augmented Dickey–Fuller (CADF) test and the Cross-sectionally Augmented IPS (CIPS) test, an extended version of the Im, Pesaran, and Shin (IPS) test, are utilized.

Panel cointegration tests developed to investigate the existence of long-run relationships in panel datasets are generally classified as first- and second-generation tests depending on whether they account for cross-sectional dependence. In this study, the use of second-generation panel cointegration tests proposed by Westerlund (2007) and Gengenbach, Urbain, and Westerlund (2016) is preferred. The Westerlund (2007) approach is based on the error-correction mechanism and tests the null hypothesis of "no cointegration." The model used within this framework is presented below:

$$\Delta Y_{it} = \delta_i{}' d_t + \alpha_i Y_{it-1} + \lambda_i{}' X_{it-1} + \sum_{j=1}^{p_i} \varphi_{ij} \Delta Y_{it-j} + \sum_{j=0}^{p_i} \gamma_{ij} \Delta X_{it-j} + e_{it} \quad (1)$$

In Equation (1), d_t represents the deterministic components, $\delta_i = (\delta_{1i}, \delta_{2i})$ denotes the vector of coefficients, α_i and λ_i represent the long-run coefficients, while γ_i and φ_i denote the short-run coefficients (Westerlund 2007). In the Westerlund test, both panel-level and unit-specific statistics are calculated, allowing heterogeneity across cross-sectional units to be taken into account.

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The cointegration test developed by Gengenbach et al. (2016) is based on an error-correction approach that incorporates a common factor structure. The main advantage of this test is that it allows for both cross-sectional dependence and heterogeneity. During the testing process, unit-specific statistics are calculated, and panel-wide results are obtained by averaging these statistics. Once the existence of a cointegration relationship is established, appropriate methods should be selected for estimating long-run coefficients. In this study, the Common Correlated Effects (CCE) and Augmented Mean Group (AMG) estimators, both of which account for cross-sectional dependence and heterogeneity, are employed.

The CCE method developed by M. Hashem Pesaran (2006) incorporates cross-sectional averages of dependent and independent variables into the model in order to control for the effects of unobserved common factors. The main objective is to filter individual-specific explanatory variables through the use of cross-sectional averages and thereby asymptotically eliminate the differentiating effects of unobserved common factors as the cross-sectional dimension (N) approaches infinity (Pesaran 2006).

$$y_{it} = \alpha_i + \beta_i X_{it} + \delta_{0i} \bar{y}_t + \delta_{1i} \bar{X}_t + \varepsilon_{it} \quad (2)$$

Here, X denotes the explanatory variable, represents the time-varying individual fixed effect, and are the coefficients to be estimated, and is the error term with a zero mean and constant variance. The bars over the variables indicate cross-sectional averages and are estimated as proxy variables for unobserved common factors.

The AMG approach was developed by Eberhardt and Bond (2009) and Eberhardt and Teal (2010), and it accounts for both heterogeneity across units and common shocks by incorporating common dynamic processes into the model. Under this approach, a common dynamic process is added to the unit-specific regression in order to capture the effects of unobserved common factors that influence all cross-sectional units. This common dynamic process is obtained from the coefficients of time dummy variables estimated in first-difference form within a pooled regression framework. These coefficients represent the average level-equivalent evolution of unobserved common factors affecting all units in the panel (Eberhardt & Teal 2010).

$$\beta_{amg} = \frac{1}{N}\sum_{i=1}^{N} \beta_i \qquad (3)$$

β_i represents the long-run coefficient estimated for each cross-sectional unit in the panel dataset, whereas N denotes the total number of units included in the panel.

EMPIRICAL FINDINGS

Since complete data could be obtained for 16 two-digit subsectors of the Turkish manufacturing industry, the analysis covers these sectors. The subsectors included in the analysis are as follows: wood and cork products, basic metals industry, printing and publishing, other electrical machinery and apparatus n.e.c., other machinery and equipment n.e.c., leather and leather products, motor vehicles and trailers, other transport equipment, food and beverages, wearing apparel, paper and paper products, plastics and rubber, chemical substances and products, fabricated metal products, other non-metallic mineral products, and textiles.

In the study, first, cross-sectional dependence and homogeneity tests, which examine the basic assumptions of the panel structure, were conducted. Then, the stationarity properties of the series were analyzed using unit root tests. The stationarity of the variables was examined using the CADF and CIPS tests, and the existence of a cointegration relationship was determined through the Westerlund (2007) panel cointegration test and the Gengenbach, Urbain, and Westerlund (2016) cointegration test. Finally, after establishing the presence of cointegration, long-run coefficients were estimated using appropriate long-run estimators.

Table 2.

Cross-Sectional Dependence (CD) and Homogeneity Test Statistics

Panel 1: Cross-Sectional Dependence Test						
	DA1A	**DA1B**	**DA2A**	**DA2B**	**DA3A**	**DA3B**
LM	1091***	1061***	978.8***	1072***	1015***	1112***
LM adj.	152.7***	148.6***	135.3***	149.6***	141.3***	156.4***
LM CD	31.66***	31***	30.07***	31.58***	30.93***	32.39***
Panel 2: Homogeneity Test						
Delta	9.947***	7.757***	6.051***	4.901***	5.798***	3.922***

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The cross-sectional dependence test results presented in Panel 1 of Table 2 are statistically significant at the 1% level for all variables, according to the standard LM statistic, the bias-adjusted LM (Adj. LM), and the LM CD test proposed by Pesaran (2004). These findings indicate the presence of strong cross-sectional dependence among the sectors. The Delta statistics reported in Panel 2 of Table 2 for the homogeneity test are also statistically significant for all trade openness variables. This suggests that the coefficients in the model vary across sectors, indicating that the panel exhibits a heterogeneous structure. Accordingly, unit root tests that account for both cross-sectional dependence and heterogeneity were employed in the analysis.

Table 3.

Panel Unit Root Test Statistics

Variables	CADF		CIPS	
	Level	First Difference	Level	First Difference
ENF	-1.939	-2.697***	-4.163***	-5.500***
DA1A	-1.941	-3.710***	-2.082*	-4.738***
DA1B	-1.512	-3.661***	-1.830	-4.173***
DA2A	-2.004	-2.686***	-2.300**	-4.334***
DA2B	-2.081	-3.355***	-2.157**	-4.545***
DA3A	-2.063	-3.102***	-2.443***	-4.903***
DA3B	-2.203	-2.883**	-2.842***	-4.586***

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

For the series in which cross-sectional dependence and heterogeneity are detected, second-generation unit root tests should be applied. Accordingly, the stationarity properties of the relevant variables were analyzed using the second-generation panel unit root tests, namely the CADF and CIPS tests presented in Table 3. According to the CADF test results, the inflation series is stationary in its first difference, whereas the CIPS test indicates that the series is stationary at level. In addition, all trade openness measures are found to be stationary in their first differences based on the CADF test results. The CIPS test results, on the other hand, show that the DA2A and DA2B series are stationary at the level at the 5% significance level, while the DA3A and DA3B series are stationary at the level at the 1% significance level.

Table 4.

Westerlund Panel Cointegration Test

Models	Independent Variables	Gt	Ga	Pt	Pa
1	DA1A	-2.493	-16.233**	-11.074	-11.199
2	DA1B	-2.022	-12.302	-9.327	-9.303
3	DA2A	-3.018*	-14.580	-11.567	-11.377
4	DA2B	-2.817	-16.205	-10.492	-10.997
5	DA3A	-2.333	-11.768	-11.045	-10.737
6	DA3B	-2.469	-12.627	-10.973	-11.523

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

According to the Westerlund panel cointegration test results presented in Table 4, a cointegration relationship between trade openness and inflation is detected only in Model 1 and Model 3. However, since the test statistics do not exhibit full consistency, the extended panel cointegration test developed by Gengenbach, Urbain, and Westerlund (2016) is also employed in the study to enhance the robustness and reliability of the results.

Table 5.

Gengenbach, Urbain, and Westerlund Panel Cointegration Test

Models	Independent Variables	Error Correction Coefficient	T-bar
1	DA1A	-1.226^{***}	-3.898
2	DA1B	-1.098^{***}	-3.371
3	DA2A	-1.192^{***}	-4.476
4	DA2B	-1.172^{***}	-4.072
5	DA3A	-1.122^{***}	-3.839
6	DA3B	-1.064^{***}	-3.444

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5 presents the results of the Gengenbach, Urbain, and Westerlund (GUW) panel cointegration test. According to the results, the estimated error correction coefficients (ECT) for each model are negative and statistically significant at the 1% level. This indicates that short-run deviations adjust back toward the long-run equilibrium and provides evidence of a strong cointegration relationship between inflation and trade openness.

The estimated T-bar statistics are also negative, supporting the statistical significance of the coefficients. These findings reveal the existence of a long-run equilibrium relationship between trade openness and inflation within the panel data framework. Following the identification of cointegration, the Common Correlated Effects (CCE) and Augmented Mean Group (AMG) estimators are employed to obtain reliable long-run coefficient estimates.

Table 6.

CCE Findings

Sector Name	DA1A	DA1B	DA2A	DA2B	DA3A	DA3B
Total	**-0.106**	**-0.103^{**}**	**-0.220**	**-0.068**	**-0.032**	**-0.032^{**}**
Wood and Cork	-0.934	-0.273^{***}	0.453	-0.029	0.056	-0.134^{**}
Basic Metals	-0.498	-0.086^{*}	-0.193	-0.110^{***}	-0.390	-0.073^{***}
Printing and Publishing	3.172	-0.772	0.328	-0.007	0.397	-0.022
Other Electrical Machinery and Apparatus n.e.c.	-0.805	-0.155	0.151	0.174	0.124	0.002
Other Machinery and Equipment n.e.c.	-0.024	0.021	0.045	0.006	0.039	0.000
Leather and Leather Products	-0.149	-0.062^{*}	0.211	0.034	-0.137	-0.015
Other Transport Equipment	-0.184^{**}	-0.051^{**}	0.018	-0.016	-0.058	-0.037^{***}
Food and Beverages	-0.713	-0.168^{*}	-1.482	-0.342	-0.975^{**}	-0.123^{*}
Wearing Apparel	-0.904	-0.072	0.853	0.149	0.070	-0.131
Paper and Paper Products	-0.821^{*}	-0.150^{*}	0.056	-0.014	-0.279	-0.066^{*}
Plastics and Rubber	0.224	0.054	-0.177	0.051	0.041	0.042
Chemical Substances and Products	-0.026	-0.028	0.110	0.006	0.075	0.006
Fabricated Metal Products	-0.225	0.048	0.783	0.150	0.377	0.074
Other Non-Metallic Mineral Products	0.610	0.000	-5.458	-1.325^{**}	-0.271	-0.083
Motor Vehicles and Trailers	0.289	0.030	0.377	0.018	0.247	0.009
Textiles	-0.762	0.016	0.385	0.167	0.166	0.035

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

According to Table 6, which reports the CCE results, only the long-run coefficients of DA1B and DA3B are statistically significant at the 5% level in the aggregate analysis (excluding subsectors). A one-unit increase in DA1B reduces inflation by 0.103 units. Similarly, a one-unit change in DA3B leads to a 0.032 unit decrease in inflation. These results indicate that particularly the ratios of exports and total trade to value added exert a statistically significant and negative effect on inflation.

At the subsector level, Table 6 shows that the long-run coefficients of the DA1A series are statistically significant only in the Other Transport Equipment and Paper and Paper Products sectors. In the Other Transport Equipment sector, a one-unit increase in DA1A reduces inflation by approximately 0.184 units. For the DA1B series, the most notable result is observed in the Wood and Cork Products sector, where DA1B is found to be statistically significant at the 1% level with a coefficient of -0.273, indicating a strong disinflationary effect. In addition, DA1B coefficients are negative and significant at the 10% level in the Basic Metals, Leather and Leather Products, Food and Beverages, and Paper and Paper Products sectors. The DA2A series coefficients are not statistically significant in any sector. For DA2B, long-run coefficients are negative and significant in the Basic Metals and Other Non-Metallic Mineral Products sectors; in these sectors, a one-unit increase in trade openness reduces inflation by 0.110 and 1.325 units, respectively. Regarding the DA3A series, a significant coefficient is found only in the Food and Beverages sector, indicating a disinflationary effect of trade openness in this sector. Finally, for DA3B, the long-run coefficients are negative and statistically significant in the Wood and Cork Products, Basic Metals, Other Transport Equipment, Food and Beverages, and Paper and Paper Products sectors. These findings suggest that trade openness has heterogeneous effects across sectors, with a clearly stronger inflation-reducing impact in certain industries.

Table 7.

AMG Findings

Sector Name	DA1A	DA1B	DA2A	DA2B	DA3A	DA3B
Total	**-0.410*****	**-0.138****	**-0.366**	**-0.141***	**-0.050**	**-0.056*****
Wood and Cork	-0.573	-0.258***	-0.010	-0.072	-0.045	-0.134**
Basic Metals	-0.536	-0.083***	-0.234	-0.112***	-0.418	-0.069***
Printing and Publishing	-1.068	-1.031**	0.114	-0.119	0.129	-0.155*
Other Electrical Machinery and Apparatus n.e.c.	-0.176	0.118	0.436	0.156	0.169	0.083
Other Machinery and Equipment n.e.c.	-0.035	-0.053**	-0.034	-0.020**	-0.034	-0.021**
Leather and Leather Products	-0.375*	-0.074**	0.218	0.012	-0.056	-0.021
Other Transport Equipment	-0.186**	-0.051**	-0.089*	-0.037**	-0.122***	-0.041***
Food and Beverages	-1.075*	-0.202**	-1.374	-0.345	-0.593	-0.106
Wearing Apparel	-1.102**	-0.087	0.804	0.100	-0.241	-0.068
Paper and Paper Products	-0.453	-0.103	-0.058	-0.039	-0.103	-0.045*
Plastics and Rubber	-0.004	-0.039	-0.580*	-0.168***	0.128	-0.059**
Chemical Substances and Products	-0.110	-0.064	0.089	-0.010	0.063	-0.012*

Fabricated Metal Products	-0.260	-0.101	-0.362	-0.172**	-0.173	-0.096*
Other Non-Metallic Mineral Products	-0.321	-0.124	-5.273*	-1.339**	-0.248	-0.088
Motor Vehicles and Trailers	0.085	-0.009	-0.127	-0.071	0.123	-0.029
Textiles	-0.375	-0.046	0.618	-0.019	0.615	-0.029

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

To support the CCE findings, the AMG estimator is also employed in the study. The estimated AMG results are presented in Table 7. When the analysis is conducted without disaggregating into subsectors, it is found that the long-run coefficients of the DA1A, DA1B, DA2B, and DA3B models are statistically significant.

At the subsector level, the findings show that for the DA1A series, long-run coefficients are negative and statistically significant in the Leather and Leather Products, Other Transport Equipment, Food and Beverages, and Wearing Apparel sectors. Regarding the DA1B series, the results indicate that long-run coefficients are negative and statistically significant at least at the 5% level in the Wood and Cork Products, Basic Metals, Printing and Publishing, Other Machinery and Equipment n.e.c., Leather and Leather Products, Other Transport Equipment, and Food and Beverages sectors. In this context, a one-unit increase in DA1B leads to a 0.258 unit decrease in inflation in the Wood and Cork Products sector. Additionally, DA1B reduces inflation by 0.083 units in Basic Metals, 0.074 units in Leather and Leather Products, 0.051 units in Other Transport Equipment, and 0.202 units in Food and Beverages. For the DA2A series, the results indicate that long-run coefficients are negative and statistically significant at the 10% level in the Other Transport Equipment, Plastics and Rubber, and Other Non-Metallic Mineral Products sectors. In the DA2B model, the Basic Metals and Plastics and Rubber sectors are significant at the 1% level, while Other Machinery and Equipment n.e.c., Other Transport Equipment, Fabricated Metal Products, and Other Non-Metallic Mineral Products are significant at the 5% level, all with negative long-run coefficients. In the model where DA3A is the explanatory variable, only the Other Transport Equipment sector shows a statistically significant long-run coefficient. Accordingly, a one-unit increase in DA3A reduces inflation by 0.122 units. Finally, in the DA3B models, long-run coefficients are found to be negative and statistically significant in the Wood and Cork Products, Basic Metals, Printing and Publishing, Other Machinery and Equipment n.e.c., Other Transport Equipment, Paper and Paper Products, Plastics and Rubber, Chemical Substances and Products, and Fabricated Metal Products sectors.

When the results of the CCE and AMG estimations are evaluated together, it is observed that both methods produce similar sets of statistically significant long-run coefficients. Another striking finding is that all statistically significant coefficients in both CCE and AMG estimations carry a negative sign. This indicates that trade openness is an important factor that reduces inflation, with heterogeneous effects across sectors. Overall, the combined CCE and AMG results suggest that trade openness has a negative effect on inflation in the manufacturing sector. However, this relationship becomes stronger and more statistically significant under the AMG estimator. This difference stems from the fact that the AMG method explicitly accounts for time-varying common shocks such as exchange rate fluctuations, energy price changes, and crisis periods. Therefore, the long-run effect of trade openness on inflation appears more pronounced in the AMG results. In addition, the fact that some coefficients that are statistically insignificant under the CCE model become significant and negative under AMG suggests that, in the long run, trade openness operates more through competition and productivity channels rather than cost-push mechanisms in certain sectors.

CONCLUSION

The negative effect of trade openness on inflation is known in the literature as the Romer hypothesis. In his seminal study, Romer (1993) shows that in more open economies, policymakers tend to face greater constraints in implementing expansionary monetary policies, which results in lower inflation rates. In this framework, trade openness acts as a disciplining mechanism on monetary authorities, helping to contain inflationary pressures. This finding has received extensive attention in the literature and has been tested in numerous empirical studies using different country groups and datasets.

In this study, the impact of trade openness on inflation is analyzed at the subsector level of the Turkish manufacturing industry over the period 2003–2023 using panel data methods. Trade openness is considered through three main indicators: exports/GDP, imports/GDP, and (exports + imports)/GDP. However, due to the unavailability of sector-level GDP data, these ratios are redefined using factor-cost value added and output series, resulting in six different model specifications. In addition, second-generation econometric methods that account for cross-sectional dependence and heterogeneity are employed to better capture the structure of the panel data. The results support both the suitability of the methodology and provide important empirical insights. The findings indicate strong cross-sectional dependence and heterogeneity in the panel data, suggesting that sectors are affected by common macroeconomic shocks and that coefficients vary across industries. Unit root tests show that the variables are integrated at different orders, while cointegration tests confirm the existence of a long-run relationship between the variables. In particular, the results of the Gengenbach, Urbain, and Westerlund (2016) test indicate a strong and statistically significant cointegration relationship between inflation and trade openness across all models.

Long-run coefficient estimates show a high degree of consistency between CCE and AMG estimators. The most important finding is that all statistically significant coefficients are negative. This indicates that trade openness reduces inflation in the Turkish manufacturing industry as a whole, thereby supporting the Romer hypothesis. The effect is particularly strong and significant for indicators representing export intensity and total trade intensity relative to value added (DA1B and DA3B).

However, the results also reveal that the impact of trade openness on inflation is not homogeneous across sectors. In some industries, the disinflationary effect of trade openness is strong and statistically significant, while in others it is weak or statistically insignificant. These differences stem from structural characteristics of sectors. In particular, sectors with high import dependency tend to experience faster transmission of exchange rate fluctuations into prices, which limits the disinflationary effect of openness. In contrast, in sectors with lower import dependence and higher competition, trade openness enhances price discipline and reduces inflation. Similarly, market structure, concentration levels, and the domestic value-added content of exports also play important roles in explaining these differences. In more technology-intensive and internationally competitive sectors, trade openness reduces inflation through productivity gains, economies of scale, and lower production costs. In contrast, in more protected or low value-added sectors, this effect tends to be weaker. Demand structure and price elasticity also influence firms' ability to pass cost increases onto prices, further amplifying sectoral heterogeneity.

From a policy perspective, these findings suggest that trade openness can serve as an important tool for controlling inflation. However, its effectiveness varies across sectors and should therefore be considered within a sector-specific policy framework. In particular, while policies aimed at reducing cost pressures may be more relevant for high import-dependent sectors, increasing trade openness in competitive and high value-added sectors may contribute more effectively to inflation control.

In conclusion, this study shows that the relationship between trade openness and inflation in the Turkish manufacturing industry is heterogeneous across subsectors but generally negative. These findings confirm the validity of the Romer hypothesis at the sectoral level while also highlighting the importance of sector-specific structural differences in shaping this relationship.

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