

CHAPTER 1

Introduction

Macroeconomics of Climate Change in a Dualistic Economy intends to construct a series of regional and dynamic general equilibrium models that accommodate the structure and dynamics of the dual trap embedded in the Turkish economy. These models include the analysis of macroeconomic development policies that are designed at the regional level, as well as those that are aimed at climate change abatement and mitigation. Recent studies have focused on environmental issues and have taken the macroeconomic structure of the modeled economies as given. We are of the opinion that by incorporating underlying characteristics of a dual economic structure, alongside questions of sustainability, increasing greenhouse gas (GHG) emissions, and income distribution, *Macroeconomics of Climate Change in a Dualistic Economy* can address questions, such as:

- What effects do energy and environmental policies in Turkey have on national and regional GHG emissions?
- What effects may “greening” policies of the Turkish economy have on regional employment and development patterns?
- How will patterns of production and employment be shaped in strategic sectors of the Turkish economy (i.e., agriculture, automotive, construction, machine industry, and advanced services) by “greening” and regional development?
- From the viewpoint of social welfare: What is the optimal mix of taxation, subsidization, and technology policies in the Turkish economy that will alleviate the duality trap, sustain “greening” efforts, and mitigate climate change?

The key contribution of *Macroeconomics of Climate Change in a Dualistic Economy* rests on addressing the issues of duality and environmental policy on climate change within a general equilibrium modeling approach. We therefore hope that the modeling will be of interest to students studying the macroeconomics of development, general equilibrium modeling, and the economics of climate change. The last topical area focuses on a burgeoning field surrounding policy debates on the 2°C target set by the UN and the participants of the widely-acclaimed COP meetings. Coupled with a discussion of recent advances in dynamic multiregional applied general equilibrium modeling, the proposed methodology is expected to be

of wide interest to graduate students, applied researchers, practitioners, and researchers from both the academic and public sectors.

1.1 BACKGROUND

Various aspects of sustained growth (or lack of) under regional fragmentation and patterns of duality have long been reported in the literature, especially regarding the structuralist tradition (Ros, 2000; Taylor, 1983, 2004). “Dual” economic structures have recently come to the forefront of the development economics literature, with seminal contributions from Fields (2004), Laitner (2000), and Temple (2005). In his survey of the concept for growth economists, Temple (2005) noted that “dual economy models (ought to) deserve a central place in the analysis of growth in developing countries (...) with factor misallocation, aggregate growth in the presence of factor market distortions, international differences in sectoral productivity, and the potential role of increasing returns to scale.” Our investigation will go beyond the analyses of “traditional” dualism (based on differences in the wage rate from labor’s marginal product in traditional agriculture) to encompass what Bertrand and Squire (1980) noted as “modern-sector dualism,” with an advanced modern sector generating and sustaining traditional-sector conditions with a poverty trap based on informality and fragmentation.

Classic treatment of “Duality” was introduced to the literature with the dual-economy models of Fei and Ranis (1964) and Lewis (1954). Both visions highlighted the pathways of transitional growth via the transference of unlimited supplies of labor from traditional agriculture to modern industry. In their view, duality initially was referred as a diverse structure, which nevertheless followed a smooth adjustment toward modernity. As labor was lured from low-productivity (actually zero) traditional agriculture to high-productivity urban industries, growth occurred through lifting the masses toward a modern society.

However, over 50 years of research has clearly revealed that one of the striking feature of the mode of development is polarization of income per capita, which occurs across global, national, and regional economies. The expected smooth transition that destroys (creatively, according to Schumpeter? We doubt it!) traditionally stagnant rural economies, and moves masses out of poverty into the modern urban centers of growth, has not taken place. Globalization in the 20th century created miracles and disasters thus filling the ranks of what Colander termed as the bottom 1 billion, where

daily per capita incomes fell below one dollar. Rates of growth were, on average, negative over the last quarter.

Such polarization was not limited across nations. Informalization, fragmentation, and social exclusion are indispensable outcomes of modern enclaves; in short, modern and formal centers of growth have simultaneously created and sustained fragmented informal bases. In Turkey, modern Istanbul not only retains and produces backwardness in Urfa, but also generates further Urfas within its geographical domain. As informal Urfas surround the Istanbul core, fragmented and dualistic activities form the basis of cheap labor sources and consist mainly of socially-excluded migrants who are, in turn, pressed to offer their labor power in “a race to the bottom.” Turkey’s experience is by no means unique. It is part of a larger picture of the international division of labor within the global economy, where formal and informal structures exist side by side as part of a larger social formation. In their study of the structural transformation of India’s economy, [Rada et al. \(2012\)](#) noted that “a widening gap between India’s skilled and well-paid on the one hand and those unskilled and mostly poor on the other hand has been on the rise.” (p. 4). They further noted that “despite impressive expansion in production, job creation in the formal or organized sector has been meager for the last two decades. India’s workforce remains employed in relatively low-productivity, low-pay jobs even if formal urban high-technology services output has expanded very rapidly.” This has dire implications for social cohesion and the sustainability of growth ([Bremas, 2010](#); [Chandrasekhar and Ghosh, 2007](#)), where economic expansion is ultimately constrained by the hard boundaries of either lack of growth demand or the availability of skilled labor. With inequality at the regional and state levels becoming increasingly apparent, India seems to be trapped within the widening gaps between enclaves and backwardness ([Deaton and Dréze, 2002](#)). Similar observations have also been shared under diverse external conditions for Mexico, post-NAFTA. A McKinsey report ([Bolio et al., 2014](#)) described the Mexican structure as a “two-speed economy,” with highly-productive industrial conglomerates with easy access to foreign technology and finance across the maquiladora belt of the US border coexisting with traditional family-owned small-scale businesses with almost stagnant labor productivity. These observations are in contrast to the well-defined, across-the-board conceptualizations of the classical duality theories, which suggested there would be sustained growth based on unlimited supplies of labor. However, further to these observations the enigma remains as, in the words of [Reinert et al. \(2016\)](#), “the profession’s recent leaps into the mysteries of institutions’

and ‘human behavior’ (failed to) solve the basic underlying problem of explaining why economic growth, by its nature, (has been) so uneven.”

In our context, at least four clear-cut attributes of 21st century dualism come forward. The first pertains to the geographical location along the lines of classical periphery versus the core. The second pertains to access to technology, modern finance, and organizational management in firms and other production units. The underlying source of duality here does not necessarily rest on the different types of labor across skill levels, but, as a manifestation of the third attribute of modern duality, it is the direct outcome of heterogeneous capital formation. In the words of [Mészáros \(1995\)](#), “labor markets remain heterogeneous, because capital itself is heterogeneous.” Heterogeneity of capital, along with the seemingly endless formation of subcontracting, off-shoring, etc., creates its own demand for heterogeneous labor types and causes deeply fragmented labor markets across organized formal sectors. We are therefore left with the fourth characteristic of dualism, which pertains to the persistence of fragmented regional peripheries due to the constraints of backward technologies, limited access to knowledge capital, and exclusion from modern or secular education. This encompasses all forms of social stratification along gender, ethnic, and religious castes. In this book we introduce various forms of sluggish inter-regional adjustment processes over both capital and relevant labor types. We incorporate various empirically-validated rigidities along the supply of informal labor, and modify the traditional assumption of a perfectly elastic long-run supply of rural labor in an unlimited population, as is seen in the conventional labor market duality.

[Stifel and Thorbecke \(2003\)](#) attempted to capture some of these elements through their characterization of a dual–dual economy, which included: (1) subsistence agriculture using traditional labor-intensive technologies; (2) commercial large-scale agricultural units using high-technology capital-intensive techniques; (3) an informal urban sector; and (4) urban modern industrial and service sectors.

We hinge on and extend this basic framework of duality by incorporating fragmentation across spatial forms of production and employment. Accommodation of migration is a further key feature of this social formation. Our approach here will be a multifaceted model of migration flow, allowing both skilled and unskilled labor from the poverty-trapped regions to join the ranks of vulnerability in the high-income regions. This specification goes well beyond traditional characterizations that lure rural labor surplus into the ranks of the higher-paid urban sectors and is designed to

accommodate more complex migration traits, as this is both an economic and social phenomenon. In summary, our specification rests on the foundations of the regional location theory, empirical-based characterization of heterogeneous labor categories, and differentiated labor-supply responses along the fragmented factor markets. All of this can be cast in a dynamic framework driven by differentiated (lopsided) rates of productivity growth, stimulated through instruments of environmental abatement.

Fiscal policy and provision of public infrastructure constitute integral components of our abatement strategy. The role of public infrastructure investments in combatting regional growth bottlenecks is well documented (Conrad and Heng, 2002; Deepak et al., 2001; Giesecke, 2003). Our analysis will extend the arsenal of fiscal policy instruments to account for the objectives of abatement. Redirection of the (existing) subsidies to fossil fuels, invigoration of a carbon tax based on the polluter-pays principle, earmarking tax monies to targeted discretionary venues of pollution control, and expanding renewable energy sources are specific examples of the wide-ranging possibilities.

1.2 ON TURKEY

The methodological section of this study is performed with the aid of a multiregional multisector macroeconomic general equilibrium model. Referred to as regional computable general equilibrium modeling, the most important contributions of this construction are the decomposition of the national economy into its observed regional differences, and the generation of an impact analysis of the regional and environmental policy instruments. The choice of this focus was made for two reasons: First, as an emerging developing market economy, Turkey displays a dual structure (duality). The main features of the dual trap are revealed by the coexistence of a “middle-high income Turkey,” which is on its way to reaching higher-income status, alongside a “poor Turkey,” which is trying to exit from the poverty trap and is in need of accelerated growth. This spatial duality, which continuously breeds and enclaves “poor Turkey” within an eternal poverty trap, creates regional inequalities and a fragmented and informalized industry and labor market structure for the Turkish economy at large. It also leads to environmental degradation and renders the environmental policies for mitigating climate change inefficient. As “high income Turkey” relocates its production costs, which arise from the burden of high corporate taxes and environmental abatement regulations, toward “poor Turkey,” it creates conditions of

concerted urbanization and an unsustainable growth path in which poverty and informalization are continuously reproduced.

The second reason for this choice is that economic growth has generally not been decoupled from resource use and environmental quality. For example, a United Nations report (UN, 2013) noted that “the present dominant model of development is facing simultaneous multiple crises, such as depletion of natural resources and the market failures that have already marked the first decades of the current millennium.” Therefore this model has been ineffective at enabling productive and decent employment and has exacerbated the phenomenon of climate change with its facets, including the depletion of natural resources, the loss of biodiversity, energy crisis, food security, etc. In contrast, the report underlines that the “green economy concept proposes to break away from the not very effective current model of development and move toward a more sustainable development paradigm that is merely characterized by low carbon emissions, rational use of resources and social inclusiveness.” These observations are central to green growth, a relatively new concept that has captured the attention of global policy makers, researchers, and civil society organizations, which could help to design and evaluate policies that could efficiently achieve environmental sustainability. This is of particular interest to fast-growing emerging market economies, which are characterized by rapidly increasing ecological footprints, and which seek to decouple economic growth from rising energy use and pollution.

The lack of decoupling is also observable in Turkey. As of 2015, Turkey’s per capita emissions of carbon dioxide (CO₂) and other GHGs (CO₂ eq.) stood at around 6 tons, while its total CO₂ eq. emissions per GDP (in constant USD) reached 0.524 kg. Turkey displays relatively low emission figures in comparison to global and OECD averages; however, it is cited in the top five countries with the fastest growing rates of aggregate CO₂ eq. emissions. Turkey’s CO₂ eq. emissions increased from 214 to 475 million tons in the period from 1990 to 2015 (a cumulative increase of 122%), and are expected to increase to 675 million tons by 2030. This suggests that Turkey will be on a divergent trend to many of the emerging market developing economies as well as to the world average over the coming decades (Acar and Yeldan, 2016).

Environmental policy instruments in Turkey have thus far consisted of carbon tax-cum-subsidies and administering high taxes through the energy markets, both to the user and the supplier. However, it is well-documented that the administration of price instruments through the market alone is

not sufficient to control global GHG concentrations or maintain a sustainable and eco-friendly growth path (Acar et al., 2014). Part of the problem is that the development of novel eco-friendly technologies typically involves positive spillovers in the form of agglomeration effects, knowledge diffusion, cross-firm externalities, and industry-wide learning; however, the decentralized optimization embedded in the laissez-faire actions of the markets may fail to capture these positive spillovers. Market failures are at the root of these problems, as although basic (economic and regulatory) instruments are available, their systematic use in broader policy packages have been lacking.

Considering the lack of an adequate modeling paradigm for environmental policy analysis in Turkey, the effectiveness of policy interventions and their economic impacts are not well-known. Hence there is a strong need for the construction and utilization of analytical models that can account for the general equilibrium effects of environmental policy analysis.

1.3 OBJECTIVES

The literature regarding classical development has emphasized the relationship between economic growth and changes in the production structure. It also allocates special properties to industry and the process of industrialization in its capacity to create and combine a series of complementarities, scale properties, and external economies to generate a sustainable cycle of resource mobilization, increased productivity, rising demand, increased income, and economic growth.

Developments in the global economy have contributed to renewed discussions on the role of structural transformation in achieving sustained economic growth and development. Other factors that have added to this discussion include the catch-up failure of many developing regions, which are often associated with “traps” and downturns (i.e., low-development traps, middle-income traps, and premature deindustrialization); the end of the windfall export gains led by the commodity price boom in the 2000s; and the continued vulnerability of many developing regions to external shocks (UNCTAD, 2016).

The dual relationship between climate change and development serves as yet another important factor. For example, climate change creates serious challenges for development; however, the priorities of economic growth and development also have major consequences on climate change and vulnerability. In its basic form, emission control and effective mitigation

require massive transformations in production and energy systems, such as moving away from traditional high-carbon energy sources (i.e., a phase-out of coal or gas-fueled power plants and fossil fuel subsidies), increasing fuel efficiency, broadly deploying advanced renewable technologies, and implementing measures to increase energy efficiency (IEA, 2008).

Given the overall scope, we propose the concrete objectives of this study are:

- to use the analytical findings in the literature regarding technological change and innovation in response to environmental pollution abatement and climate change mitigation (Goulder and Schneider, 1999; Löschel, 2002; Porter and van der Linde, 1995), technology path (Aghion, 2014; Aghion et al., 2011, 2012), and duality (OECD, 2014; Temple, 2005) to construct a dynamic small “open economy” general equilibrium model for the regional Turkish economies, which can be utilized for the analysis of policies of regional development and environmental abatement;
- to evaluate the environmental tax or subsidy policies, the policies for promoting sustainable and equitable regional growth, and the policies for employment and investment under the resource constraints and the social welfare criteria; and
- to decompose the dynamic growth path of the Turkish economy and the climate-related problems that are likely to be faced along this path using a long-term time horizon encompassing the 2010s.

Previous research regarding these questions has typically been conducted within a macroeconomic environment where the analyzed economy is regarded as a homogenous entity. Conversely, evidence on global capitalism for the 21st century suggests that growth over the next century will be erratic and highly uneven. For example, a recent OECD (2014) report claims that the world economy will significantly decline over the next 60 years. OECD researchers argue that two important factors of this prognostication will be: (1) the duality and unevenness of income distribution across functional and regional sites, with a consequent rise of social exclusion and conflict; and (2) environmental degradation due to the threat of climate change. This manuscript aims to address these two issues simultaneously within the discipline of general equilibrium, and attempts to provide an analytical quest into viable alternatives using real world data for an indigenous economy, Turkey, in a dynamic framework. We believe that this will serve as the unique identifier of this manuscript.

1.4 OUTLINE OF THIS MANUSCRIPT

The remaining sections of the book are as follows:

Chapter 2 is devoted to understanding the dual characteristics of economies and growth patterns within the context of development challenges in the 21st century. This will be performed for both developing countries in general and more specifically for Turkey. The broad contours of growth and adjustments in the global economy before, during, and after the 2008–09 global crises are initially identified. Second, structural sources of deindustrialization, widening duality in labor markets, and technological diffusion are addressed. Third, all of the aforementioned observations are linked with the macroeconomics of global climate change and the implications for resource use and environmental degradation. A key hypothesis of this chapter is that the projected lack of decoupling between growth and GHG emissions is mostly driven by the dualistic patterns of growth and industrialization across Turkey. [Yeldan et al. \(2014\)](#) suggest that the main causes of the productivity slowdown in the Turkish economy over the 2010s are the diverging patterns of regional development and the widening gap between high- and low-income regions, as well as modern versus traditional sectoral production (and consumption) patterns. In this chapter the fragmented nature of the commodity and labor markets across regional Turkey is documented. We argue that the fragmented dualistic structure is maintained within the current macroeconomic path of Turkey, as is the continued informalization of both the capital and labor markets and the diverging growth across regions.

Based on the economic structure laid out in Chapter 2, Chapter 3 argues that the lack of mitigation at the national level is manifested by the widening gap across regional GHG emissions, which is caused by the dual economic structure and the differential subsidization schemes across the regions. This chapter dissects and interprets the existing statistics related to energy and climate change in Turkey. It also provides an account of the legal background, strategy documents, and policies related to energy and the environment (i.e., fossil fuel subsidies and feed-in tariffs for renewable energy). In addition, it casts light on the possible extensions of environmental policies from the voluntary carbon markets and the Partnership for Market Readiness project in Turkey. Finally, this chapter has been extended to include the post-Paris agreement era for climate change and to undertake an international comparison of developing countries with respect to climate change policies.

Chapter 4 introduces the main components of the applied general equilibrium model designed for Turkey. It discusses its distinguishing features and its contribution to the modeling literature with a unique emphasis on duality, regionalization, and social relevance. It further conceptualizes a social accounting matrix for the regionally fragmented dual economy to accommodate Turkish macrolevel data. Given the theoretical structure of the computable general equilibrium (CGE) model, the main data sources of the modeling paradigm are introduced and tabulated within the discipline of Walrasian general equilibrium. The unique contribution of this chapter is its accommodation of regional differentiation and dualistic labor markets and its preparation for the database in social accounting matrix format. This chapter purports to extend traditional neoclassical (Walrasian) growth modeling (based on one-sector depictions of the aggregate economy) with a balanced growth path notion toward the steady state. As such, we aim to contribute to the empirics of the traditional growth paradigm by questioning the long-run equilibrium pathway toward a balanced steady state.

Finally, Chapter 5 introduces various policy scenarios and tests them for equitable and sustained regional development, mitigation of climate change, and provision of green growth.

The existing environmental policies in Turkey are mainly comprised of gasoline and fuel taxes. Conversely, Turkey continues to support coal mining and coal-fired power generation with the aim of utilizing all its domestic coal resources in the near future. Since coal subsidies work against the competitiveness of renewable energy technologies, the energy sector has been locked in to the continuation of fossil fuel-based systems, and thus the investment decisions of renewable energy investors have been heavily jeopardized (Bridle and Kitson, 2014). Eliminating coal subsidies and redirecting these funds toward renewable energy, green jobs, or CO₂ mitigation will likely improve efficiency and social welfare.

One of our key hypotheses is that coal subsidies could be phased out and fiscal savings from this, as well as the additional revenue from carbon taxation schemes, could be used to develop renewable energy and energy efficiency while simultaneously mitigating the environmentally harmful impacts. Coal subsidy phaseout and carbon taxation would decrease CO₂ emissions, increase fiscal revenues, and potentially generate green energy and green jobs. Switching from subsidization of coal and other fossil fuels to supporting the development of renewables is expected to be a win-win-win strategy for a cleaner environment, a decreased dependence on fuel imports, and an expansion of renewables in electricity production. In addition,

alternative public policy intervention mechanisms could be developed to accelerate technology adoption and energy efficiency and achieve higher employment, energy security, and sustainable growth patterns.

In the search for viable alternative policy instruments to complement efforts of greening and decarbonizing the economy, the last chapter intends to use a dynamic and regionally-differentiated applied general equilibrium model. This model will investigate the impacts of various policy instruments, such as the removal of fossil fuel subsidies, the introduction of a carbon tax, the development of a “renewables sector” via induced technology, and the investment in research and development devoted to the stimulation of such efforts toward a greener economy.

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