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# Worthy Transfers? A Dynamic Analysis of Turkey's Accession to the European Union

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**Abstract**

We build a two-country dynamic general equilibrium model to study whether European citizens would benefit from the eventual accession of Turkey to the European Union. The results of the simulations show that Turkey's accession to the European Union is welfare enhancing for Europeans, provided that Turkish total factor productivity (TFP) increases sufficiently after enlargement. In the model with no capital mobility, the Europeans are better off if the Turkish TFP increase bridges more than 31% of the initial TFP gap between Turkey and the European Union. That figure becomes 45% when capital mobility is introduced.

**Keywords: European Union, Turkey, Enlargement, Dynamic General Equilibrium, Open Economy Macroeconomics**

**JEL Classification: F41**

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# 1 Introduction

The possible entry of Turkey into the European Union raises more than an eyebrow. If many objections have a political flavour, one of them concerns an economic aspect: transfers. As a new member state with a GNP per capita which is 30% lower than the EU-15 average (Lejour and de Mooij (2005)), Turkey would be a net recipient of EU harmonization funds. Such a perspective is obviously hard to swallow for many incumbents, not keen to see their net transfers from Brussels diminished again, only a few years after the 2004 enlargement.

This paper adopts a dynamic general equilibrium (DGE) perspective to explore whether this objection to the accession of Turkey to the European Union is well-founded. The idea is that mechanisms may exist such that the general equilibrium effect of Turkey's entry into the European Union may compensate, or even outweigh the negative effect of transfers from incumbent members to Turkey. The aim of this paper is to scrutinize the quantitative relevance of some of these mechanisms.[1]

Our analysis stems from the probable improvement of Turkish institutions due to the full adoption of the Copenhagen criteria. Following the widespread literature (Acemoglu and Johnson (2005), Dawson (1998), Klein and Luu (2003), North (1990)), we accept the hypothesis that better institutions prompt better economic performance. To model this view in a DGE framework in the specific case of Turkey, we assume that accession to the European Union will push Turkish total factor productivity (TFP) up.

In this context, we build a two-country DGE model similar to those pioneered by Backus, Kehoe, and Kydland (1994). Turkey and the European Union are modelled as two countries trading in goods. To mimic the resource transfer from the European Union to Turkey, we shall assume that the EU household pays a lump-sum transfer to the Turkish one in the aftermath of the enlargement.[2] Such a transfer is modelled as proportional to the output

[1] Ertan Özgüzer (2007) develops an analytical model that deals with the same issue in a static set up.

[2] If accession takes place, Turkey will benefit from both the structural and the cohesion EU funds (see European Commission (2007b) for details about the definitions of the funds and the eligibility criteria). The EU structural funds are typically granted for specific objectives or specific projects, in order to help backward regions in the Union. The EU Treaties' definition of a backward region is a region whose per capita income is less than 75 percent of the EU average. All the Turkish regions qualify for funds according to this criterion (Griffiths (2004)). The EU cohesion fund is intended for countries whose per capita GDP is below 90 percent of the Community average. Again, Turkey qualifies for fund according to this criterion. So, we can conclude that our lump-sum transfer assumption is an innocuous simplification for the sake of analytical tractability.

gap between the EU-25 and Turkey, with the proportionality factor estimated from the data.

We shall first study the price-effect of a TFP increase in Turkey, assuming factor immobility. The idea is that a TFP increase in Turkey will cause the price of Turkish exports to decrease, thereby positively affecting the utility of Europeans. This effect operates through two channels. First, the price decrease directly affects consumption, inducing both an income effect (EU consumers get richer) and a substitution effect (Turkish goods cost relatively less). Second, hours worked in the European Union change as a consequence of the shift in production.

By means of numerical simulations, we assess both the direction and the quantitative importance of these effects. We then compare them with the welfare effects due to the transfer. In fact, the transfer also influences the terms of trade, and entails significant general equilibrium effects. This exercise allows us to estimate how big the induced TFP increase must be to fully compensate the Europeans for the transfer. We then extend the model to the case of perfect capital mobility, to verify whether mobile capital can affect the transmission mechanism of the model. It turns out that it does, and significantly so.

The results show that, within the assumptions made in this paper, Turkey's accession to the European Union might be beneficial for European citizens, provided that TFP in Turkey increases enough (31% of the initial gap, in the model with no capital mobility; 45%, in that with capital mobility).

The remainder of this paper is structured as follows. Section 2 describes the two-country model economy. In Section 3, we present the calibration of the parameters and discuss the results of the simulations. Section 4 discusses the TFP-convergence hypothesis, in terms of both theory and empirical evidence. Section 5 draws together the threads of the argument and advances some conclusions.

# 2 The benchmark model

We model the European Union and Turkey within a two-good, two-country DGE framework similar to Backus, Kehoe, and Kydland (1994). Each country produces one good, denoted as $Y$ for the European Union and $Y^*$ for Turkey, using a constant-return-to-scale Cobb-Douglas production function:

$$y_t = e_t^z (k_t)^{\alpha} (l_t)^{1-\alpha}, \tag{1}$$

$$y_t^* = e_t^{z^*} (k_t^*)^{\alpha^*} (l_t^*)^{1-\alpha^*}. \tag{2}$$

In the expression above, lowercase variables stand for per capita (i.e. $y_t = \frac{Y_t}{N_t}$ and $y_t^* = \frac{Y_t^*}{N_t^*}$), and subscripts for time; $k$ is capital, $l$ hours worked, and the scale factor $e^z$ is total factor productivity (TFP). Turkish variables are denoted by *.

We choose one unit of the European good as the numeraire. We shall therefore denote as $p_t$ the price in period $t$ of one unit of $Y^*$, expressed in terms of $Y$.

Both goods can be consumed in both countries. The representative European household can consume both the European, ($c^E$), and the Turkish ($c^T$) good. Aggregate consumption per-capita in the EU, $c$, is

$$c_t = (c_t^E)^{\gamma}(c_t^T)^{1-\gamma}, \tag{3}$$

where $0 < \gamma < 1$. Accordingly, for the representative Turkish household we have

$$c_t^* = (c_t^{*E})^{\gamma^*}(c_t^{*T})^{1-\gamma^*}, \tag{4}$$

with $0 < \gamma^* < 1$. The variables $c^j$ and $c^{*j}$, for $j = E, T$, stand for the goods produced in country $j$ and consumed by Europeans and Turks, respectively.[3]

We assume free trade between countries and perfect competition.[4]

Labour and capital are assumed to be internationally immobile. Population growth is set to zero in both countries. We call $n$ the ratio of the European to the Turkish population ($n = \frac{N}{N^*}$), which is therefore assumed to be constant.

[3]Assuming a Cobb-Douglas aggregator is tantamount to assuming $\sigma = 1$ in an Armington aggregator of the kind

$$c_t = \left[\gamma(c_t^E)^{\left(\frac{\sigma-1}{\sigma}\right)} + (1-\gamma)(c_t^T)^{\left(\frac{\sigma-1}{\sigma}\right)}\right]^{\frac{\sigma}{\sigma-1}}.$$

In this formulation, $\sigma$ stands for the elasticity of substitution between the home and foreign good. The empirical evidence about its value is controversial. Typical macroeconomic estimates of $\sigma$ in the United States range from 1 to 2. Backus, Kehoe, and Kydland (1994) and Chari, Kehoe, and McGrattan (2002) set $\sigma = 1.5$, while Corsetti, Dedola, and Leduc (2008) choose a lower value of 0.85. We run a sensitivity analysis to verify the robustness of our results to changes in the assumed form of the Armington aggregators. For every simulation presented in this paper, two additional models are simulated, one with $\sigma = \sigma^* = 0.5$, and the other with $\sigma = \sigma^* = 1.5$. As expected, the higher the complementarity between the home and foreign goods, the less powerful is the terms-of-trade transmission mechanism highlighted in this paper. However, the changes in the results are qualitatively negligible and quantitatively minor.

[4]A customs union between Turkey and the EU has been in place since Janury 1996. It involves the abolition of customs duties, the abolition of charges on industrial and processed agricultural products, the abolition of quotas, as well as a common tariff towards third countries. Turkey also adopted most of the EU commercial and competition policies.

This model can be solved by adopting a two-step procedure. First, in each period $t$, with fixed preferences, endowments and technical conditions, households in each country determine their optimal allocation between different kinds of goods, given the total amount of consumption and investment. This problem is static by its nature. Second, households have to decide how to allocate their wealth intertemporally, thereby determining their consumption and saving. This is the dynamic part of the model, and it is again country-specific.

## 2.1 The static problem

### 2.1.1 Firms

In each period $t$, the representative European firm chooses labour and capital so as to maximize its profits

$$\Pi = y - wl - rk, \tag{5}$$

subject to the technical constraint in Equation (1).[5] The variable $w$ is the real wage, whereas $r$ is the interest rate.

The first order conditions for this problem give the static demand schedules for labour and capital in the European Union, that is

$$w = (1-\alpha)e^{z}(k)^{\alpha}(l)^{-\alpha}, \tag{6}$$

$$r = \alpha e^{z}(k)^{\alpha-1}(l)^{1-\alpha}. \tag{7}$$

Symmetrically, for Turkey we have:

$$w^* = p(1-\alpha^*)e^{z*}(k^*)^{\alpha^*}(l^*)^{-\alpha^*}, \tag{8}$$

$$r^* = p\alpha^* e^{z*}(k^*)^{\alpha^*-1}(l^*)^{1-\alpha^*}. \tag{9}$$

### 2.1.2 Households

For any given total amount of aggregate consumption $\bar{c}$, the representative European household chooses a combination of European and Turkish consumption goods so as to maximize Equation (3) subject to

$$c^E + pc^T \leq \bar{c}. \tag{10}$$

[5]Given the static nature of the problem, we omit the time subscript for simplicity.

The solution to this problem gives the European demand for each variety of good as a function of both its relative price and aggregate consumption:

$$c^E = \gamma p^c c, \tag{11}$$

$$c^T = (1-\gamma)\left(\frac{p^c}{p}\right)c. \tag{12}$$

The price index $p^c$ is defined as the minimum expenditure $\bar{c} \equiv c^E + pc^T$ such that $c = 1$, given $p$. This amounts to

$$p^c = \frac{p^{1-\gamma}}{\gamma^\gamma (1-\gamma)^{(1-\gamma)}}. \tag{13}$$

In view of the symmetry of the problem for Turkey, its demand functions and price index are immediately derived as

$$c^{*E} = \gamma^* p^{*c} c^*; \tag{14}$$

$$c^{*T} = (1-\gamma^*)\left(\frac{p^{*c}}{p}\right)c^*; \tag{15}$$

$$p^{*c} = \frac{p^{1-\gamma^*}}{(\gamma^*)^{\gamma^*}(1-\gamma^*)^{(1-\gamma^*)}}. \tag{16}$$

## 2.2 The dynamics

The infinitely-living representative European household chooses its lifetime consumption and leisure patterns so as to maximize its lifetime expected utility, within the resource constraints

$$\max_{\{c_t, l_t, a_{t+1}\}_{t=0}^{\infty}} E_t \sum_{t=0}^{\infty} \beta^t \left[\ln c_t + \varphi \ln(1-l_t)\right], \tag{17}$$

subject to

$$a_{t+1} = (1-\delta)a_t + s_t, \tag{18}$$

$$r_t a_t + w_t l_t - \theta_t \geq p_t^c c_t + s_t, \tag{19}$$

plus a transversality condition.

In Problem (17), we have chosen a log-log utility function. The parameter $\beta$ is the intertemporal discount factor, while $\varphi$ is the preference for leisure. The variable $a$ stands for assets, $s$ for savings. Equation (18) is the law of motion of wealth, with $\delta$ being its (constant) depreciation rate. In

this model, we have assumed that all savings are invested in financial assets. Equation (19) is the budget constraint equating disposable income to expenditure. In the latter, we have modelled the per-capita transfer from the EU to Turkey, ($\theta$), as a lump-sum direct transfer from the European to the Turkish representative household.

Assuming perfect foresight, the first order conditions of this problem are given by

$$\frac{1}{c_t}\left(\frac{1}{p_t^c}\right) = \beta\frac{1}{c_{t+1}}\left(\frac{1}{p_{t+1}^c}\right)(1 + r_{t+1} - \delta), \tag{20}$$

$$\frac{\varphi}{1 - l_t} = \frac{1}{c_t p_t^c} w_t. \tag{21}$$

Equation (20) is the Euler equation governing the intertemporal allocation of consumption. Equation (21) is the European labour supply, which, together with Equation (6), clears the labour market.

By solving the symmetric problem for Turkey gives

$$\frac{1}{c_t^*}\left(\frac{p_t}{p_t^{*c}}\right) = \beta^*\frac{1}{c_{t+1}^*}\left(\frac{p_{t+1}}{p_{t+1}^{*c}}\right)(1 + r_{t+1}^* - \delta), \tag{22}$$

$$\frac{\varphi^*}{1 - l_t^*} = \frac{1}{c_t^* p_t^{*c}} w_t^*. \tag{23}$$

## 2.3 Equilibrium conditions

To finish the model, we need to specify the equilibrium conditions. For the trade balance between Turkey and the European Union, we assume

$$p_t c_t^T - \frac{1}{n} c_t^{*E} + \theta_t = i_t - s_t, \tag{24}$$

where

$$i_t = k_{t+1} - (1 - \delta)k_t, \tag{25}$$

stands for the European investment in physical capital. Equation (24) is the standard balance of payment equilibrium which equates trade surplus, or deficit, to the difference between investment and saving. This condition also ensures equality between the supply and demand for all goods.

In the benchmark model we assume that capital is not mobile across countries. Hence, domestic financial wealth is wholly invested in domestic capital:

$$a_t = k_t, \tag{26}$$

$$a_t^* = k_t^*. \tag{27}$$

Accordingly, the right-hand-side of Equation (24) turns out to be zero.

Finally, although households in both countries perceive the amounts $\theta$ and $\theta^*$ as a lump-sum transfer, we want them to be correlated with the output gap between the two countries, and therefore endogenously determined by the model. In the following, we assume

$$\theta_t^* = b(y_t - p_t y_t^*), \tag{28}$$

$$\theta = \frac{\theta_t^*}{n}, \tag{29}$$

where Equation (29) scales the transfer to take the difference between the populations of the European Union and Turkey into account.

As households do not take Equations (28) and (29) into account in solving the optimization problem, the transfer acts here as an externality.

# 3 Worthy transfers? The dynamic impact of a TFP increase in Turkey

Equipped with the benchmark model developed in the previous section, we can assess quantitatively whether, in a European perspective, enlargement of the EU to include Turkey is welfare enhancing, and therefore worth the price of the resource transfer. Specifically, in this section we study the theoretical and quantitative implications of a TFP increase in Turkey for the EU in the aftermath of the enlargement. The idea is that adherence to the Copenhagen criteria leads to a generic improvement in the Turkish institutions, which in turn increases TFP in the model.[6]

## 3.1 Calibration and simulation

In order to simulate the model, we first need to calibrate the structural parameters. Table 1 illustrates our choices. The 'Target' column reports the reference variable used for the calibration of each parameter.

The unit period is the year.

The capital shares $\alpha$ and $\alpha^*$ are set equal to one minus the labor-income shares in the EU-27 and Turkey, respectively, as measured by the European Commission (European Commission (2007a)) The parameter $\gamma$ indicates the proportion of the EU produced good in the European consumption bundle. Given that imports from Turkey amount to 3% of total European imports, we

[6]Notice that in this article the TFP improvement is exogenous. In particular, it does not depend on the transfer.

| *Parameter* | *Value* | *Target* |
|---|---|---|
| $\alpha$ | 0.43 | Labour income share in the EU |
| $\alpha^*$ | 0.47 | Labour income share in Turkey |
| $\gamma$ | 0.988 | Share of EU imports from Turkey |
| $\gamma^*$ | 0.14 | Share of Turkish imports from the EU |
| $\beta$ | 0.96 | Real interest rate in the model in the EU |
| $\beta^*$ | 0.96 | Real interest rate in the model in Turkey |
| $\delta$ | 0.1 | Depreciation rate of capital in the RBC literature |
| $\varphi$ | 1.64 | Steady-state hours in the model in the EU |
| $\varphi^*$ | 1.59 | Steady-state hours in the model in Turkey |
| $b$ | 0.007 | Regression of net transfers on the GDP gap for the EU-25 |
| $n$ | 6.4 | Population ratio between the EU and Turkey |
| $\rho$ | 1.35 | Steady state level of $z^*$ |

Table 1: Calibration of the parameters

take this to mean that 98.8% of total European consumption does not come from Turkey (Eurostat (2006)). In a similar way, we set $\gamma^*$ by computing the proportion of Turkish imports which come from the European Union. This turns out to be 45% (Undersecretariat of the Prime Ministry for Foreign Trade (2007)). The preferences for leisure, $\varphi$ and $\varphi^*$, are calibrated so that both $l$ and $l^*$ are 1/3 in the pre-accession steady state. The depreciation rate of capital, $\delta$, is set to 0.1, a common value in the literature (Kydland and Prescott (1982)). We gave both $\beta$ and $\beta^*$ the same 0.96 value, which guarantees a net real interest rate of about 4% in both countries. We have assumed the same discount factor for both countries.[7]

We calibrated the parameter $b$, the sensitivity of the transfer to the output gap, by regressing the net per-capita transfers received in 2005 by each EU-25 country on the gap between the average EU-25 GDP per capita and the

[7]This is a common assumption in the literature (see for instance Backus, Kehoe, and Kydland (1992), Corsetti and Pesenti (2001), Obstfeld and Rogoff (1995)). While such an assumption is only a simplification in the model with no capital mobility, it becomes instead important when capital mobility is allowed. There, the fact that the two countries have the same discount factor guarantees that the steady state capital level is non zero in both of them.

country's GDP per capita.[8] Table 2 shows the output from the regression.[9]

| Regressor | Coefficient | S. E. | $t$ stat. | p-value |
|---|---|---|---|---|
| GDP gap | 0.00794759 | 0.00249689 | 3.1830 | 0.0040 |

| | | | |
|---|---|---|---|
| Mean dependent variable | 25.49415 | S.D. dependent variable | 141.2745 |
| Sum of squared residuals | 348243.7 | S.E. of regression | 120.4581 |
| $R^2$ | 0.296836 | Adjusted $R^2$ | 0.296836 |
| $F(1, 24)$ | 10.13145 | P-value($F$) | 0.004002 |
| Log-likelihood | −154.7457 | Akaike criterion | 311.4915 |
| Schwarz criterion | 312.7103 | Hannan–Quinn | 311.8295 |

Table 2: Calibration of $b$ using an OLS regression with the net transfers as the dependent variable

The parameter $n$ is computed by taking the ratio of the EU-25 population to Turkey's population (Eurostat (2007)). Finally, to model the post-accession Turkish TFP increase, we assume that TFP grows monotonically along an S-shaped path, until the (exogenous) catch-up process is over.

$$z_t^* = \rho z_{t-1}^* (1 - z_{t-1}^*) + \epsilon_t \tag{30}$$

The parameter $\rho$ governs the curvature of the function, and the steady-state level of $z^*$.

## 3.2 Comments on results

We simulated how the model reacts to a positive productivity shock in Turkey. The shock is such that the TFP gap between Turkey and the EU is reduced by half at the post-enlargement final steady state. Specifically, the model starts with the steady-state productivity levels $z = 0.47$ and $z^* = 0$. This means that at the pre-accession steady state, the Turkish TFP is set equal to 62.5% of the European one, which roughly corresponds to the TFP

[8] This is admittedly a sharp simplification. The actual allocation of the EU funds among member States is usually the result of complex political interactions that are obviously non-mechanical and difficult to quantify. Our formulation aims at capturing the statutory definition of the various EU funds in terms of distance between the average EU country and the country receiving the transfer.

[9] In an exercise not shown here, we run the regression including also the intercept. Results show that the value of $b$ is not affected, while the constant term turns out to be insignificant. To check for the robustness of the calibrated value of $b$, we run the same regression on the 2004-2008 years. Results do not change appreciably.

gap between Turkey and France in the data (Eicher, Garcia-Peñalosa, and Teksoz (2006)).[10] According to our catch-up hypothesis, the new steady state after enlargement is characterised by $z^* = 0.26$, which implies that the Turkish TFP has increased to 81.05% of the European.

Assuming that there are no transfers before accession, $b$ is set to 0 at the initial steady state. After accession, Turkey starts to receive transfers from the European Union, according to Equation (28), with $b = 0.007$. The red lines in Figures 1,2, 3 and 4 display the results of this simulation.

There are two impulse mechanisms in this model; the transfer from the European Union to Turkey, and the assumed post-accession TFP increase in Turkey. Both have an effect on $p$, the price of the Turkish good in terms of the European one, although in opposite directions. While the TFP increase reduces the price of the Turkish good, because it enhances the efficiency of production in Turkey, the unilateral lump-sum transfer causes $p$ to increase. The increase in $p$ is the standard terms-of-trade effect found in the international trade literature (see Devereux and Smith (2007), Djajic, Lahiri, and Raimondos-Moller (1998) and Galor and Polemarchakis (1987), among others), in a model with capital immobility, and no international borrowing or lending.

At the beginning of the simulation, the impact of the transfer from the EU to Turkey is the dominant impulse mechanism. It induces a negative income effect in the EU and thus a fall in the European consumption. On the other hand, the transfer has a positive impact on the price index, diminishing the value of the marginal utility of future consumption. The interest rate rises (see Equation (20)), making saving more attractive. The fall in consumption leads to a rise in the number of hours worked, and a drop in wages. The utility of the European household decreases.

As expected, the transfer has the opposite initial impact on the Turkish variables.

Due to the assumed S-shaped path of the TFP catch-up by Turkey, the TFP growth gains momentum as time passes, and finally dominates the transfer effect, leading to a fall in the Turkish price after the first decade. Eventually, the terms of trade, $p$, decrease by more than 30%.

The drop in the relative price of the Turkish good explains the increase in the demand for the Turkish good both in Turkey and in the EU. While European and Turkish agents substitute the cheaper Turkish good for the more expensive European one, the Europeans will also be experiencing a positive income effect, as now their own good buys more units of the Turkish one. Eventually, these effects almost cancel out. The European household also ex-

[10] We use France as representative of the EU average.

periences a negative income effect due to the transfer payment to the Turkish household. These three effects together explain why the European demand for its own consumption good, $c^E$, ('ceu' in the graphs) stays constant after an initial drop, in spite of its increasing price. Symmetrically, a negative income effect will affect Turkish households. Such a negative income effect is counterbalanced by the sudden transfer that the Turkish agents receive from the European Union, and by the gradual improvement of their own TFP. On the whole, these contrasting influences result in a sudden increase of $c^{*E}$ ('ceustar' in the graphs), the demand for the European consumption good by the representative Turkish household, that reaches the new steady state immediately, and then stays roughly constant around it.

Aggregate consumption rises in both countries. However the increase in consumption is much higher in Turkey than in the European Union. As well as being a consequence of the demand patterns for the EU and the Turkish good discussed above, such behaviour also depends on the different values assigned to $\gamma$ and $\gamma^*$ in Equations (3) and (4). As $c^T$ represents a small share of total consumption in the EU, its variations only have a small effect on $c$. On the other hand, $c^*$ is affected by small variations in $c^{*E}$, due to its relatively high value in the consumption bundle of the Turkish household.

By construction, the qualitative behaviour of the price indices is explained by the drop in $p$. The quantitative differences between the European and Turkish indices again depend on the different values assigned to $\gamma$ and $\gamma^*$.

A peculiarity of this model with immobile capital is that both labour and wealth (capital) in Europe adjust immediately to the new steady-state level, leaving the behaviour of consumption after the initial period to be explained by variations of the terms of trade. In other words, labour- and capital-related variables in Europe are influenced by the transfer, but not by the TFP increase in Turkey.

However, the TFP increase in Turkey does affect the capital and labor dynamics there. The reason for such a different reaction of labour and capital in the two countries is that the terms of trade cannot affect the production side of the European economy, while the TFP increase that causes the variation in the terms of trade has, by definition, direct effects on production in Turkey. The rate of return on capital in Turkey, for instance, jumps at the very beginning of the simulation and increases for about 20 years after the accession, to finally fall to the new steady state, when the catching-up process is over. The Turkish wage follows a more complex path, because of the impact that the productivity shock has on the demand for labour. This adds up to the traditional intertemporal substitution of labour supply.

After the initial jump, transfers from the EU to Turkey follow an almost constant pattern. The positive level of the transfer in the final steady state

stems from two assumptions: first, that the two countries are asymmetric; and, second, that Turkey will not completely catch up with Europe in terms of productivity.

Figure 4, shows the behaviour of the instantaneous utility function of the EU household. Utility decreases slightly in the initial post-accession years, to increase thereafter. Therefore, to assess whether transfers are "worthwhile" for European households, we need to compare the life-cycle utility after enlargement with the counterfactual case of no accession. To carry out this exercise, we chose an horizon of 300 periods, after which the value of the discount rate $\beta^t$ is approximately zero, for $\beta = 0.96$. Then, we computed

$$\Delta_u = \sum_{t=1}^{300} \beta^t u_t - \left( \sum_{t=1}^{300} \beta^t \bar{u} \right), \tag{31}$$

where $\bar{u}$ is the constant steady state level of utility, the one that Europeans would have enjoyed, had no enlargement occurred (and had no transfer been paid). We got $\Delta_u > 0$, meaning that, conditional on the assumptions we have made in this exercise, Europeans would be better off, if Turkey were admitted to the European Union.

As an additional quantitative exercise, we computed the necessary increase in Turkish TFP for the Europeans to be indifferent towards the accession of Turkey to the European Union (i.e. to get $\Delta_u = 0$). It turns out that, within the framework considered here, the Europeans are indifferent, if Turkish TFP rises from 62.5% to 74.1% of European TFP, i.e. if the initial TFP gap is reduced by 31%.

## 3.3 Capital mobility

So far we have assumed that capital does not move between the European Union and Turkey. For all its being a useful simplification, such an assumption is nonetheless at variance with the available evidence. Turkey liberalised capital flows as early as 1989. In 2003, the New Foreign Capital Law was introduced, so as to facilitate foreign direct investment (FDI) in the country. In 2007, Turkey received 2.5% of the total EU-25 FDI, and its market integration index was 1.9, compared with a value of 3.5 for the EU-25[11].

In this section, we relax the immobile capital assumption. That is, households of both countries now have direct access to the ownership of capital in

[11]Data are from Eurostat, `http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database`. The market integration index is the average of inward and outward FDI flows divided by gross domestic product (GDP). The index measures the intensity of investment integration within the international economy.

the other country. In terms of the benchmark model, we substitute

$$r_t = r_t^*, \tag{32}$$

and

$$a_t + \frac{1}{n} p_t a_t^* = k_t + \frac{1}{n} p_t k_t^*, \tag{33}$$

for Equations (26) and (27).

Equation (33) implies that the sum of the value of assets in Turkey and the EU must equal the aggregate value of capital. Capital market equilibrium (Equation 32)) requires that the rates of return on capital are the same in the two countries.

This new formulation makes a distinction between saving (the variation in the stock of assets) and investment (the variation in the stock of capital). Whenever the former exceeds the latter, domestic households own capital in the foreign country, and vice versa. Accordingly, the right-hand-side of Equation (24) is no longer constrained to be zero, meaning that countries can experience unbalanced trade accounts. The equality between interest rates ensures that agents will exhaust all the arbitrage possibilities. That is, both the European and the Turkish household will use savings to build new capital in the EU (Turkey) whenever $r > r^*$ ($r < r^*$).

The simulation exercise is the same as before. We started from the pre-accession steady state, and we assumed that after accession, half of the TFP gap between Turkey and Europe is closed, while the Europeans start to pay the transfer. The blue lines in Figures 1 to 4 display the simulation results.

The behavior of the model with capital mobility differs from the no-capital-mobility case. The increase in European consumption is now short lived. As Turkish productivity gains momentum, there is a reversal of the pattern of the terms of trade. The European household starts to invest in Turkey, which implies a shift from a trade deficit to a trade surplus. The reversal in the terms of trade comes from the no-arbitrage condition in Equation (32). When the growth of TFP starts to reduce, the return on capital in Turkey in terms of the Turkish good ($r^*/p$), (i.e. the physical marginal productivity of capital in Turkey), starts to diminish. This implies that the price of the Turkish good must increase so as to equalize the rates of return between Turkey and the EU in terms of the European good. Consumption and investment in Turkey both increase appreciably. Such an increase, coupled with the progressive reversal of the terms of trade depreciation implies a widening trade deficit for Turkey.

The real-wage reaction in Turkey is much stronger than in the previous exercise, as the appreciable increase in the capital-to-labour ratio is no longer

counterbalanced by a decrease in the terms of trade anymore. Real wages in Europe have minor oscillations, converging towards a slightly lower steady state. Finally, capital mobility facilitates a stronger catch up by Turkey on Europe, as witnessed by the decreasing pattern of the transfer after the initial post-accession jump.

The general equilibrium effects considered so far imply that the pattern of the instantaneous utility of the European household is again non-monotone, and as a whole it is less affected than in the case of no capital mobility. Still, by computing Equation (31), we obtained $\Delta_u > 0$, thereby confirming our previous results that, conditional on the assumptions we have made so far, the Europeans would be better off if Turkey entered the European Union.

Finally in the case of capital mobility, the required TFP increase in Turkey to make the Europeans indifferent towards the accession of Turkey to the European Union is much bigger than in the previous case. It turns out that $\Delta_u = 0$ if the Turkish TFP goes from 62.5% to 79.45% of European TFP, meaning a 45% closure of the TFP gap.[12]

# 4 The TFP-convergence hypothesis

Throughout this paper, we have made two fundamental assumptions: first, Turkish accession to the European Union will improve Turkish institutions, and second, this institutional improvement can be proxied by relative TFP growth in Turkey. In this section we shall discuss these two hypotheses.

The first hypothesis, namely that Turkish institutions will improve in the bid for the EU membership is hardly controversial. Candidate countries have to comply with precise formal requirements to join the European Union. More specifically, these requirements include the implementation of the so-called 'Copenhagen criteria' and a minimum level of compliance with the EU law, i.e. the 'Community *Acquis*'. The Copenhagen criteria set down the requirements about the stability of institutions guaranteeing democracy, the rule of law, the respect of human rights and the existence of a functioning market economy that member countries must meet before accession. Compliance with the Community *Acquis* means the harmonization of Turkey's

[12]In an exercise not shown in the text, we considered a model where agents anticipate the future accession of Turkey to the European Union in 15 years. The results show little qualitative change. The only significant change is a quantitative one. The TFP increase in Turkey necessary to make the Europeans indifferent between accession and no-accession in the case of no capital mobility, becomes 32.8% of the initial TFP gap. This compare to 31%, the value found in the benchmark case without expectations. No such change is observed when expectations are introduced into the model with perfect capital mobility.

laws with those of the European Union. It is verified in progressive negotiations over 35 'chapters', including intellectual property and company law, institutions, environment, education and culture.

In the process of meeting these criteria on its way towards EU membership, Turkey has already gone through major institutional changes, and many more are expected to come. Central to the idea of this paper is that this conditional process will finally lead to an overall improvement of Turkish institutions.

The fact that better institutions foster economic growth is also commonly accepted. There exists a widespread literature that emphasises the role played by institutional features such as property rights and the rule of law in enhancing economic performance (Acemoglu and Johnson (2005), North (1990), among others).

The link between such institutional developments and the growth of TFP is less evident, although, we shall argue, no less compelling. It is common wisdom among growth theorists that cross-country differences in TFP are of primary importance in accounting for cross-country income disparities (Hall and Jones (1999), Klenow and Rodrìguez-Clare (1997), Prescott (1998)). This growth-accounting result, coupled with the notion that better institutions foster economic growth, leads to the conclusion that one way in which the quality of institutions stimulates economic growth must be through its effect on TFP. A number of empirical studies have already documented the existence of a positive link between institutions and TFP growth. For instance, using the economic freedom index as an indicator of institutional quality, Dawson (1998), Ayal and Karras (1998) and Klein and Luu (2003) find that economic freedom affects economic growth through its direct effect on TFP. Similarly, Moomaw and Yang (2006) find in a sample of 12 OECD countries, 8 of which are EU members, that increases in economic freedom since 1975 are positively correlated with TFP convergence. On the basis of these results, they conclude that analogous improvements in the economic freedom of recent EU members might boost their productivity growth, thereby reinforcing their convergence process. A recent analysis by Manca (2010) confirms these results and shows that countries endowed with better institutions have higher TFP growth rates, resulting in a faster catch-up with the industrial leader (the United States).

If the arguments above provide a solid theoretical ground for the TFP-convergence hypothesis adopted in this paper, the historical evidence concerning TFP convergence among old and new EU members is more mixed.

Kutan and Yigit (2007) find that, between 1980 and 2004, five new members of the EU-15 (Spain, Portugal, Austria, Finland and Sweden) experienced stronger TFP growth than France, which is taken as representative of

the original EU countries. They conclude that the integration into the EU stimulates productivity (TFP) and growth.

Crespo Cuaresma, Ritzberger-Grünwald, and Silgoner (2008) also argue that EU membership has a convergence-stimulating effect on long-run growth. They show that the poorer the country joining the EU, the stronger the effect is. Similar conclusions are reached by Parente and Prescott (2006). Comparing the labour productivity performance of the original members of the EU with that of Western European countries that either acceded to the Union in 1995 or have not yet acceded, they conclude that EU membership fosters labour productivity growth. In particular, non-member countries in 1993 were only 81 percent as productive as the original EU countries, although they were 106 percent as productive in 1957.

These positive results are, however, far from conclusive. Salinas-Jimenez, Alvarez-Ayuso, and Delgado-Rodrìguez (2006) find that the TFP contribution to labour productivity was negative for new members of the EU-15, during the 1980-1997 period. Delgado-Rodrìguez and Alvarez-Ayuso (2008) find similar results for five different periods between 1980 and 2002. Both studies point out that most of the observed labour productivity convergence was driven by capital deepening, not TFP increase. Fare, Grosskopf, and Margaritis (2006) find evidence for labour productivity convergence within three different groups of EU countries, rather than convergence among all EU members. Moreover, they argue that the contribution of TFP to productivity growth differs from country to country, although it is negative in most places.

In short, our TFP-catching up hypothesis is not an unreasonable theoretical assumption, although it lacks definitive empirical support. It should therefore be taken for what it is: a simplifying assumption that condenses complex institutional dynamics into the variation in one parameter.

# 5 Conclusions

The accession of Turkey to the European Union is currently much debated in Europe. If the core of the debate is about political, historical and cultural issues, the main economic objection to Turkey's possible membership concerns transfers. As a new member State considerably poorer than the average EU country, Turkey would end up being a net recipient of the European structural and cohesion funds.

In this paper, we have used a two-country DGE framework to show that the negative welfare effect for Europeans induced by the transfers might be balanced, and even outweighed, by a positive general equilibrium effect, op-

erating through an external TFP-driven improvement of the EU terms of trade, vis-à-vis Turkey. The results of the simulations show that Turkey's accession to the European Union is welfare enhancing for Europeans, provided that Turkish total factor productivity (TFP) increases sufficiently after enlargement. In the model with no capital mobility, the Europeans are better off if the Turkish TFP increase bridges more than 31% of the initial TFP gap between Turkey and the European Union. That figure becomes 45% when capital mobility is introduced.

Our analysis rests on the hypothesis that EU membership produces better institutions, e.g. institutions that are more favourable to growth. We have modelled this view by assuming an exogenous increasing pattern for Turkish total factor productivity after accession. While the better-institutions hypothesis is crucial to our result, we do not attach much importance to the specific way in which we have modelled it. More realistic models could be devised to make the point, for instance by adding government, and modelling the institutional improvement as a decrease in the deadweight loss due to government inefficiencies. We leave the task of enriching the institutional set up presented here to future research.

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# Figures

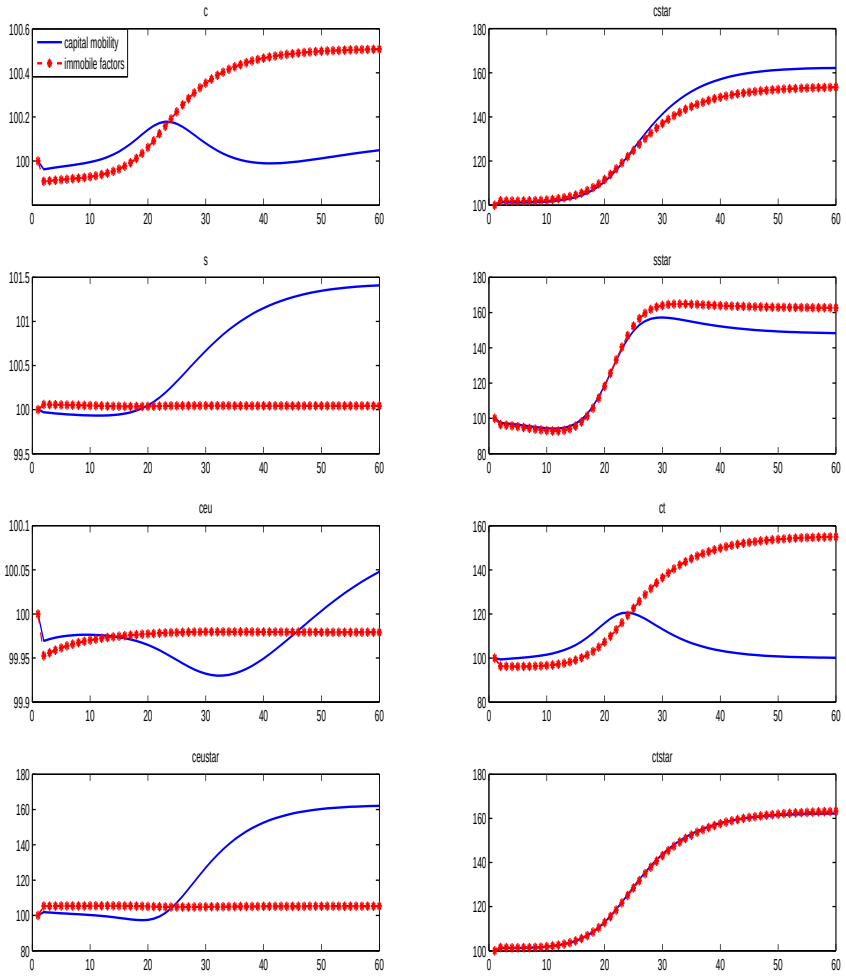


Figure 1: Simulation with half TFP-gap catch-up: the results of models with immobile factors and with capital mobility

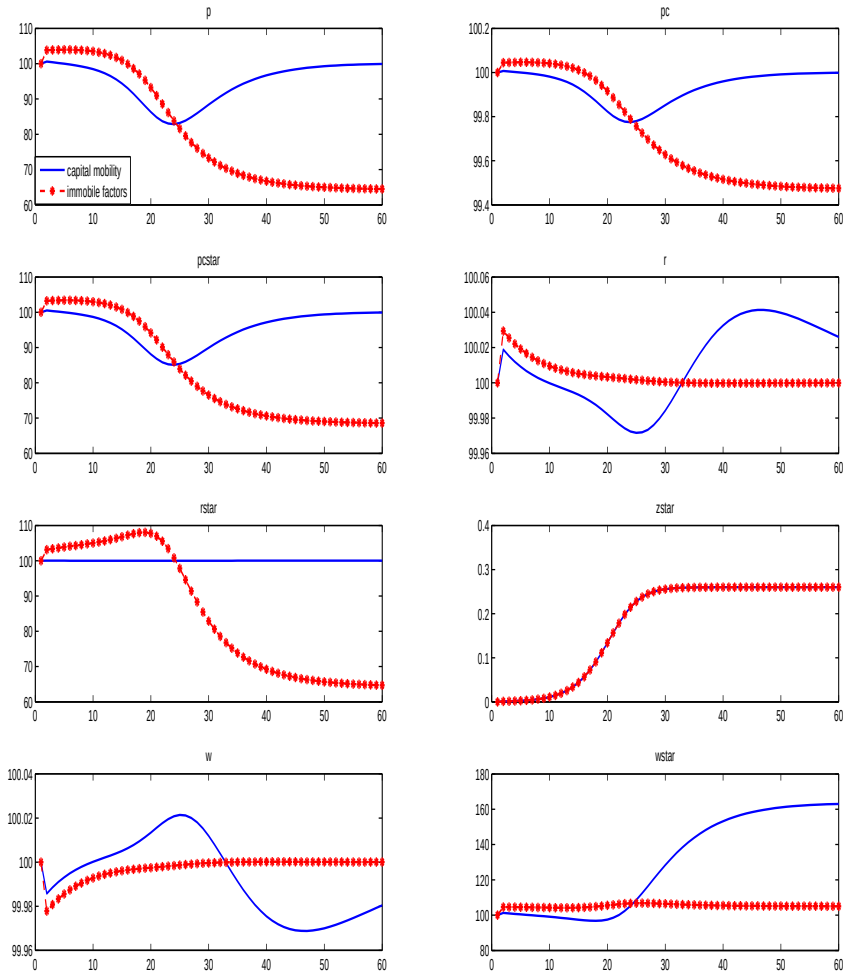


Figure 2: Simulation with half TFP-gap catch-up: the results of models with immobile factors and with capital mobility

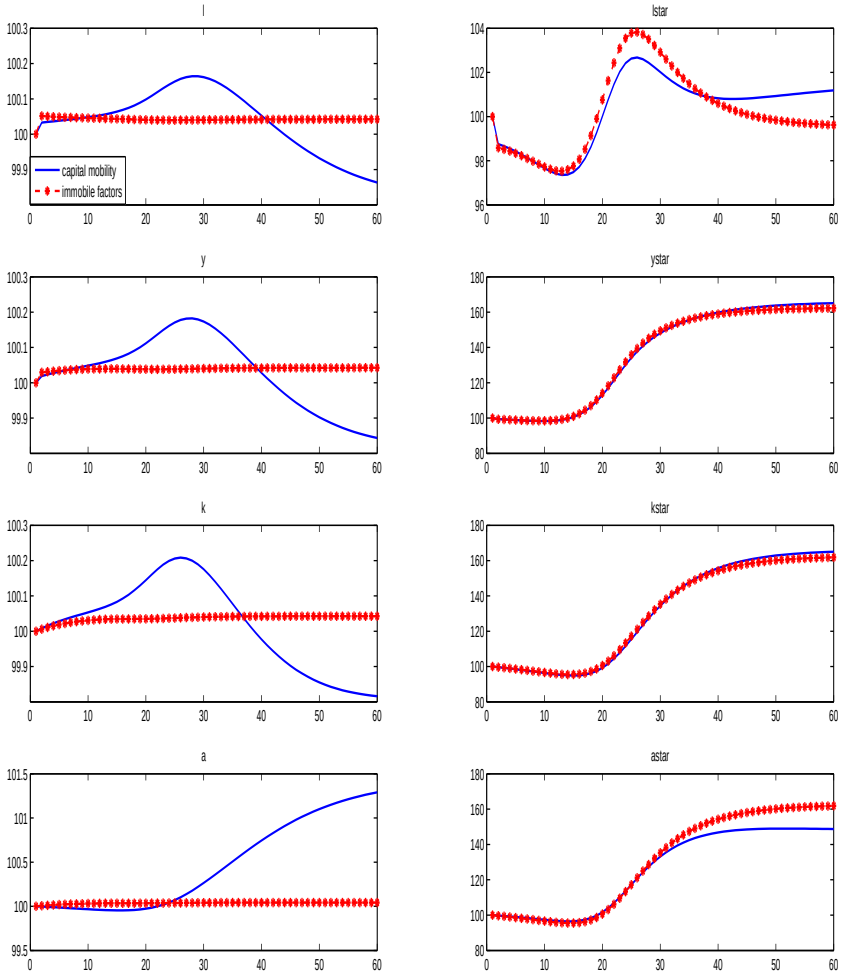


Figure 3: Simulation with half TFP-gap catch-up: the results of models with immobile factors and with capital mobility

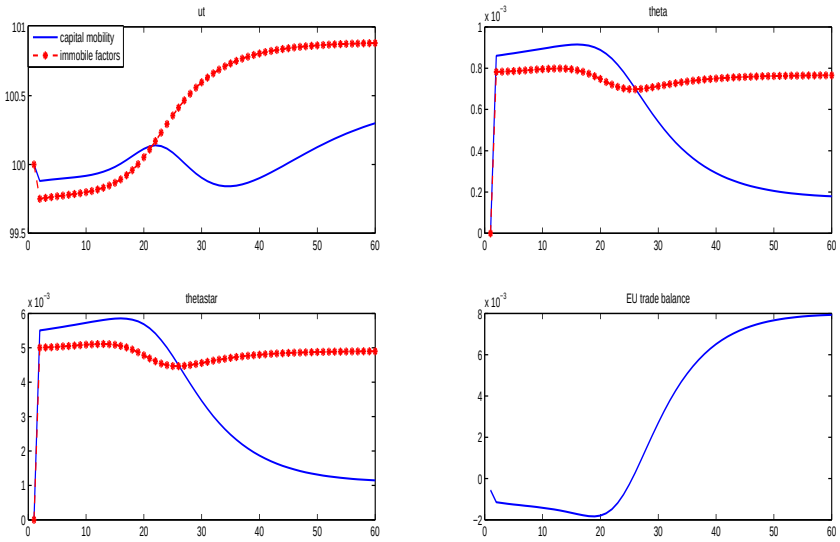


Figure 4: Simulation with half TFP-gap catch-up: the results of models with immobile factors and with capital mobility