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The impact of foreign direct investment on environmental quality: A bounds testing and causality analysis for Turkey

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ABSTRACT

This study aims to investigate the impact of foreign direct investment (FDI), together with gross domestic product (GDP), the square of GDP, and energy consumption, on carbon dioxide (CO₂) emissions in Turkey over the period 1974–2010. We employ both the bounds test approach which has superior properties especially in small samples and the Hatemi-J test which takes structural breaks into consideration in the co-integration analysis. Due to the co-integration relationship between CO₂ emissions and other variables, the autoregressive distributed lag (ARDL) model is used in order to investigate short and long run elasticity between the variables. The long-run coefficients of the ARDL model indicate that the effect of FDI on CO₂ emissions is positive but relatively small, while the effects of the GDP and energy consumption on CO₂ emissions are quite considerable. Moreover, the short-run coefficients obtained by the error correction model (ECM) are found to be similar to those of the long-run model. The findings support the validity of the environmental Kuznets curve (EKC) hypothesis in both time-horizons. The vector ECM based Granger causality test is also applied to investigate the causal link. The causality test results indicate the existence of a causality running from all explanatory variables to CO₂ emissions in the long run. Overall, the findings suggest that Turkey should promote energy efficiency with sustainable growth, and encourage more FDI inflows particularly in technology-intensive and environment-friendly industries to improve environmental quality.

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1. Introduction

Foreign direct investment (FDI) flows have considerably increased all around the world, especially over the last two decades. FDI inflows are widely expected to promote host countries' economic growth by

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increasing capital accumulation and productivity, which explains, not unexpectedly, why many developing countries are eager to attract more FDI [1,2]. However, despite its potential contributions to economic growth, the increase in the FDI inflows leads to a debate on its potential effects on the environmental quality [3].

The studies that analyze the determinants of environmental quality mainly focus on the income variable either with or without energy consumption [4–8]. This group of literature generally tests the validity of the environmental Kuznets curve (EKC) hypothesis. The EKC hypothesis argues an inverted-U Shaped EKC relationship between environmental pollution and per capita income, meaning that initially the rise in per capita income increases environmental pollution up to a turning point and then starts to decrease it beyond that point [9,10]. However, this inverted-U Shaped EKC relationship between environmental pollution and income does not hold for every case [10,11].

Recently, FDI inflows have also been considered as an additional determinant of environmental quality because of their potential effects on pollution [3,12–15]. Indeed, the relationship between FDI inflows and environmental degradation is uncertain [12]. In this regard, there are two opposite arguments regarding the nexus between FDI and the environment. The first one, Pollution Haven Hypothesis (PHH), asserts that different environmental regulations among countries influence the location decisions of the firms or industries [16]. In this argument, multinational companies, especially in pollution-intensive industries, tend to migrate from developed economies to developing ones where the environmental standards are less stringent [15–17]. On the other hand, Pollution Halo Hypothesis focuses on environmental performance of foreign firms relative to domestic counterparts, rather than industry location [16]. This argument suggests that FDI inflows by multinational companies are likely to improve environmental standards in a developing host country, by bringing cleaner technologies and better environmental management systems [16–18]. Despite the aforementioned theoretical arguments, the empirical works intended to test these two hypotheses have not yet provided conclusive results [12,14].

Turkey, as a relatively open growing economy, represents an ideal case to investigate the impact of the FDI on environmental quality for several reasons. First and foremost, between the years 1990 and 2010, Turkey had the greatest rate of increase in emissions of greenhouse gases (GHGs), primarily consisting of CO₂ emissions, among 42 countries listed in the Annex I of the Kyoto Protocol [19]. The amount of total GHGs emissions in Turkey reached to 402 million tons in 2010, which was 187 million tons in 1990, the amounts of CO₂, on the other hand, reached to 327 million tons and 141 million tons in the same time period [20]. As a European Union membership candidate and a party of the Kyoto Protocol, Turkey has to continue fulfilling its obligations related to the mitigation of GHGs emissions. Secondly, there has been a rapid increase in FDI inflows in Turkey over the last two decades. Turkey was the 15th most attractive FDI destination according to the World Investment Prospects Survey [21]. The reforms in the financial sector after economic crisis in 2001 in Turkey have increased foreign investors' confidence in Turkey. Accordingly, net cumulative FDI inflows between the years 2001 and 2012 reached to \$127 billion in total, while it had remained considerably low till 2000. Thirdly, the level of income as well as CO₂ emissions and FDI inflows has also substantially increased in Turkey over the last several decades. In this regard, GDP per capita increased approximately from \$1,000 in 1974 to \$11,000 in 2012. Turkish economy grew on average by 4.26% per annum in terms of real GDP over the period 1974–2012. It is worth highlighting that Turkey has the highest growth rate among European countries and one of the highest in the world in 2010 and 2011 with growth rates of 9.2% and 8.5% respectively [22,23]. Fourthly, in parallel with the

increase in income, Turkey has been one of the fastest growing energy market around the world in recent years, based on the World Bank data. The important point here is that the energy sector is considered to be the main sector in the GHGs inventory of Turkey. Based on the 5-yearly data provided by [20], approximately 71% of total GHGs emissions and 89% of CO₂ emissions were produced by the energy sector between the years 1990 and 2010. Therefore, it is of utmost importance to pay special attention to the political agenda regarding environmental quality and its determinants in Turkey.

There is a great deal of research on the determinants of CO₂ emissions, which generally focuses either on energy consumption or output, or both, as the explanatory variables. However, to the best of our knowledge, there are limited numbers of studies investigating the impacts of income, energy consumption, and FDI on environmental pollution within the same framework. Besides, the existing literature exploring this issue provides controversial results [3,14,24,25]. The primary goal of this study is to investigate the impact of FDI, together with income, the square of income, and energy consumption, on CO₂ emissions in Turkey over the period 1974–2010. Therefore, the expected contribution of this study to the existing literature is twofold. First, the study integrates a relatively new variable (FDI) into the EKC model, which may enable us to reduce the omitted variables bias possibly existing in the basic EKC model specification. Secondly, the study explores the long-run and causal impacts of FDI on environmental quality as well as the causal impacts of income and energy consumption, which may help policy-makers in designing environmental policies. To this end, we conduct a relatively new time-series methodology, the autoregressive distributed lag (ARDL) bounds testing approach, developed by Peseran et al. [26]. The bound test approach typically outperforms the alternatives when the sample size is small [27], and also provides unbiased estimations even if some of the regressors in the model are endogenous [28]. We also conduct Hatemi-J [29] co-integration test with two structural breaks in order to take into consideration the effects of the structural breaks on the existence of a long-run co-integration relationship between the variables as a robustness check. Finally, we employ Granger causality analysis based on vector error correction model (VECM) to examine the causal links between the variables.

The remainder of the paper is organized as follows. Section 2 presents a brief review of the relevant empirical literature. Section 3 describes the model and data of the empirical analysis. The empirical methodology and results are introduced in Section 4. Section 5 concludes with some policy implications.

2. Literature review

There is a wide range of literature devoted to the analysis of the determinants of environmental pollution proxied by either carbon dioxide (CO₂) emissions or any other form of environmental degradation, such as sulfur dioxide (SO₂), methane (CH₄), and nitrous oxide (N₂O), generally by taking into account the EKC hypothesis.¹ The existing literature considering the determinants of environmental pollution can be classified into three strands [30–32]. The first strand of the existing literature basically analyzes the nexus between environmental pollution and income in order to test the validity of the EKC hypothesis, following the seminal work of Grossman and Krueger [33]. Some of the studies in this strand of the literature, e.g. [34–39], provide considerable evidences about the validity of the EKC hypothesis while some others, e.g. [11,40–49], fail to do so. The validity of EKC hypothesis is also related to the special characteristics

¹ See Al-Mulali et al. [51] for the recent and comprehensive literature review about EKC hypothesis.

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