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Economic impact assessment of Turkey's post-Kyoto vision on emission trading

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HIGHLIGHTS

- We conduct welfare analysis of Turkey's post-Kyoto vision on emission trading.
- Welfare impacts of having Turkey in the EU ETS via EU accession are analyzed.
- Analysis is done with the current EU target of 20%, and the revised target of 30%.
- Welfare impacts of linkage on both regions highly depend on the emission targets.
- The EU has welfare gains when Turkey engages in abatement actions.

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ABSTRACT

For the post-Kyoto period, Turkey strongly emphasizes the establishment of national emission trading system by 2015 and its integration with the EU ETS along its accession process to the EU. In this paper, we study the mechanisms of adjustment and economic welfare consequences of various ETS regimes that Turkey considers to apply by 2020, i.e. regional ETS and international trading within the EU ETS. We conduct our analysis under the current EU 20–20–20 emission target, 20%, and also under its revised version, 30%. We find that Turkey has economic gains from linking with the EU ETS under the 20% cap, in comparison to the domestic ETSs. Despite the EU's welfare loss under linkage in comparison to the case where Turkey has domestic abatement efforts, it still prefers linking as it increases economic well being compared to the case where Turkey does not abate. Under 30% cutback, Turkey has critical output loss under linkage due to high abatement burden on the EU, while the EU is better off as it passes some of its abatement burden to Turkey. Therefore, emission quotas and their allocation across the ETS and non ETS sectors become highly critical in distributing the overall economic gains from bilateral trading.

1. Introduction

Following its removal from the Kyoto Protocol's Annex B list, Turkey did not follow any official emission reduction targets over the period, 2008 and 2012. For the post-Kyoto period, the Ministry of Environment and Urbanization (MEU) delivered Turkey's national vision within the scope of climate change in the National Climate Change Action Plan: 2011–2023 (Ministry of Environment and Urbanization, 2011). Within this document, Turkey's objectives are stated as becoming a country fully integrating climate change related objectives into its development policies, improving energy efficiency, increasing the use of renewable energy sources, and decreasing its emissions. In stabilizing CO_2 emissions, the Action Plan strongly emphasizes the establishment of national emission trading system in Turkey by 2015 and its integration with the existing and new global and regional carbon markets. Turkey has also showed its determination in participating in global carbon markets with the opening of the Environment Chapter as part of the EU enlargement process. Turkey is expected to integrate with the EU ETS along its accession process to join the EU. Besides setting the international political agenda, as being world's largest international carbon market, the EU ETS provides a natural venue for Turkey in establishing its national permit market and a potential partner for international carbon trading.

Having started in 2005 with a trial period, the EU ETS completed its second phase during 2008–2012, and is at the onset of its third phase between 2013 and 2020, compatible with the EU 20–20–20 targets (European Commission, 2008). For the post-Kyoto period, the EU strongly supports an effective global carbon market and encourages establishing direct links between the

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EU ETS and other cap-and-trade systems. The third countries neighboring the EU, together with the candidate and potential candidate countries, are stated as the most potential trading partners (European Commission, 2009).

Bottom-up linking of *cap-and-trade* schemes are highly desirable as it enhances price equalization across the linked schemes resulting in reduced aggregate abatement costs compared to ex ante abatement costs (Haites, 2001; Blyth and Bosi, 2003). In addition, both Turkey and the EU are supposed to benefit from the proper functioning of the carbon market due to increased liquidity and decreased price volatility (Baron and Bygrave, 2002). Nevertheless, overall efficiency gains do not necessarily translate into regional efficiency gains. Linking the EU ETS with the Turkish national permit market can have various distributional impacts, which strongly depend upon the design of permit trading scheme, existing distortions in the economies, carbon intensity of the economies, and further on the terms of trade effects that the regions are exposed to via international trade. Therefore, the regional efficiency gains should be analyzed in a way that accounts for these various price and income effects.

Despite incentives provided in the political background, there remain many challenges that both Turkey and the European Union face in formalizing their post-2012 abatement strategies based on permit trading. Previous modeling efforts on the Turkish abatement strategies against greenhouse gas emissions have exclusively focused on applications of taxation in the Turkish economy in isolation from the global economy. Telli et al. (2008) and Vural (2009) concentrated on the taxation of energy use as instruments of carbon dioxide abatement while Kumbaroglu (2003) focused on the taxation of sulfur emissions. In a more recent study by Aydin and Acar (2010), the economic impacts of unilateral carbon taxation in Turkey are investigated under the case of Turkey's accession to the European Union.

The economic aspects of bottom up linking of the EU ETS with other cap-and-trade systems have been assessed in various model frameworks. In their theoretical study, Eyckmans and Hagem (2011) show that the EU countries can benefit from the bottom up linking of regional cap-and-trade systems in case of certain trade agreements. They test their hypotheses in using numerical simulation methods across EU and China for 2015. In another study, Anger (2008) studies linking the EU-ETS with the newly emerging market schemes beyond Europe, i.e. Japan, Canada, the US and the OECD Pacific countries. Their numerical analysis shows that linking the EU-ETS with the emerging permit markets induces minor economic benefits for the EU, while the economic impacts for the non-EU countries can vary depending on the nature of domestic structural differences and prevalent inefficiencies. The dependence of the economic impacts to the structure of allowance allocation in the linking permit trading schemes is further analyzed in Anger (2009).

Thus, there is a gap in the previous literature in addressing the economic impacts of Turkey's abatement policies and bottom-up linking of the EU ETS with the emerging Turkish permit market during the post-Kyoto period. This paper aims to fill this gap and analyze the unilateral use of emission trading schemes in Turkey as part of its contribution to the international climate change mitigation efforts. It further investigates the economic impacts of linkage provisions on both the EU and Turkey, which is planned to take place as part of the EU's enlargement policies in the post-2012 period.

To this end, we build a multi-regional, multi-sectoral applied general equilibrium model in order to study the economic impact of Turkey's market-based abatement policies on the respective economies. Our analysis shows that the EU prefers that Turkey abates at home rather than not, while Turkey finds domestic abatement costly. However, Turkey can alleviate some of these costs by bilateral trading within the EU ETS. The economic gains out of permit trading are highly dependent on the total emission targets and their allocation across sectors. Our analysis further suggests that in the case of an increase in the EU's emission target, Turkey would not prefer to trade permits with the EU but rather stick to domestic abatement policies.

Under 20% cutback, Turkey has economic gains under bilateral trading within the EU ETS in comparison to unilateral trading schemes. Although the EU has certain level of welfare loss under bilateral trading in comparison to the case where Turkey has domestic abatement efforts, it still prefers bilateral trading as it increases economic well being compared to the case where Turkey does not abate. However, under 30% cutback, Turkey has critical output losses under bilateral trading due to high abatement burden on the EU. On the other hand, the EU favors bilateral trading as it passes some of its abatement burden to Turkey.

The following pages of the paper are organized as follows. In Section 2, we provide key environmental and economic data to portray Turkey's standing in comparison to the EU countries. In Section 3, the model structure and calibration strategy are laid out, together with the forward calibration procedure used in comparative static analysis. In Section 4, we describe the scenario runs and discuss the computational results. Section 5 summarizes our findings and concludes.

2. Key environmental and economic indicators

Over the period between 1990 and 2009, Turkey's GDP has shown a growing, yet highly volatile trend with a cumulative expansion of 92%. Within the same period, Turkey has also experienced a rapid increase in its total primary energy supply (TPES). Table 1 reports this cumulative increase as 85.1%.

Data supplied by the IEA (2011a) and OECD (2011) reveal that total primary energy supply of Turkey highly depends on coal and peat with 32%, on natural gas with 30%, and on crude oil and oil products with 27%. The composition of TPES has been more stable since 2005, and yet, the share of renewable resources remains fairly low, around 4% for hydro, 5% for biofuels, and 2% for geothermal and solar resources. As coal, peat, oil and natural gas

Table 1
Key indicators of Turkey.
Source: IEA (2011a).

	1990	1995	2000	2005	2007	2008	2009	Change 90–09 (%)
CO_2 (Mt of CO_2)	126.91	152.66	200.56	216.36	265	263.53	256.31	102.00
TPES (Mtoe)	52.76	61.55	76.35	84.38	100.01	98.5	97.66	85.10
GDP PPP (billion 2000 USD)	411.06	481.43	589.24	736.17	823.66	829.09	789.08	92
Population (millions)	55.12	59.76	64.26	68.58	70.26	71.08	71.9	30.40
CO_2/TPES (t CO_2 per TJ)	57.5	59.2	62.7	61.2	63.3	63.9	62.7	9.10
CO_2/GDP PPP (kg CO_2 per 2000 USD)	0.31	0.32	0.34	0.29	0.32	0.32	0.32	5.20
CO_2/population (t CO_2 per capita)	2.3	2.55	3.12	3.15	3.77	3.71	3.57	54.80