Economic Development in Turkey and South Korea: A Comparative Analysis*

M. Aykut Attar**
Hacettepe University

Abstract

An interesting question in comparative economic development is why Turkey fell behind South Korea even though she had better development prospects in 1960. The existing literature offers some illuminating narratives of the most plausible reasons, but only a few papers have identified the microeconomic foundations of the relative underperformance of the Turkish economy. This paper constructs and analyzes two-sector catching up models to find contrasts between Turkey and South Korea. The results, which follow from data-based calibrations, indicate the following: with respect to initial conditions and values of structural parameters, both economies have advantages and disadvantages. The most significant contrast, however, is the huge difference in how efficiently the two countries adopt frontier technologies. While the South Korean economy operates with an efficiency level very close to its upper bound of 100%, Turkey is located at the other end of the spectrum with an efficiency level of less than 1%. Counterfactual experiments confirm the dominant role of this efficiency parameter against initial conditions and other structural parameters. An extended analysis indicates that human capital differences can only partially explain the large difference in efficiency levels.

Keywords: productivity growth, catching up, efficiency, absorptive capacity, human capital, calibration.
JEL Classifications: O33, O41, O57.

Güney Kore ve Türkiye'de İktisadi Gelişme: Karşılaştırmalı Bir Çözümleme

Özet

1960'da daha iyi gelişme beklentilerine sahip olan Türkiye'nin neden Güney Kore'nin gerisine düştüğü, karşılaştırmalı iktisadi gelişmedeki ilginç bir sorudur. Var olan yazın, en akla yatkın bazı nedenlerin aydınlatıcı anlatılarını sunmaktadır, ancak sadece birkaç makale Türkiye ekonomisinin göreli olarak düşük performansının mikroiktisadi temel-

---

* Acknowledgements: The author is sincerely grateful to the two anonymous referees of the journal for comments and suggestions that significantly improved this paper. The author also thanks the language editor for corrections. All remaining errors and mistakes are the author's own.

** M. Aykut Attar is an Assistant Professor in the Department of Economics at Hacettepe University, Beytepe Campus, 06800, Çankaya. Ankara, Turkey. E-mail: maattar@hacettepe.edu.tr

Boğaziçi Journal Review of Social, Economic and Administrative Studies, Vol. 32, no. 1 (2018), pp. 01-28
doi: 10.21773/boun.32.1.1

lerini belirlemiştir. Bu makale, Türkiye ve Güney Kore arasındaki zıtlıkları bulmak için, iki sektörlü yakalama modelleri kurmakta ve çözümlemektedir. Veri temelli ölçümlemeler ile ulaşılan sonuçlar şunlardır: başlangıç koşulları ve yapısal katsayıların değerleri bakımından, her iki ülkenin de avantajları ve dezavantajları vardır. Ancak en önemli zıtlık, ülkelerin ileri teknolojileri adapte etmekteki etkinlik düzeyleri arasında bulunan devasa farklılıktır. Güney Kore ekonomisi %100'lük üst sınıra çok yakın bir etkinlik düzeyi ile çalışırken, Türkiye %1'den daha düşük olan bir etkinlik düzeyi ile spektrumun diğer ucunda yer almaktadır. Karşıolgusal deneyler, bu etkinlik katsayısının, başlangıç koşulları ve diğer yapısal katsayılara karşı olan baskın rolünü doğrulamaktadır. Genişletilmiş bir çözümleme, beşeri sermaye farklarının, etkinlik düzeylerindeki büyük farkı ancak kısmen açıklayabildiğine işaret etmektedir.

Anahtar kelimeler: verimlilik büyümesi, yakalama, etkinlik, emilim kapasitesi, beşeri sermaye, ölçümleme.
JEL Sınıflandırması: O33, O41, O57.

The South Korean economy has recorded miraculous successes in the postwar period, surpassing many initially similar economies in only a couple of decades. Turkey in 1960 had been positioned with better economic development prospects than South Korea, but South Korea has surpassed Turkey as well (Krueger, 1987).

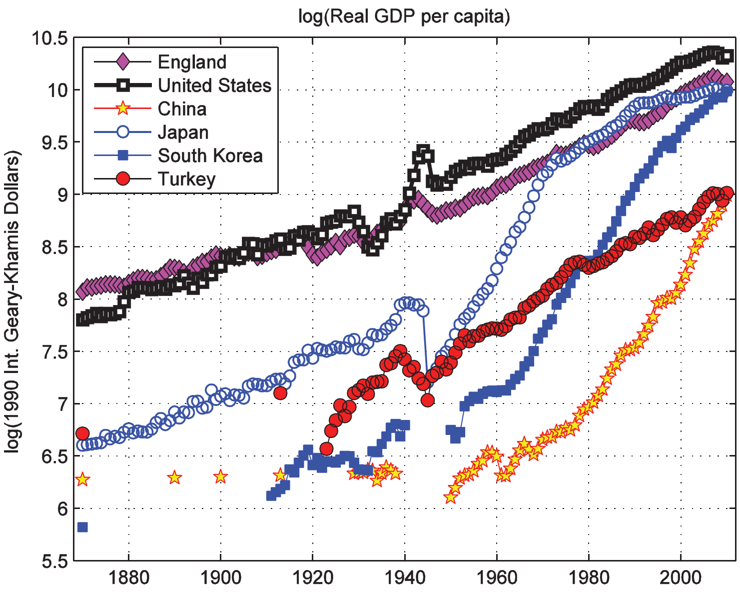
In 1960, real GDP per capita in Turkey was about 2 times larger than South Korean GDP in purchasing power parity corrected US dollars. The gross saving rate in Turkey was about 13% points higher than the South Korean rate. Perhaps most significantly, the total volume of exports in Turkey was about 8.5 times larger than in South Korea in 1961. In 1980, these statistics were reversed remarkably. Turkish real GDP per capita decreased by about 6%, whereas the gross saving rate in South Korea was about 6.5% higher than the Turkish rate. The total volume of exports in South Korea was 4.5 times larger than the corresponding volume for the Turkish economy. The relative underperformance of Turkey has continued since the 1980s with a widening difference in real GDP per capita levels between the countries. South Korea has kept converging with rich economies while Turkey has failed to do so.[1]

---

[1] The South Korean miracle is the subject of a sizable literature. A selective list of references includes Dornbusch and Park (1987), Amsden (1989), Haggard et al. (1991), and Cha et al. (1997). Also highly relevant is the World Bank's (1993) 400-page report *The East Asian Miracle*, which tends to downplay the government's role in the economies of developmental states. For an excellent critique of this report, see Rodrik (1994).

Figure 1

Long-Run Economic Growth in Selected Economies: 1870–2010



Data Source: The Maddison Project (2013)

Figure 1 pictures the evolution of real GDP per capita from 1870 to 2010 for selected economies and in purchasing power parity corrected terms.[2] In 1870 Ottoman Turkey, while richer than Japan, Korea, and China, was a poor economy in modern standards. After the fall of the Ottoman regime in the wake of World War I (WWI) and the National Liberation War, the young republic returned to its pre-WWI level of real GDP per capita in the early 1930s. The growth rate, however, never permanently exceeded 2.95% per annum for the rest of the 20th century. While all three East Asian economies considered here experienced economic growth at quantitatively comparable rates that are significantly larger than those of England and the United States, the long-run growth rate in Turkey remains much lower.

Looking more closely at the case of 'South Korea versus Turkey' reveals the persistent difference in the growth rates in these economies after the early 1960s. The end result of this difference is that Turkey fell behind South Korea around 1980. History then records the absence of an upward trend break in Turkish real GDP per capita until today and a growth slowdown in South Korea after 1990s.

---

[2] This figure captures some of the main lessons of world economic history. These include the fall of England relative to the United States in the 20th century, the persistence of the level difference between these two economies, the collapses associated with the Great Depression and World War II, and the successive rises of Japan, South Korea, and China in the second half of the 20th century.

The main question here is why this reversal happened, and this question has motivated a literature searching for the contrasts between South Korea and Turkey. Some studies emphasize the timing of the transition from import substitution to export orientation and other trade-related issues (Krueger, 1987; Yılmaz, 2002; Onaran and Stockhammer, 2005). Other studies focus on the structure of and the strategies pursued by private sector firms and the role of state in directing the process of industrialization (Öniş, 1992; Buğra, 1994; Aydın, 1997; Erdoğdu, 1999; Oh and Varcin, 2002; Öniş and Şenses, 2007; Taymaz and Voyvoda, 2012). The quality of the labor force and the innovative/imitative performance of the economy are also underlined in the existing literature (Pak and Türkcan, 2000; Taymaz, 2001; Şenses and Taymaz, 2003). In a comparative study focusing on the post-2001 experience of the Turkish economy, Öniş and Bayram (2008) ask whether Turkey will emerge as a new tiger or remain a temporary star.[3] They emphasize that Turkey can have tiger-like performance as in East Asia only if she sustains growth via higher domestic savings and exports and lower external financing.

This paper presents some quantitative evidence regarding how technology may have affected the divergent development experiences of South Korea and Turkey. Its purpose is to infer the technological structures of Turkey and South Korea using a simple model with microeconomic foundations and a collection of relevant data informative for the model economy. Since the analysis builds upon microeconomic foundations, it allows for rigorous inferences on the contrasts between the two economies. The comparison, at the end, allows us to reach some concrete conclusions.

The starting point of the analysis is the simple catching up model proposed by Lucas (2009).[4] This model has two production sectors, one representing traditional agriculture, i.e., the farm sector, and the other representing modern industry, i.e., the city sector. Productivity in the city sector grows as domestic firms catch up with the world technology frontier. This frontier expands in the leading country at a fixed and an exogenous rate. The growth of productivity in the city sector also spills over to the farm sector. In time, the dependence on land in the farm sector and free labor mobility across sectors cause the labor share of the farm sector to decline. The city sector keeps catching up with the frontier at a decelerating pace throughout the transition. Lucas (2009) calibrates the model parameters using several targets and takes the United States as the world technology frontier. His end result is that the model successfully explains the evolution of GDP per capita and the decline of agriculture in a set of open economies.

---

[3] Other than the Japan-centered and American hegemony explanations, Öniş and Bayram (2008) list three perspectives explaining the East Asian miracle; the *neoclassical* perspective focuses on the critique of import substitution policies, the *statist* perspective focuses on the enabling role of state, and the *culturalist* perspective focuses on Confucian values. It is worth noting that Landes (1998: 517) cites 'South Korea versus Turkey' as an example of how culture makes a difference in comparative economic development.

[4] The idea of catching up, in the sense of poorer economies growing faster to catch up with richer ones, dates back to Veblen's (1915) descriptions of technological diffusion and to Gerschenkron's (1962) historical analysis based on the 19th century European experience. Nelson and Phelps (1966) provide an early mathematical formalization of this idea, in which productivity growth in a follower economy is explained by its distance to the frontier and its absorptive capacity. See Baumol (1986) for an empirical analysis. See Benhabib and Spiegel (2005) for a review of catching up models.

This paper first shows that the model does not perform remarkably well in replicating South Korean and Turkish data at the benchmark parameter values Lucas (2009) uses. The data is at annual frequency covering the years from 1960 to 2014, and the source of the data is World Development Indicators (World Bank, 2016). The Lucas (2009) benchmark values predict a worse performance for South Korea and a better one for Turkey in catching up with the world technology frontier. Compared with the benchmark economy in Lucas (2009), South Korea is unsurprisingly an over-performer and Turkey is unsurprisingly an under-performer.

Given the lack of a very successful match at the benchmark values, this paper extends the simple model with a new structural parameter. This additional parameter represents a barrier to the catching up process as in Parente and Prescott (1994). It reflects, admittedly in an agnostic way, the time-invariant cultural and institutional characteristics affecting the success of the economy in exploiting the full potential of technology adoption. Denoted by , the parameter predicts how efficiently an economy will adopt more advanced technology. The parameter takes values from the [0,1] interval as in Cohen and Levinthal's (1989: 571) absorptive capacity . Specifically, the minimum at represents the complete shutdown of the catching up process because of blocking inefficiencies, and the maximum at represents the Lucas (2009) benchmark. This benchmark is the case of no structural barriers, i.e., the case of full efficiency.

The results of the extended model matches very successfully both South Korean and Turkish data. The paper carefully calibrates the structural parameters of the extended model including using Turkish and South Korean data on real GDP per capita and the share of the rural population.[5] The results indicate the following: with respect to initial conditions and values of structural parameters, both economies have advantages and disadvantages. Turkey, for example, has a higher level of exogenous productivity in the farm sector, but South Korea enjoys a larger level of spillover elasticity. The most significant contrast, however, is the huge difference in the efficiency parameter. While the South Korean economy operates with an efficiency level very close to its upper bound of unity, Turkey is located at the other end of the efficiency spectrum with an efficiency of less than 0.01. Counterfactual experiments confirm the dominant role of this efficiency parameter against initial conditions and other structural parameters.

This paper also analyzes a version of the extended model where efficiency in technology adoption is an increasing function of average human capital of the labor force as formulated by Nelson and Phelps (1966) and others. Using human capital measurements from Feenstra et al. (2015), the analysis recalibrates all structural parameters of the model where efficiency has now a time-variant component changing with human capital. The results indicate that even though the inclusion of human capital leads to a sizable reduction in the South Korean-to-Turkish efficiency difference, a large difference in efficiency in technology adoption remains as a country 'fixed effect' determined by cultural and institutional factors.

---

[5] This calibration strategy resembles the Simulated Method of Moments as it uses scaled and squared deviations of the time paths of the target variables.

This paper is most directly related to three important papers investigating the sources of relative underperformance of Turkey in the second half of the 20th century through models building upon microeconomic foundations.[6] Adamopoulos and Akyol (2009) construct a two-sector model with distortionary taxes and home production and find that Turkey's underperformance relative to the United States and Southern Europe after the 1960s can be attributed to high tax rates discouraging market hours and to low productivity growth rates. Çiçek and Elgin (2011), presenting an analysis for the 1968–2004 period, emphasize the dominant role of total factor productivity (TFP) as a driver of economic growth and the relevance of capital adjustment costs and time-variant distortionary taxes for the evolution of the real economy. İmrohoroğlu et al. (2014) conclude that, in comparison to countries with similar macroeconomic policies, lower TFP growth rates in both the agricultural and non-agricultural sectors play a role in the relative underperformance of the Turkish economy from 1968 to 2005. The main contribution of this paper to this literature is the identification of mechanisms explaining the endogenous co-evolution of sectoral productivity levels. Thus, it simply complements these papers by making productivity growth endogenous within a dual economy catching up model.

Three other papers that develop, calibrate, and simulate endogenous technology models for the Turkish economy are also related. Yeldan (2012) constructs a small open economy model with human capital and R & D and calibrates the model parameters for an analysis of alternative research policy mixes. The main conclusion is that human capital promoting programs in the short- to medium-run should be complemented with R & D promoting programs in the medium- to long-run. Attar (2013) studies the semi-reduced form of a second-generation Schumpeterian model with product and process innovations for an analysis of fertility changes. His results indicate that TFP growth will have an increasingly dominant role in the near future to sustain economic growth in Turkey, but technological progress in the absence of path-changing reforms is not fast enough to alleviate the adverse effects of population aging. Yılmaz and Saraçoğlu (2016) extend a first-generation Schumpeterian model with a catching up process to analyze how Turkey could avoid being trapped in a state of stagnation. Their results show that the Turkish economy should increase the quality and the quantity of schooling and the share of capital goods in imports to boost its absorptive and innovative capabilities.

The outline of the paper is as follows: the next section studies the simple model, first introducing the theory and then presenting the simulation results. The section following then extends the model with the efficiency parameter , calibrating the structural parameters separately for Turkey and South Korea, and presenting counterfactual experiments building upon this extended model. Another section introduces human

---

[6] Several studies published in the 2000s and 2010s use growth-accounting exercises, decomposition methodologies, and econometric estimations to decipher the sources of economic growth and relative stagnation in Turkey. These include Saygılı et al. (2005), Altuğ and Filiztekin (2006), Altuğ et al. (2008), Saygılı and Cihan (2008), Ismihan and Metin-Ozcan (2009), Atiyas and Bakış (2014), Üngör and Kalafatcılar (2014), and Üngör (2014). While results obtained in this literature are diverse due to differing data sources and methods, two of the emerging messages are less controversial: first, both physical capital accumulation and total factor productivity (TFP) growth are important in explaining economic growth in per capita terms. Second, the role of TFP growth is increasingly more important in the post-1980 period.

capital as a determinant of efficiency, recalibrates the model parameters, and implements some counterfactual analyses. A discussion section collects the main conclusions of the analyses and considers whether institutional differences between South Korea and Turkey can account for large, time-invariant differences in efficiency levels from a statist perspective. A brief, closing section presents some final remarks.

The Simple Dual Economy

Theory

This subsection introduces the dual economy model constructed by Lucas (2009). The only difference with his analysis is that the model time here is discrete. There is a traditional farm sector where land is an essential input. There also exists a modern city sector catching up with the world technology frontier. Both sectors, for simplicity, produce exactly the same commodity, e.g., “GDP,” and both are occupied by perfectly competitive firms. The demographic structure does not complicate the analysis since the model operates with *per worker* variables.

Let $t \in \{0,1,\dots\}$ denote the model time. The key control-like variable of this model, denoted by $x_t \in [0,1]$, is the share of population (and labor force) employed in the farm sector. The key endogenous state variable, on the other hand, is the level of labor productivity in the city sector, denoted by $h_t \in (0,+\infty)$. For a pair (x_t, h_t), the levels of production per worker in the city and the farm sectors respectively satisfy

$$y_{ct} = h_t(1 - x_t) \tag{1}$$

and

$$y_{ft} = A h_t^{\xi} x_t^{\alpha} \tag{2}$$

where $A \in (0,+\infty)$ is a fixed parameter that positively affects labor productivity in the farm sector. The latter also increases as a result of productivity growth in the city sector given the spillover parameter $\xi \in (0,1)$. That the labor elasticity α in the farm sector is between implies its dependence on the land input. For simplicity, land per worker is fixed and incorporated in A.

Under the assumption that labor is free to move across sectors, the equilibrium allocation of labor across sectors is simply the one that solves the problem of

$$\max_{x_t} \left[h_t(1 - x_t) + A h_t^{\xi} x_t^{\alpha} \right]. \tag{3}$$

The unique (interior) solution given h_t satisfies

$$x_t = x(h_t) \overset{\text{def}}{=} \left(\frac{\alpha A}{h_t^{1-\xi}} \right)^{\frac{1}{1-\alpha}}, \tag{4}$$

and real GDP per capita, denoted by y_t, clearly satisfies

$$y_t = y(h_t) \overset{\text{def}}{=} y_{ct} + y_{ft} = h_t[1 - x(h_t)] + Ah_t^{\xi}[x(h_t)]^{\alpha}. \tag{5}$$

What governs the process of economic development in this static resource allocation framework is simply the growth of h_t. Provided that h_t keeps growing for large t, an increasing fraction of labor would be employed in the city sector. The farm sector then disappears asymptotically, i.e.,

$$h_t \rightarrow +\infty \Rightarrow x(h_t) \rightarrow 0. \tag{6}$$

The labor productivity h_t in the city sector grows because the firms in this sector catch up with foreign firms operating with frontier technology. $H_t \in (0, +\infty)$denotes the level of labor productivity corresponding to the world technology frontier. The $\{H_t\}_t$ sequence is exogenous to the dual economy model, and H_t exhibits perpetual growth at the fixed (percentage) rate μ, i.e.,

$$\frac{H_{t+1}}{H_t} = 1 + \mu. \tag{7}$$

Given H_t and $x(h_t)$ at the end of period , t, h_{t+1} satisfies a law of motion postulated as

$$\frac{h_{t+1}}{h_t} = 1 + \mu[1 - x(h_t)]^{\zeta}\left(\frac{H_t}{h_t}\right)^{\theta} \tag{8}$$

where $\zeta \in (0, +\infty)$ and $\theta \in (0,1)$ are fixed parameters.

This catching up technology works as follows: first, being a laggard country in technology is an opportunity in technology adoption; the relative backwardness term $(H_t/h_t)^{\theta}$ positively affects the growth of h_t where θ indicates the strength of frontier technology spillovers. As is usually taken for granted in the literature of catching up models, a larger potential for technology adoption implies, ceteris paribus, a larger level of actual "exploitation" of this potential.

The second notion here is that, in "exploiting" the given potential of technology adoption, the dual economy enjoys an agglomeration effect in cities. When a larger fraction $1 - x(h_t)$ of the population is in the city sector given (α, A, h_t), the growth rate of h_t is larger. This, as Lucas (2009: 15) emphasizes, is due to "*the role of cities as centers of intellectual interchange and as the recipients of technological inflows*." Put differently, the dual economy faces a drag imposed by the gradual decline of the farm sector; technically, we have $[1 - x(h_t)]^{\zeta} < 1$ for any h_t.

Notice that, for any given pair (h_0, H_0) of initial values of the state variables naturally satisfying $h_0 < H_0$, we can easily solve for the unique dynamic equilibrium of the model. The end result is that the growth rate of h_t in the dual economy converges to the same perpetual (percentage) rate μ of the world technology frontier as t diverges to $+\infty$. Asymptotically, this transition also witnesses the convergence of $x(h_t)$ to 0 and h_t of to H_t. In other words, the follower country catches up in the long run.

Data and Simulations

This subsection evaluates the empirical performance of the simple dual economy model for South Korea and Turkey. As in Lucas (2009), the country representing the world technology frontier is the United States, with H_t simply denoting real GDP per capita in this country. South Korea and Turkey, on the other hand, are two follower countries, with initial levels of h_t satisfying $h_0^{\mathrm{TUR}} < H_0$ and $h_0^{\mathrm{KOR}} < H_0$.

The task of this section is to see how closely the simulated sequences for the observed variables keep track of their empirical counterparts at the benchmark parameter values Lucas (2009) uses. For a meaningful match, one needs to correctly initialize the South Korean and Turkish economies using the model equations and the relevant data points.

Table 1

Common Values for the Simple Model

	Symbol	Support	Value	Source / Comment / Target
frontier growth rate, H	μ	$(0, +\infty)$	0.02	Estimated via OLS
farm technology, x	α	$(0,1)$	0.60	Lucas (2009, Sec. IV)
farm technology, h	ξ	$(0,1)$	0.75	Lucas (2009, Sec. IV)
catching up, $1 - x$	ζ	$(0, +\infty)$	1.00	Lucas (2009, Sec. IV)
catching up, H/h	θ	$(0, +\infty)$	0.65	Lucas (2009, Sec. IV)

Notes: This table collects the values Lucas (2009) uses to match both cross-section and time-series data. The value for the frontier growth rate follows from the OLS regression in the form of $\log(H_t) = \log(H_0) + \log(1 + \mu) \times t + u_t$ where H_t simply denotes real GDP per capita in the United States at 2005 constant US dollars and u_t is an i.i.d. normal variable with zero mean and constant variance. The estimated value, $\mu = 0.0207$, is only slightly larger than the value of 0.02 used by Lucas (2009).

The quantitative analysis of the model uses observed values of x_t and y_t at an annual frequency for the period of 1960–2014 from the World Development Indicators (World Bank, 2016).[7] Thus, it is natural to match with the year 1960 in the sample. Then, given the benchmark parameter values collected in Table 1, two model equations defining x_t and y_t as functions of h_t simultaneously identify the pair $\left(A^{\mathrm{i}}, h_0^{\mathrm{i}}\right)$ for all $\mathrm{i} \in \{\mathrm{TUR}, \mathrm{KOR}\}$. Specifically, for all $\mathrm{i} \in \{\mathrm{TUR}, \mathrm{KOR}\}$, we have

$$A^{\mathrm{i}} = \left\{ \frac{y_0^{\mathrm{i}}}{\left[\alpha\left(x_0^{\mathrm{i}}\right)^{-(1-\alpha)}\right]^{\frac{1}{1-\xi}}\left(1-x_0^{\mathrm{i}}\right)+\left[\alpha\left(x_0^{\mathrm{i}}\right)^{-(1-\alpha)}\right]^{\frac{\xi}{1-\xi}}\left(x_0^{\mathrm{i}}\right)^{\alpha}} \right\}^{1-\xi} \tag{9}$$

and

$$h_0^{\mathrm{i}} = \left(\frac{\alpha A^{\mathrm{i}}}{\left(x_0^{\mathrm{i}}\right)^{1-\alpha}}\right)^{\frac{1}{1-\xi}} \tag{10}$$

---

[7] For both countries, y_t is simply GDP per capita in constant 2005 U.S. dollars, and x_t is derived by taking $1 - x_t$ as the share of the urban population from the original data source.

Table 2

Country-Dependent Values for the Simple Model

	Symbol	South Korea	Turkey	Source / Comment / Target
initial rural population share	x_0	0.72	0.68	Data
initial GDP per capita	y_0	1,106.75	2,345.64	Data
initial productivity, city	h_0	746.83	1,610.39	Initial values (x_0, y_0)
exogenous productivity, farm	A	7.65	9.07	Initial values (x_0, y_0)

Notes: This table collects the initial values (x_0, y_0) and the calibrated values (A, h_0) for each country for the simple model.

Table 2 shows the resulting values for h_0^{i} and A^{i} as well as the input values of x_0^{i} and y_0^{i}. These indicate that, if South Korea and Turkey did have the same microeconomic structure characterized by the parameter values reported in Table 1, Turkey in 1960 must have had a larger city sector productivity and a larger exogenous productivity in the farm sector. The reversal story of South Korea and Turkey is indeed an interesting case of comparative economic development.

Figures 2 and 3 picture the main results of this section. Figure 2's bottom panel shows that the Lucas (2009) benchmark initialized for South Korea exhibits a poorer economic growth performance than South Korea's actual growth. The mismatch is increasingly more pronounced after 1970s, and the share of rural population is not very successfully matched for the entire sample except in the 1990s.

Figure 2

South Korea and the Lucas (2009) Benchmark

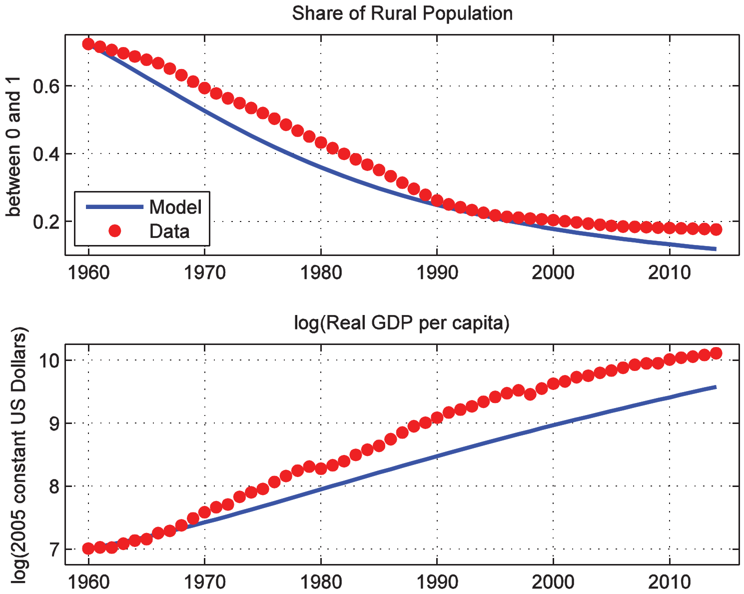


Figure 3

Turkey and the Lucas (2009) Benchmark

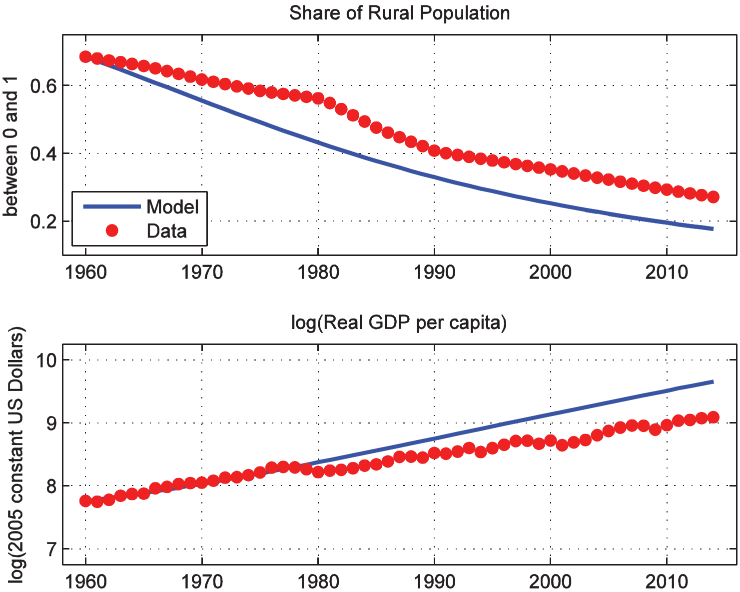


Figure 3 shows analogous images for Turkey. The Lucas (2009) benchmark is not very successful in explaining the pace of economic growth and urbanization in Turkey, with discrepancies becoming more visible after the 1980s. Turkey in fact grew consistently slower than the benchmark economy, and the level difference keeps increasing into the present day.

Inefficiency in Technology Adoption

An Extension

The simple dual economy model studied above teaches us a lot about technology adoption and catching up. A relatively backward economy has a potential advantage in quickly diminishing its distance to frontier $H_t - h_t$. The existence of a dual economy within such a framework plays a central role for the model economy to match the data satisfactorily well: the knowledge spillovers from the city to the farm sector slow down the rural-urban migration, and this drag on technology adoption implies more realistic initial growth rates for the follower countries; see Lucas (2009).

But the simple model's prediction that there are underperformers such as Turkey relative to the Lucas (2009) benchmark suggests another plausible drag. What if a follower economy does face deep, structural barriers to technology adoption as emphasized by Parente and Prescott (1994)? What if cultural and institutional features of a society affect the level of efficiency at which its economy is catching up with the leader? What if inefficiency in technology adoption, due to structural features not quite easily changed over time, act to block the process of catching up?

This section of the paper shows that a significant contrast between South Korea and Turkey may indeed be the difference in the associated efficiency levels. This result follows from a secondary evaluation of the dual economy model extended in a straightforward way.

First, a time-invariant parameter $\eta \in [0,1]$, representing the level of efficiency in technology adoption, extends the technology of catching up as in

$$\frac{h_{t+1}}{h_t} = 1 + \eta\mu[1 - x(h_t)]^{\zeta} \left(\frac{H_t}{h_t}\right)^{\theta}. \tag{11}$$

Here, then, $\eta = 0$ represents the complete shutdown of technology adoption, and $\eta = 1$ represents full efficiency. The interior values with an increasing level of η simply indicate increasing levels of efficiency.

The second task achieved in this section is to recalibrate all the parameters of the model including η, for both South Korea and Turkey, to find the best possible match between the extended model and the corresponding data on observed variables. It is this calibration exercise that allows us to infer the microeconomic structures of Turkey and South Korea in a simple but rigorous way; the exercise returns country-dependent values not only for A and h_0 but also for ξ, ζ, θ, and η.

The quantitative algorithm works as follows: let $\boldsymbol{\phi}^{\mathrm{i}} \overset{\mathrm{def}}{=} (\xi^{\mathrm{i}}, \zeta^{\mathrm{i}}, \theta^{\mathrm{i}}, \eta^{\mathrm{i}})$ denote the vector of structural parameters for each of the follower countries where $\mathrm{i} \in \{\mathrm{TUR}, \mathrm{KOR}\}$. Set $\alpha^{\mathrm{TUR}} = \alpha^{\mathrm{KOR}} = \alpha = 0.6$ as in Lucas (2009) since the observed variables turn out to be not informative for this technology parameter. Also, set $\mu = 0.0207$ as before since extending the simple model does not affect how the world technology frontier evolves in time. Then, for any given pair $(\alpha, \boldsymbol{\phi}^{\mathrm{i}})$ of structural parameters, $(A^{\mathrm{i}}, h_0^{\mathrm{i}})$ pair for country $\mathrm{i} \in \{\mathrm{TUR}, \mathrm{KOR}\}$ follows from the data points x_0^{i} and y_0^{i} exactly as in the previous section. Moreover, the simulations of the observed variables can simply be calculated using the forward recursion of the model economy. Let these sequences be conveniently denoted by

$$\{y_t^{\mathrm{i}}(\boldsymbol{\phi}^{\mathrm{i}}), x_t^{\mathrm{i}}(\boldsymbol{\phi}^{\mathrm{i}})\}_t,$$

and notice that the algorithm returns a unique collection of these sequences for any given $\boldsymbol{\phi}^{\mathrm{i}}$. Thus, a numerical optimization problem in the form of

$$\min_{\boldsymbol{\phi}^{\boldsymbol{i}} \in \boldsymbol{\Phi}} Q^{\mathrm{i}} = Q(\boldsymbol{\phi}^{i}) \overset{\mathrm{def}}{=} \sum_{r=1}^{R} \left[\frac{y_r^{\mathrm{i}} - y_r^{\mathrm{i}}(\boldsymbol{\phi}^{\mathrm{i}})}{(0.5)\left(y_r^{\mathrm{i}} + y_r^{\mathrm{i}}(\boldsymbol{\phi}^{\mathrm{i}})\right)}\right]^2 + \sum_{r=1}^{R} \left[\frac{x_r^{\mathrm{i}} - x_r^{\mathrm{i}}(\boldsymbol{\phi}^{\mathrm{i}})}{(0.5)\left(x_r^{\mathrm{i}} + x_r^{\mathrm{i}}(\boldsymbol{\phi}^{\mathrm{i}})\right)}\right]^2 \tag{12}$$

would return an optimal point $\boldsymbol{\phi}^{\mathrm{i}}$ if it exists and is numerically identified.

Here, $\{y_r^{\mathrm{i}}, x_r^{\mathrm{i}}\}_r$ is the collection of observed data sequences where $r = 1$ corresponds to $t = 1961$ and $r = R$ to $t = 2014$ in the sample. $\boldsymbol{\Phi}$, a subset of $\mathbb{R}^4$, is a compact set enlarged after a couple of evaluations of the algorithm in order to ensure convergence to an interior point; this choice set must ideally be large enough to avoid the convergence to boundary points that are usually implausible from an economic point of view. The initial point $\boldsymbol{\phi}^{\mathrm{i}}_{(\mathbf{0})}$ of the numerical optimization problem sets the values of $(\xi^{\mathrm{i}}, \zeta^{\mathrm{i}}, \theta^{\mathrm{i}})$ to the values of the Lucas (2009) benchmark and of η^{i} to simply 0.5.[8]

Figures 4 and 5 and Table 3 summarize the main results of this section. Starting from the first row of Table 3, South Korea seems to have been enjoying a slightly larger productivity spillover parameter ζ in the farm sector. Also slightly larger in South Korea is the drag parameter ξ but this implies a city sector productivity growth advantage on the side of Turkey since $[1 - x(h_t)]^{\zeta} < 1$ for any h_t.

While the calibrated values of these two parameters seem to be close to each other in South Korea and Turkey, the next two parameters exhibit large differences. The catching up parameter θ governing the effect of the distance to the frontier is considerably larger for Turkey. This indicates an advantage for Turkey since the distance to the frontier satisfies $H_t/h_t > 1$. That Turkey has a larger productivity growth elasticity with respect to H_t/h_t is perhaps surprising at first glance, but such a finding actually demonstrates why our inferences should follow from rigorous calibrations of models with microeconomic foundations.

Most importantly, the largest difference in favor of South Korea is obtained for the efficiency parameter η, whose higher values directly imply higher growth rates of city sector productivity. In fact, the results indicate that South Korea attained a level of efficiency in technology adoption that is extremely close to its upper bound of unity. In stark contrast, the level of efficiency for Turkey is around 0.12%. This roughly means that, while South Korea adopts almost all of its technological opportunity in any given year, Turkey performs very poorly and is located at the other extreme of the efficiency spectrum, shrinking by a miniscule fraction its distance to the frontier.

Table 3

Country-Dependent Values for the Extended Model

	Symbol	South Korea	Turkey
farm technology, h	ξ	0.8281	0.7712
catching up, $1 - x$	ζ	4.6168	4.0308
catching up, H/h	θ	1.9053	4.5301
efficiency	η	0.9999	0.0012
exogenous productivity, farm	A	4.5651	7.7581

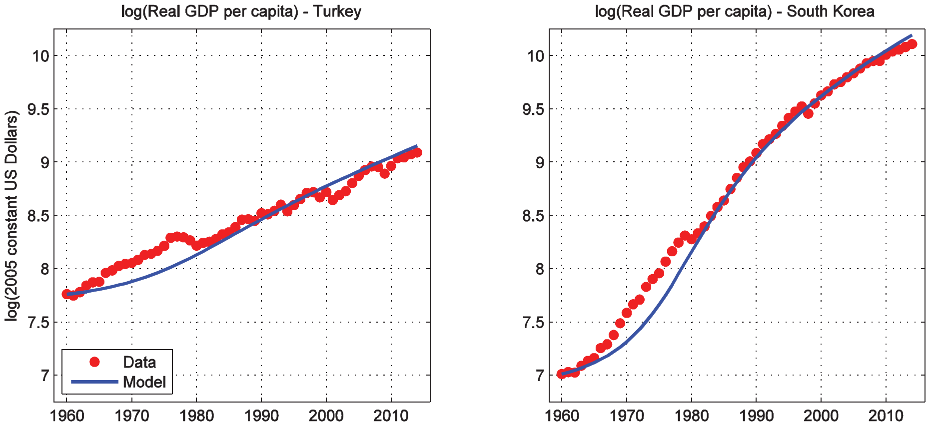
Notes: This table collects the (re)calibrated structural parameters for each country for the extended model.

---

[8] Ensuring that the global minimum of $Q(\cdot)$ exists and is unique is in general not a very straightforward task for such algorithms. However, mainly because control-like variables are not piecewise functions of the endogenous state variable h_t, the algorithm converges quickly in all of the runs with successful matches in both the Turkish and South Korean cases. Besides, calibration targets are informative for the parameters since the optimal point is coordinate-wise different than the initial point $\boldsymbol{\phi}^{\mathrm{i}}_{(\mathbf{0})}$.

Figure 4

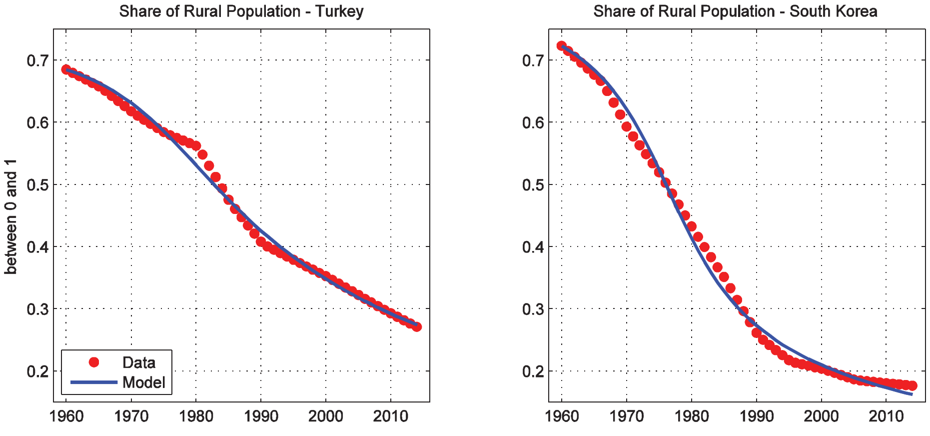
Real GDP per capita in the Extended Model



Finally, the table also reports the resulting recalibrated values of *A* that respond to the values of other parameters. Turkey here is the advantageous country as reflected in its initially superior position in terms of lower rural population share and higher real GDP per capita level.

Figure 5

The Share of Rural Population in the Extended Model



That the extended model is a good enough representation of reality, or at least that it is better than the Lucas (2009) benchmark, is visible from Figures 4 and 5. Careful examinations of these figures and comparisons with the corresponding figures of the simple model reveal that extending the model with η and formally calibrating the structural parameters in a country-wise manner allow the theory to get the *shape* of transitions remarkably well. For both countries, the calibrated trajectories of real GDP per capita are quite close to their data counterparts especially after the 1980s. This also reflects the extended model's success in correctly identifying the growth slowdowns for both countries even though the slowdown is much more pronounced in South Korea for the period after 1990.

Figure 6

City Sector Productivity in the Extended Model

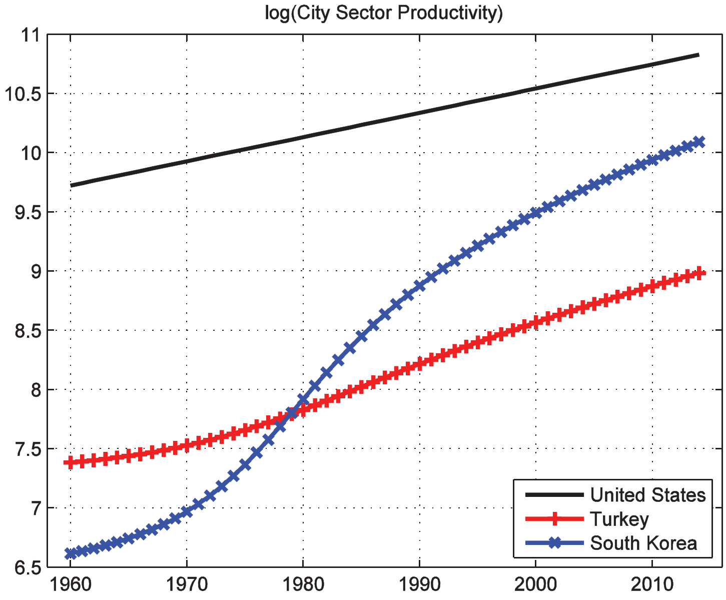


Figure 6, the last piece of this section, pictures the implied city productivity levels for both countries and the United States in logarithmic terms. Here, the logic of the growth slowdowns becomes fully transparent as it is simply implied by the logic of the catching up process: South Korea's growth slowdown is more pronounced simply because the South Korean miracle after the 1960s quickly diminishes the productivity gap between the United States and South Korea, and the percentage growth rate of its city sector productivity starts converging to its minimum of $\eta^{\mathrm{KOR}}\mu$.

Counterfactual Experiments: The Extended Model

We have now an understanding of the most crucial difference between Turkey and South Korea if the extended dual economy catching up model is a sufficiently good approximation of reality: The main problem Turkey has faced appears to be the very low level of efficiency in technology adoption. But can we learn more about the mechanisms in play? Specifically, can we isolate the role of inefficiency from other aspects of the microeconomic structure and the effect of initial conditions?

To provide some answers, this section reports the results of three counterfactual experiments obtained through the simulations of the extended model. A brief description of these experiments is now in order.

The first experiment supposes that structural parameters ξ, ζ, θ, and η in South Korea are exactly equal to those of Turkey, i.e. $\boldsymbol{\phi}^{\mathrm{KOR}} = \boldsymbol{\phi}^{\mathrm{TUR}}$, but it allows for the initial conditions to differ. Therefore, this experiment distinguishes the role of structural parameters affecting the shape and pace of transition from the role of historical starting points.

The second experiment changes only the value of the efficiency parameter η by imposing $\eta^{\mathrm{KOR}} = \eta^{\mathrm{TUR}}$. Hence this experiment isolates the sole effect of inefficiencies in technology adoption.

Finally, the third experiment imagines a South Korean economy where η^{KOR} is equal to some cutoff value such that the two economies attain exactly the same level of real GDP per capita in 2014. It turns out that this cutoff value is approximately equal to 33% of South Korea's benchmark efficiency. Since the latter is very close to unity, the experimented value of η^{KOR} is about 1/3.

Figure 7

Counterfactual Experiments

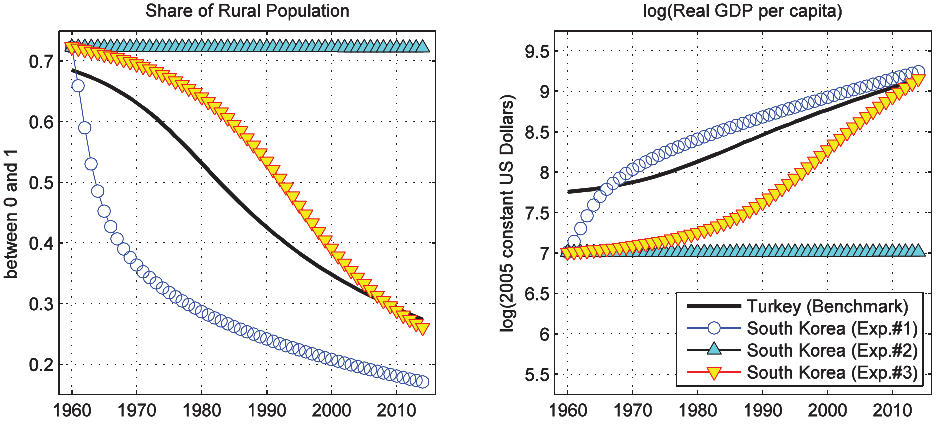


Figure 7 summarizes the main results of the counterfactual analysis; it pictures Turkey's benchmark along with three counterfactual results for South Korea. First notice that structural parameters dominate initial values in determining the long-run evolution of real GDP per capita as South Korea in the first experiment quickly forges ahead of Turkey and converges along the same growth path. Here, initial values explain why South Korea's economy grows at the very fast pace predicted by such catching up models. The second experiment, isolating the role of inefficiency, clearly indicates that inefficiency is perhaps all that matters for the divergence of South Korea and Turkey within the limitations of the present framework. Put differently, the South Korean economy would not have taken off if its technology adoption practices were limited to the very low level of efficiency seen in Turkey. Finally, we also learn that a counterfactual efficiency level of 1/3 for an economy such as South Korea significantly alters the rate of growth and urbanization. South Korea in this third experiment does not forge ahead of Turkey before 2014.

Inefficiency in Technology Adoption and Human Capital

The analysis above builds upon a framework where inefficiency in technology adoption, while allowed to vary from one country to another, is fixed for any country in time. This section investigates whether the poorer catching up performance of Turkey relative to South Korea can partially be attributed to human capital differences.

The Human Capital Model

Efficiency in technology adoption is assumed here to be an increasing function of human capital per worker. An extensive theoretical and empirical literature after Nelson and Phelps (1966) suggests that efficiency in technology adoption (or the absorptive capacity) is positively associated, among other things, with average human capital of the labor force.[9]

Imagine, then, an extended framework where the efficiency parameter η is no longer exogenous and constant but instead an increasing function of human capital per worker, e.g., $\eta_t \equiv \eta \times f(\text{Human Capital}_t)$ with $\eta, f' > 0$. More specifically, let $q_t^i > 0$ denote the average quality (or human capital) of the labor force in country i $\in \{\text{TUR}, \text{KOR}\}$ at time t, and suppose that we have

$$\eta_t^i = \eta^i \left(q_t^i\right)^{\omega^i} \tag{13}$$

where the time-variant efficiency term η_t^i of country i $\in \{\text{TUR}, \text{KOR}\}$ has both a fixed, country-dependent component $\eta^i > 0$ that reflects the role of broadly-defined institutional factors and a time-variant component that increases with q_t^i endogenously. In this specification, it is assumed that $\omega^i > 0$, which partially determines the effect of q_t^i on η_t^i, is also country-dependent.[10]

Estimates of average human capital per worker for both South Korea and Turkey are readily available from the Penn World Table data of Feenstra et al. (2015). These rigorous estimates build upon various sources on average years of schooling and returns to education. Figure 8 pictures the evolution of average human capital per worker for Turkey and South Korea. Clearly, the South Korean average is about two times larger than that of Turkey in the 1960s, and the difference slightly grows in time. There thus exists a persistent level difference as well as an increasingly more discernible difference in growth rates of average human capital levels.

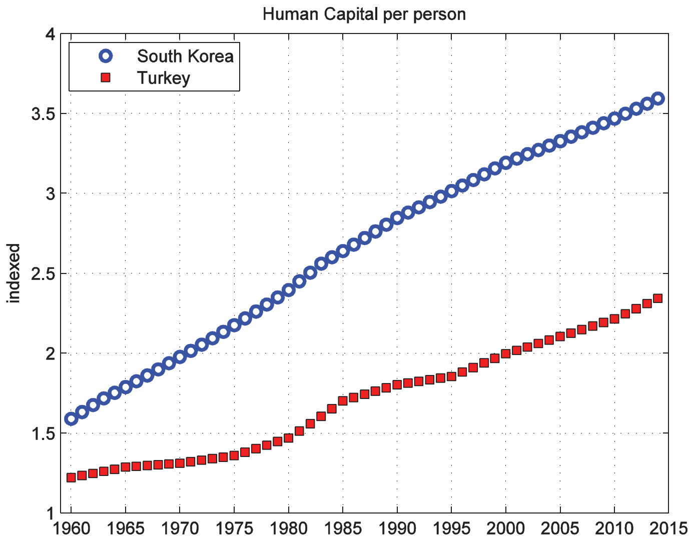
---

[9] Benhabib and Spiegel's (2005) chapter in *Handbook of Economic Growth* is the classic reference for the literature on human capital and technology adoption. The authors cite several empirical papers supporting the Nelson-Phelps view, and they also analyze the theoretical properties of different technology adoption models. See Stokey (2015) for an illuminating theoretical analysis.

[10] Also note the following: first, the curvature parameter ω^i is not restricted to be smaller than unity. Thus, in principle, any type of "efficiency" return from human capital is allowed. Second, the specification in (13) implies that a country is not fully inefficient in technology adoption (i.e., $\eta_t^i \neq 0$) if q_t^i, however small, is positive; q_t^i should not be equal to zero due to innate abilities and/or raw skills in theory and is not equal to zero in the Penn World Table data of Feenstra et al. (2015).

Figure 8

Human Capital in South Korea and Turkey



Data Source: Feenstra et al. (2015)

The task now is to implement the calibration exercise for each country when the model is fed directly with q_t^i data of country i ∈ {TUR, KOR}. Note that $\boldsymbol{\phi}^{\mathbf{i}}$ is now being extended to include ω^i. The initial value for this parameter is set to unity, and the support is capaciously bounded between 0 and 2.

Figure 9

Efficiency in Technology Adoption vs. Human Capital

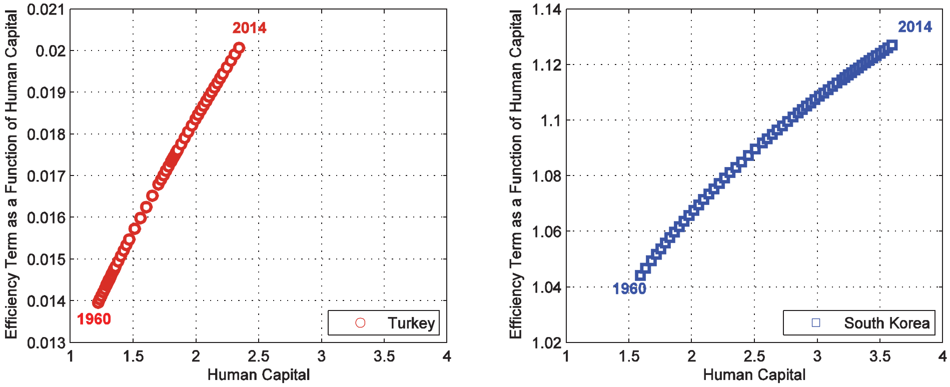


Table 4

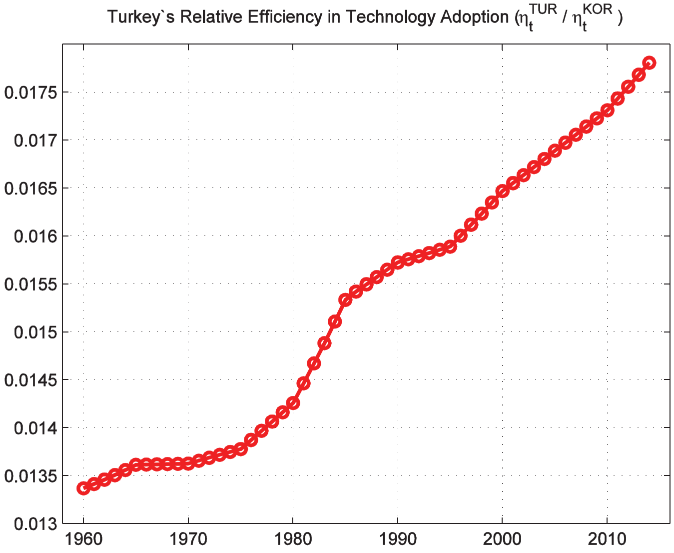
Country-Dependent Values for the Human Capital Model

	Symbol	South Korea	Turkey
farm technology, h	ξ	0.8301	0.7811
catching up, $1-x$	ζ	4.5329	2.7259
catching up, H/h	θ	1.8632	2.9723
efficiency, fixed	η	0.9999	0.0125
efficiency, human capital (q)	ω	0.0935	0.5571
exogenous productivity, farm	A	4.5038	7.2127

Notes: This table collects the (re)calibrated structural parameters for each country for the human capital model.

Figure 10

Efficiency Dynamics: Turkey relative to South Korea



The main results for the human capital model are summarized in Table 4 and Figures 9 and 10.[11] The table collects the newly calibrated parameter values for both South Korea and Turkey. The results are mostly in line with those originating from the extended model without human capital differences. For instance, the spillover parameter ξ is still

---

[11] The calibration algorithm performs well for both countries as in the previous section. Omitted figures that compare and contrast model versus data counterparts of real GDP per capita and the share of rural population are quite similar to the ones pictured in Figures 4 and 5.

larger for South Korea, and the elasticity of the distance to frontier term (H/h) is still higher for Turkey. However, nontrivial differences across countries exist regarding the parameter pair (η, ω) that determines efficiency in technology adoption. First, while a remarkably large difference between South Korea and Turkey in terms of the fixed component of efficiency represented by η is still present, this difference is being reduced from about 833-fold to about 80-fold in the human capital model. Put differently, the model ignoring human capital differences between South Korea and Turkey vastly overpredicts the time-invariant differences in efficiency levels. Second, the elasticity of efficiency with respect to human capital represented by ω is about 6 times higher in Turkey. This results in a much flatter efficiency as a function of human capital in Turkey as pictured in Figure 9 than South Korea's, which is much more curved.

Note that the efficiency term η_t^{TUR} for Turkey remains remarkably lower than the corresponding term for South Korea at all years even though extending the model with human capital considerably decreases the ratio $\eta^{\mathrm{KOR}}/\eta^{\mathrm{TUR}}$ of exogenous efficiency components. In 1960, the efficiency term in South Korea is about 75 times larger while this number decreases only to 55.8 in 2014. Figure 10 pictures the evolution of relative efficiency for Turkey, i.e., $\eta_t^{\mathrm{TUR}}/\eta_t^{\mathrm{KOR}}$. In time, Turkey keeps decreasing its efficiency gap with South Korea, but the pace of this convergence is visibly lower for the 1960–1975 and the 1985–1995 episodes.

Counterfactual Experiments: The Human Capital Model

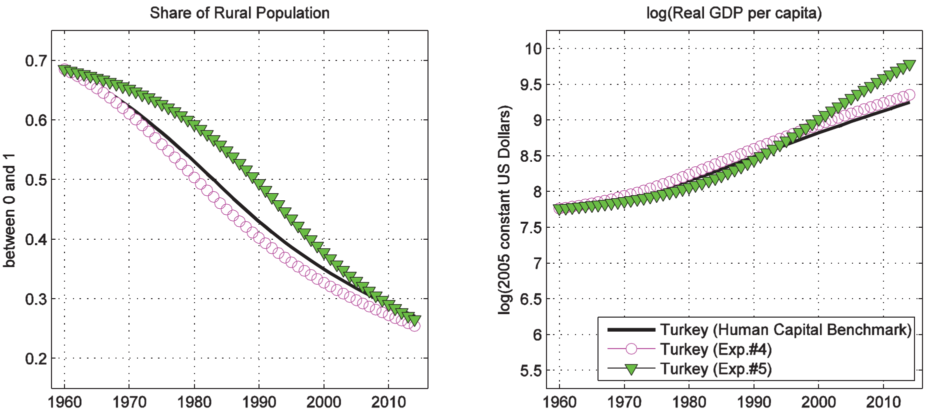
To get a better understanding of the effects of human capital, this subsection reports the results of two counterfactual experiments. The design of these experiments, i.e., Experiments 4 and 5, are similar in spirit to those implemented in the previous section.

Here, in Experiment 4, we simulate the human capital model for Turkey where counterfactual Turkey has a (micro)economic structure characterized by Turkey's parameter values but endowed with South Korean human capital at all years. Then, in Experiment 5, the reversed case is simulated where counterfactual Turkey is endowed with her own human capital but characterized with South Korean structural parameters.

Figure 11 shows the simulated sequences of real GDP per capita and the share of the rural population for Experiments 4 and 5 and for the benchmark of Turkey. Comparing counterfactual Turkey cases of Experiment 4 and 5 (circles and triangles respectively) with the benchmark of Turkey (solid line) allows us to see the isolated effects of human capital and of structural parameters for technology adoption. Notice that since human capital enters the model by partially determining the efficiency of technology adoption only, observed effects are of a second-order nature; counterfactually higher values of human capital do not have direct output effects. Considering large human capital differences between South Korea and Turkey, we can conclude that efficiency gains for Turkey due to higher levels of human capital are minor. The counterfactual Turkey of Experiment 5, having her own human capital endowment but otherwise being identical to South Korea, is slightly poorer until mid-1990s but grows significantly faster in the long run.

Figure 11

Counterfactual Experiments in the Human Capital Model



The overall conclusion here is that the level of human capital *per se* does not significantly alter the growth path of the economy in the long run. What matters most for the growth path is still the fixed, country-dependent component η^i.

Discussion

The analysis presented above offers a few conclusions about the experience of economic development in South Korea and Turkey. First, the dual economy catching up model of Lucas (2009) is not extremely successful in explaining the diverging paths of South Korea and Turkey at the common benchmark values. Second, when this simple model is parsimoniously extended with a country-dependent efficiency term, the extended model performs remarkably well for both countries. Crucially, this extended model shows that the two countries differ most significantly with respect to the level of efficiency in technology adoption. South Korean efficiency is 833 times higher than Turkey's, with country-dependent "fixed effects" being decisive. Third, one further extension—making efficiency a function of human capital—shows that the fixed component of efficiency, albeit modified considerably, is about 80 times higher in South Korea. Finally, counterfactual experiments in the human capital model show that it is this fixed, country-dependent component of efficiency, not the human capital level, that significantly alters the long-run growth rate of the economy. The key task is thus to understand which particular deep causes are at the root of such efficiency differences.

The particular mechanisms explaining the South Korean economic miracle may help us understand why Turkey has had a remarkably low level of efficiency in technology adoption. In one of the most comprehensive accounts of technological capability building in South Korea, Kim (1993) includes (i) strategic import substitution and export promotion policies and (ii) the government's involvement in the establishment of big companies among the main areas in which South Korea differed most from other newly industrialized countries. From the statist perspective, the South Korean state played the enabling role in these two areas as a developmental state that coordinates and regulates economic activity (Amsden, 1989, 2001; Wade, 1990; Rodrik, 1994, 1995; Evans, 1995; Kang, 2002; Chang, 2007). What follows is a brief, comparative account of how the South Korean state successfully directed strong technological capability building after the 1960s when the Turkish state failed to do so.[12]

The South Korean state's success in strategic import substitution and export promotion policies is one of the foremost defining characteristics of the country's economic miracle. In Amsden's (1989: v) words, state interventions deliberately got the relative prices "wrong" as these prices, determined through subsidies and protection decisions, basically governed what, when, and how much to produce (Amsden, 1989: 144). Rodrik (1995: 55) likewise describes how South Korea and Taiwan grew rich by "getting interventions *right*." In South Korea, different industries were under protection and promotion schemes in different times; Kim (1993: 362) underlines that, in the 1960s, the strategy was to protect and promote the plywood, textile, consumer electronics, and automobile industries, but the strategic sectors were steel, shipbuilding, construction, and machinery in the 1970s. Interestingly, some sectors were selected for import substitution even after the Korean development strategy transitioned to export orientation (Şenses, 1996: 103). Perhaps most importantly, governments in South Korea were successful in sustaining exporting as a performance standard and in implementing tax penalties on businesses when export targets were not met (Rodrik, 1994: 41). The Turkish path differs from the Korean in a number of ways. First, strategic trade policy in Turkey transitioned from import substitution to export orientation in 1980. This is about a decade later than the time South Korea initiated strategic export promotions, and being late may have adversely affected technological capability building in Turkey relative to South Korea (Öniş and Şenses, 2007). Second, the expansion of export volume in Turkey in the 1980s was largely due to increased capacity utilization and the Iran-Iraq war (Celasun and Rodrik, 1989), and production and investment flows in manufacturing remained below the expansion in the volume of exports (Kepenek and Yentürk, 2008). While structural transformation and investment increases were key aspects of South Korean development as discussed by Rodrik (1995), Turkey's development witnessed a slower pace of industrialization since then. A third noteworthy difference between South Korean and Turkish trade policy is the degree of effectiveness in implementing strategic export promotion. Rodrik (1994: 41) explains the Turkish disadvantage in this respect by citing Krueger and Aktan (1992) on how exporting firms in Turkey faced no tax or exclusion penalties when they failed to meet export targets in a given year.

---

[12] Two other areas of relevance, according to Kim (1993), are education and foreign technology imports. In education, the most important qualitative difference between South Korea and Turkey seems to be that a high fraction of business and government personnel in South Korea had access to overseas training since as early as the 1950s (Kim, 1993). In Turkey, this was limited mostly to the mobility of academic personnel. Regarding foreign technology imports, flows of foreign direct investment and foreign licensing were limited in both countries during 1960s and 1970s. The Turkish disadvantage stems mainly from the fact that the share of capital goods imports in total declined from over 40% to levels slightly higher than 20% in Turkey after the 1980s (Conway, 1987). As noted in the Introduction, Yılmaz and Saracoğlu's (2016) analysis for Turkey indicates that there exist large absorptive capacity gains from increasing education quality and increasing capital goods imports.

The establishment of big companies called “chaebols” in South Korea was a key complement of strategic trade policy. Similar to the Japanese Zaibatsu, chaebols owned by elite Korean families became defining actors of South Korean development after the 1960s. Receiving generous financial support from commercial banks nationalized after 1961 and benefiting from strategic trade policy actions, chaebols exhibited fast growth with respect to the volume of exports. In 1982, the total export share of the 10 biggest chaebols was around 58% (Koo, 1984). Accompanying this growth was a high degree of capital concentration, and market structures were far from being competitive. This corporatist stance contaminated with corrupt practices contradicted the South Korean tradition of an egalitarian society, but the state-business relationships reduced transaction costs considerably (Kang, 2002). The crucial thing here is that these big chaebols increased their technological learning and absorptive capacities as they were operating in foreign markets since as early as the 1970s. Exactly as in the imitation-to-innovation strategy of Acemoğlu et al. (2006), big chaebols such as Samsung and Hyundai eventually became world leaders in technology. In Turkey, holding companies owned by elite families were the closest things to Korean chaebols. According to Buğra (1994: 222), the major difference lies in the fact that the South Korean state was a mechanism of stability but, in contrast, the Turkish state was a major risk factor in business life. One reason for weaker state autonomy in Turkey is the Turkish state’s much more limited control over the financial system and, hence, over the holding companies, and Buğra (1994: 223) underlines the Turkish state’s failure to implement necessary policy mixes in a timely manner. Oh and Varcin (2002) characterize both South Korea and Turkey as similar top-down mafioso states and argue that Korean chaebols and Turkish holding companies were organizational forms of private business corporations created under similar conditions. An important difference in big business performance, however, exists mainly because military coups were much more frequent and militarist regimes had much shorter durations in Turkey after 1960s. Last but not least, Öniş and Şenses (2007) describe the Turkish developmental state as a fragmented one as it did not possess a strong autonomy as seen in East Asia; eventually the Turkish state was not able to coordinate the actions of holding companies.

Concluding Remarks

This paper studies a challenging problem of comparative development. This is the problem of finding the causes of the divergent experiences of economic development in Turkey and South Korea in the second half of the 20th century. Even though Turkey had clear advantages and more promising prospects for development at the beginning of the 1960s, world economic history has recorded a growth miracle for South Korea and missed opportunities for Turkey. South Korea has transformed itself into an innovative economy, converging with the world technology frontier in only a couple of decades. Turkey, however, has attained a limited success and lagged behind other emerging market economies that have achieved high growth rates.

Identifying the proximate causes of this reversal story is very straightforward: R & D inputs and outputs, the volume and share of high technology exports, the estimated levels of human capital, and productivity statistics clearly indicate the South Korean success and the Turkish failure. But these are the so-called proximate causes of economic growth; what we really need to do is to take further steps and identify the fundamental causes at work.

The literature that investigates the contrasts between South Korea and Turkey provides us with a truly illuminating narrative of significant differences between the two economies. These differences run all the way from (international) political-economic considerations to cultural endowments. This paper fills a gap in this literature by identifying some microeconomic foundations. The analysis constructs a dual economy catching up model and uses the relevant data that is informative for this model's structural parameters. The purpose of all this is to see exactly where South Korea and Turkey have been and are differing. This is a route that has not been traveled before.

While both economies have advantages and disadvantages, Turkey's relative underperformance against South Korea is primarily associated with Turkey's remarkably low level of efficiency in technology adoption. Importantly, this result is not sensitive to the inclusion of human capital as a determinant of efficiency, and a sizable difference in favor of South Korea remains. A plausible explanation for this remaining difference in efficiency is the differential performances of the South Korean and Turkish states in directing late industrialization through strategic industrial and trade policies. The comparative analysis shows that Turkey was unsuccessful in transforming her big businesses into global innovation machines. This is largely consistent with Arpacı's (2011) survey-based finding that the three most significant obstacles to innovation in Turkey are bureaucracy, the authority of approval, and legislation.

The main consequence of low-efficiency in technology adoption is the slow growth of TFP in the city sector, and this in turn explains why the sectoral transformation of the Turkish economy has been very slow and has left a significant portion of the workforce in agriculture. The present analysis thus resolves two of the three puzzles emphasized by Altug et al. (2008) for the Turkish economy.

The models studied in this paper ignore fertility and population growth. This simplification is clearly not trivial, and much insight can be generated with a richer model where fertility is endogenous. This would not merely add some realism to the analysis; the real contribution would be the opportunity to understand the deep causes of differences in human capital levels and growth rates through the quality-quantity tradeoff in the fashion of, e.g., Becker (1960), Becker and Lewis (1973), Becker et al. (1990), and Galor and Weil (2000). Since fertility and education decisions are taken jointly in such frameworks, the partial roles of preference and technology parameters would be made entirely transparent.[13] A further extension of the model with endogenous fertility dynamics is left for future research.

---

[13] Galor et al. (2009) develop a model with endogenous fertility and endogenous human capital accumulation and argue that land ownership inequality has an adverse effect on development as human capital is not complementary with land input and landowners would not benefit from educational reforms. One of the historical cases that provides strong support for this hypothesis is the South Korean development path where a fast expansion in education and a decline in fertility followed the land reforms of 1948–1950.

References

Acemoğlu, D., Aghion, P. and Zilibotti, F. (2006). "Distance to Frontier, Selection, and Economic Growth," *Journal of the European Economic Association*, 4(1): 37-74.

Adamopoulos, T. and Akyol, A. (2009). "Relative Underperformance *Alla Turca*," *Review of Economic Dynamics* 12(6): 697-717.

Altuğ, S. and Filiztekin, A. (2006). "Productivity and Growth, 1923-2003," in: Altuğ, S. and Filiztekin, A. (eds). *The Turkish Economy: The Real Economy, Corporate Governance and Reform*: 15-62, New York: Routledge.

Altuğ, S., Filiztekin, A., and Pamuk, Ş. (2008). "Sources of Long-term Economic Growth for Turkey, 1880-2005," *European Review of Economic History* 12(3): 393-430.

Amsden, A. (1989). *Asia's Next Giant: South Korea and Late Industrialization*. New York: Oxford University Press.

------, (2001). *The Rise of "The Rest": Challenges to the West from Late-Industrializing Economies*. New York: Oxford University Press.

Arpacı, İ. (2011). "Kamu Kurumlarında Teknolojik İnovasyon ve İnovasyon Politikası (Innovation Policy and Technological Innovation in the Public Administration)," *ODTÜ Gelişme Dergisi*, 38(2), 111-123.

Atiyas, İ. and Bakış, O. (2014). "Aggregate and Sectoral TFP Growth in Turkey: A Growth Accounting Exercise," İktisat İşletme ve Finans, 29(341): 9-36.

Attar, M. A. (2013). *Growth and Demography in Turkey: Economic History vs. Pro-Natalist Rhetoric*. Ankara: TEPAV.

Aydın, Z. (1997). "The Role of the State in Turkish and South Korean Development Experiences," *Turkish Public Administration Annual*, 22-23: 17-44.

Baumol, W.J. (1986). "Productivity Growth, Convergence and Welfare: What the Long-Run Data Show," *American Economic Review*, 76(5): 1072-1085.

Becker, G.S. (1960). "An Economic Analysis of Fertility," in *Demographic and Economic Change in Developed Countries*: 209-231, Princeton: National Bureau of Economic Research.

Becker, G.S. and Lewis, H.G. (1973). "On the Interaction between the Quantity and Quality of Children," *Journal of Political Economy*, 81(2): S279-S288.

Becker, G.S., Murphy, K.M., and Tamura, R. (1990). "Human Capital, Fertility, and Economic Growth," *Journal of Political Economy*, 98(5): S12-S37.

Benhabib, J. and Spiegel, M. (2005). "Human Capital and Technology Diffusion," in: Aghion, P. and Durlauf, S. (eds), *Handbook of Economic Growth Volume 1A*: 935-966. The Netherlands: Elsevier.

Buğra, A. (1994). *State and Business in Modern Turkey: A Comparative Study*. New York: State University of New York Press.

Celasun, M. and Rodrik, D. (1989). "Debt, Adjustment and Growth: Turkey," in: Sachs, J. and Collins, S. (eds), *Developing Country Debt and Economic Performance*: 617-808. Chicago: University of Chicago and NBER.

Cha, D-S., Kim, K.S., Perkins, D.H. (eds) (1997). *The Korean Economy 1945-1995: Performance and Vision for the 21st Century*. Seoul: Korea Development Institute.

Chang, H.-J. (2007). *Bad Samaritans: The Myth of Free Trade and the Secret History of Capitalism*. New York: Bloomsbury Press.

Cohen, W.M. and Levinthal, D.A. (1989). “Innovation and Learning: The Two Faces of R & D,” *Economic Journal*, 99(397): 569-596.

Conway, P. (1987). *Economic Shocks and Structural Adjustments: Turkey after 1973*. New York: Elsevier.

Çiçek, D. and Elgin, C. (2011). “Not-quite-great Depressions of Turkey: A Quantitative Analysis of Economic Growth over 1968-2004,” *Economic Modelling*, 8(6): 2691-2700.

Dornbusch, R. and Park, Y.C. (1987). “Korean Growth Policy,” *Brookings Papers on Economic Activity*, 1987(2): 389-444.

Erdoğdu, M. (1999). “The Turkish and South Korean Automobile Industries and the Role of the State in their Development,” *METU Studies in Development* 26(1-2): 25-73.

Evans, P. (1995). *Embedded Autonomy: States and Industrial Transformation*. Princeton: Princeton University Press.

Feenstra, R.C., Inklaar, R., and Timmer, M.P. (2015). “The Next Generation of the Penn World Table,” *American Economic Review*, 105(10): 3150-3182, URL: www.ggdc.net/pwt.

Galor, O. and Weil, D.N. (2000). “Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond,” *American Economic Review*, 90(4): 806-828.

Galor, O., Moav, O., and Vollrath, D. (2009). “Inequality in Landownership, the Emergence of Human-capital Promoting Institutions, and the Great Divergence,” *Review of Economic Studies*, 76(1): 143-179.

Gerschenkron, A. (1962). *Economic Backwardness in Historical Perspective: A Book of Essays*. Cambridge: Harvard University Press.

Haggard, S., Kim, B.K., and Moon, C.I. (1991). “The Transition to Export-led Growth in South Korea: 1954-1966,” *Journal of Asian Studies*, 50(4): 850-873.

İmrohoroğlu, A, İmrohoroğlu, S., and Üngör, M. (2014). “Agricultural Productivity and Growth in Turkey,” *Macroeconomic Dynamics*, 18(5): 998-1017.

Ismihan, M. and Metin-Özcan, K. (2009). “Productivity and Growth in an Unstable Emerging Market Economy: The Case of Turkey, 1960-2004,” *Emerging Markets Finance and Trade*, 5(5): 4-18.

Kang, D.C. (2002). *Crony Capitalism: Corruption and Development in South Korea and The Philippines*. Cambridge, UK: Cambridge University Press.

Kepenek, Y. and Yentürk, N. (2008). *Türkiye Ekonomisi* (*The Turkish Economy*). İstanbul: Remzi Kitabevi.

Kim, L. (1993). “National System of Industrial Innovation: Dynamics of Capability Building in Korea,” in: Nelson, R.R. (eds). *National Innovation Systems: A Comparative Analysis*: 357-383. New York: Oxford University Press.

Koo, H. (1984). “The Political Economy of Income Distribution in South Korea: The Impact of the State’s Industrialization Policies,” *World Development*, 12(10): 1029-1037.

Krueger, A.O. (1987). “The Importance of Economic Policy in Development: Contrasts between Korea and Turkey,” *NBER Working Paper* No. 2195, Cambridge, MA: National Bureau of Economic Research.

Krueger, A.O. and Aktan, O.H. (1992). *Swimming against the Tide: Turkish Trade Reform in the 1980s*. San Francisco: ICS Press.

Landes, D.S. (1998). *The Wealth and Poverty of Nations*. London: Little, Brown Book Group.

Lucas, R.E. (2009). “Trade and the Diffusion of the Industrial Revolution,” *American Economic Journal: Macroeconomics*, 1(1): 1-25.

Nelson, R.R. and Phelps, E.S. (1966). “Investment in Humans, Technological Diffusion, and Economic Growth,” *American Economic Review*, 56(2): 69-75.

Oh, I. and Varcin, R. (2002). “The Mafioso State: State-Led Market Bypassing in South Korea and Turkey,” *Third World Quarterly*, 23(4): 711-723.

Onaran, Ö. and Stockhammer, E. (2005). “Two Different Export-oriented Growth Strategies: Accumulation and Distribution in Turkey and South Korea,” *Emerging Markets Finance and Trade*, 41(1): 65-89.

Öniş, Z. (1992). “The East Asian Model of Development and the Turkish Case: A Comparative Analysis,” *METU Studies in Development*, 19(4): 495-528.

Öniş, Z. and Şenses, F. (2007). “Global Dynamics, Domestic Coalitions and a Reactive State: Major Policy Shifts in the Post-War Turkish Economic Development,” *METU Studies in Development*. 34(2): 217-250.

Öniş, Z. and Bayram, İ.E. (2008). “Temporary Star or Emerging Tiger? Turkey’s Recent Economic Performance in a Global Setting,” *New Perspectives on Turkey*, 39: 47-84.

Pak, N.K. and Türkcan, E. (2000). “Türkiye – Güney Kore Kalkınma ve Teknoloji Politikaları (Turkey – South Korea Development and Technology Policies),” *Cumhuriyet Bilim Teknik*, July 1st, 2000: 8-10.

Parente, S.L. and Prescott, E.C. (1994). “Barriers to Technology Adoption and Development,” *Journal of Political Economy*, 102(2): 298-321.

Rodrik, D. (1994). “King Kong Meets Godzilla: The World Bank and *The East Asian Miracle*,” in Fishlow, A., Gwin, C., Haggard, S., Rodrik, D. and Wade, R. (eds), *Miracle or Design: Lessons from the East Asian Experience*: 13-54. Washington DC: Overseas Development Council.

------, (1995). “Getting Interventions Right: How South Korea and Taiwan Grew Rich,” *Economic Policy*, 10(20): 53-107.

Saygılı, Ş., Cihan, C., and Yurtoğlu, H. (2005). *Türkiye Ekonomisinde Sermaye Birikimi, Verimlilik ve Büyüme: 1972-2003* (*Capital Accumulation, Productivity and Growth in the Turkish Economy: 1972-2003*). İstanbul: TÜSİAD Yayınları.

------, (2008). *Türkiye Ekonomisinin Büyüme Dinamikleri: 1987-2007 Döneminde Büyümenin Kaynakları, Temel Sorunlar ve Potansiyel Büyüme Oranı* (*The Growth Dynamics of the Turkish Economy: Sources of Growth, Main Problems and the Potential Growth Rate in the Period of 1987-2007*). İstanbul: TÜSİAD Yayınları.

Stokey, N. L. (2015). “Catching Up and Falling Behind,” *Journal of Economic Growth*, 20(1): 1-36.

Şenses, F. (1996). “Gelişme İktisadı ve İktisadi Gelişme: Nereden Nereye? (Development Economics and Economic Development: From Where to Where?),” in Şenses, F. (ed), *Kalkınma İktisadı:* Yükselişi *ve Gerilemesi* (*Development Economics: Its Rise and Fall*): 93-128. İstanbul: İletişim Yayınları.

Şenses, F. and Taymaz, E. (2003). “Unutulan Bir Toplumsal Amaç: Sanayileşme (A Forgotten Social Purpose: Industrialization),” in Köse, A.H., Şenses, F., and Yeldan, E. (eds), İktis*adi Kalkınma, Kriz ve İstikrar* (*Economic Development, Crisis, and Stability*): 429-61. İstanbul: İletişim Yayınları.

Taymaz, E. (2001). *Ulusal Yenilik Sistemi: Türkiye İmalat Sanayiinde Teknolojik Değişim ve Yenilik Süreçleri* (*National Innovation System: Technological Change and Innovation Processes in the Turkish Manufacturing Industry*). Ankara: TÜBİTAK/TTGV/DİE.

Taymaz, E. and Voyvoda, E. (2012). "Marching to the Beat of a Late Drummer: Neo-liberal Industrialization Experience of Turkey Since 1980," *New Perspectives on Turkey*, 7: 83-113.

The Maddison Project (2013). URL: http://www.ggdc.net/maddison/maddison-project/home.htm.

Üngör, M. (2014). "Some Observations on the Convergence Experience of Turkey," *Comparative Economic Studies*, 56(4): 696-719.

Üngör, M. and Kalafatcılar, K. (2014). "Productivity, Demographics, and Growth in Turkey: 2004-2012," *Ekonomi-tek*, 3(1): 23-56.

Veblen, T. (1915). *Imperial Germany and the Industrial Revolution*. New York: A.M. Kelley (Third Edition, Published in 1964).

Wade, R. (1990). *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization*. Princeton: Princeton University Press.

World Bank (1993). *The East Asian Miracle*. Washington, DC: Policy Research Department, The World Bank.

------, (2016). *World Development Indicators*, URL: http://data.worldbank.org/products/wdi The Date of Access: August 1, 2016.

Yeldan, E. (2012). "Türkiye Ekonomisi için Beşeri Sermaye ve Bilgi Sermayesi Birikimine Dayalı bir İçsel Büyüme Modeli (An Applied Endogenous Growth Model with Human and Knowledge Capital Accumulation for the Turkish Economy)," *Ekonomi-tek*, 1(2): 21-60.

Yılmaz, B. (2002). "The Role of Trade Strategies for Economic Development: A Comparison of Foreign Trade between Turkey and South Korea," *Russian & East European Finance and Trade*, 38(2): 59-78.

Yılmaz, G. and Saracoğlu, D.Ş. (2016). "Technological Change, Human Capital, and Absorptive Capacity: Can Turkey Escape the Middle Income Trap?," *METU Studies in Development*, 43(1): 391-424.