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TFP growth in Turkey revisited: The effect of informal sector

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ABSTRACT

In this paper, we aim to contribute to the growth literature by presenting evidence that the presence of an informal sector might significantly affect both the level as well as the course of the total factor productivity (TFP). To this end, we develop a framework where we can compare the TFP in Turkey generated by a one-sector benchmark model to the one originating from an extended model with the presence of formal and informal labor. Our results indicate that, over the course of 1950–2014, the TFP generated by the benchmark model generally underestimates the productivity of the formal sector and this underestimation is mainly observed and is widened after 1980. Moreover, we also find that the substitution between formal and informal labor significantly affects this underestimation.

1. Introduction

A general empirical result arising from the growth literature is that the total factor productivity (TFP) is the main source of economic growth for a large set of countries and a significant time horizon. (See Prescott, 1998 or Senhadji, 2000 among many others in the literature). Independent of the production function or the dataset used in the analysis, growth in TFP generally dominates the contributions of other inputs on growth. A similar and related fact from the business cycle accounting literature also postulates that the efficiency wedge, which is nothing but the detrended TFP, is also the main source behind the business cycles for a large set of economies, including Turkey (Cicek and Elgin, 2011a).

Turkey is also not an exception with respect to the growth accounting. Even though in some sub-episodes of the Turkish economy, inputs other than the TFP might play some significant roles, TFP is also the main general source of growth in Turkish economy over the past 60 years (See Ismihan and Metin-Ozcan, 2006; Imrohoroglu and Ungor, 2009; Cicek and Elgin, 2011b; more recently Ungor, 2014.). Therefore, it is very important for economists as well as policy-makers in Turkey to understand the evolution of the TFP as well as its components.

In this paper, we aim to contribute to the growth and productivity literature by presenting evidence that the presence of an informal sector might significantly affect both the level as well as the course of TFP. Specifically, we develop a framework where we can compare the TFP in Turkey generated by a one-sector benchmark model to the one originating from an extended model with the presence of formal and informal labor. Our results indicate that, over the course of 1950–2014, the TFP generated by the benchmark model generally underestimates the productivity of the formal sector and this underestimation is mainly observed and is widened after 1980. Moreover, the underestimation is more pronounced when the elasticity of substitution between formal and informal labor increases. Therefore, these results imply that the omission of the informal labor input and neglecting the potential substitution between the two types of labor may result in significantly understated levels of formal productivity. We also argue that these results are also in line with the evolution of some key and relevant variables during the recent history of Turkish economy.

Turkey with an informal sector size at about 25–30 % of official GDP has the largest informal sector size (relative to GDP) among OECD members along with Mexico. Even though the informal sector size has declined significantly after 1980's, it still constitutes a large fraction within the economy and acts as a barrier for growth, technological advancement and the efficiency of public finance. Even though the analysis we present here is only applied to the Turkish economy, it can also be generalized to include any other economy.

The rest of the paper is organized as follows: In the next section, we present the benchmark model as well as the two modified models we use in our simulations. Then, in the third section, we

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discuss the data and the calibration methodology. In section four, we present the quantitative analysis. Finally, in the last section we provide some concluding remarks.

2. Model

First, we will summarize the standard neoclassical production technology with only one type of labor (formal labor). Second, we will summarize two alternative production technologies that extend the standard neoclassical production technology to incorporate a second type of labor - the informal labor.

2.1. Model with formal sector labor (Benchmark)

There is a standard well-known approach to calculate TFP levels in the neoclassical development literature. Following this line of work, our proposed production technology overlaps one-to-one with the standard one used in the neoclassical framework. More in details, we assume that the GDP at time t - is denoted by Y_t - is a function of factor endowments and productivity, and this function follows a constant returns to scale Cobb-Douglass technology as follows:

$$Y_t = (K_t)^{\alpha}(A_t L_t)^{1-\alpha}, \tag{1}$$

where A_t, K_t and L_t denotes, respectively, the productivity, the stock of capital and the input of labor. Notice that the production technology assumes the productivity is labor augmenting. This assumption, which is a standard approach in the literature, is important for the analysis we want to pursue because it will make the productivity measures proposed in this section and the next one comparable. We will elaborate on this point later on.

Based on the production technology given in (1), the productivity measure A_t can be calculated by using the following equation:

$$A_t = \left[\frac{Y_t}{(K_t)^{\alpha}(L_t)^{1-\alpha}}\right]^{\left(\frac{1}{1-\alpha}\right)} \tag{2}$$

2.2. Models with formal and informal sector labor

In this section, we will introduce informal sector labor into the neoclassical production technology. Following Caselli and Coleman (2002, 2006), we will use two alternative CES production technologies. Next section provides a summary of these two alternative setups.

One Level CES Production Technology (Model 1). We assume that the output Y_t is produced according to the following CES production technology

$$Y_t = (K_t)^{\alpha}\left[\left(A_t^F L_t^F\right)^{\sigma} + \left(A_t^I L_t^I\right)^{\sigma}\right]^{\frac{1-\alpha}{\sigma}}, \tag{3}$$

where L_t^F is formal labor, L_t^I is informal labor, A_t^F is productivity level of formal labor, A_t^I is productivity level of informal labor and $\sigma < 1$. The elasticity of substitution between formal and informal labor is equal to $1/(1-\sigma)$. Observe that in case $\sigma = 1$, this production technology implies that only the more productive labor input (the one with higher A_t) will be employed. Logically, assuming that the more productive labor input is the “formal labor”, the informal labor will not show up in the production function in the case of $\sigma = 1$ and, therefore, the production function will be reduced to the standard Cobb-Douglass.

Notice that, in this modelling approach, Y_t corresponds to the sum of formal and informal sector outputs. Therefore, in our productivity calculations, the output measures used will incorporate this fact.

When we solve for the optimal allocation problem by assuming that all factors of productions are paid their marginal productivity, we can obtain closed form solutions for A_t^F and A_t^I. Let w_t^F, w_t^I and r_t denote, repectively, the formal wage, informal wage and marginal productivity of capital stock. Then, we obtain closed form solutions for A_t^F and A_t^I as follows:

$$A_t^F = \left[\frac{(Y_t)^{\frac{1}{1-\alpha}}(K_t)^{\frac{-\alpha}{1-\alpha}}}{L_t^F}\right]\left(\frac{w_t^F L_t^F}{w_t^F L_t^F + w_t^I L_t^I}\right) \tag{4}$$

$$A_t^I = \left[\frac{(Y_t)^{\frac{1}{1-\alpha}}(K_t)^{\frac{-\alpha}{1-\alpha}}}{L_t^I}\right]\left(\frac{w_t^I L_t^I}{w_t^F L_t^F + w_t^I L_t^I}\right) \tag{5}$$

The productivity A_t^F in (4) will be the measure that will be used (in our comparisons) to identify *“the effect of the existence of informal labor on **formal productivity**”.*

Two Level CES Production Technology (Model 2). In this section, we assume that the output Y_t is produced according to the following two level CES production technology

$$Y_t = \left\{\left(A_t^I L_t^I\right)^{\sigma} + \left[\left(A_t^F L_t^F\right)^{\rho} + \left(A_t^K K_t\right)^{\rho}\right]^{\frac{\sigma}{\rho}}\right\}^{\frac{1}{\sigma}}, \tag{6}$$

where L_t^F is formal labor, L_t^I is informal labor, A_t^F is productivity level of formal labor, A_t^I is productivity level of informal labor, A_t^K is productivity level of capital, $\sigma < 1$ and $\rho < 1$. The elasticity of substitution between formal labor and capital is equal to $1/(1-\rho)$. Similarly, the elasticity of substitution between formal and informal labor, and between capital and informal labor, is equal to $1/(1-\sigma)$. This production structure allows us to capture the fact that *the interaction between capital and formal labor can be quite different compared to the interaction between capital and informal labor.*

As in Model 1 summarized above, we can obtain closed form solutions for productivity levels by assuming that all factors of productions are paid their marginal productivity. Let w_t^F, w_t^I and r_t denote, repectively, the formal wage, informal wage and the marginal productivity of capital stock. Then, we obtain closed form solutions for A_t^F, A_t^I and A_t^K as follows:

$$A_t^F = \frac{Y_t}{L_t^F}\left(1 - \frac{r_t\left(\frac{K_t}{Y_t}\right)}{S_t}\right)^{1/\rho} S^{1/\sigma} \tag{7}$$

$$A_t^I = \frac{Y_t}{L_t^I}(1-S)^{1/\sigma} \tag{8}$$

$$A_t^K = \left(\frac{r_t\left(\frac{K_t}{Y_t}\right)^{1-\rho}}{S_t}\right)^{1/\rho} S^{1/\sigma} \tag{9}$$

where