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THE INFORMAL SECTOR AND TAX ON EMPLOYMENT: A DYNAMIC GENERAL EQUILIBRIUM INVESTIGATION

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The Informal Sector and Tax on Employment: A Dynamic General Equilibrium Investigation*

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Abstract

This paper elaborates on the evolution of the informal sector vis-à-vis the evolution of agricultural and formal sectors in a stylized developing country economy in process of growth. The analytical contribution of this essay extends the Ramsey theory of growth into a framework that includes an informal sector, and household preferences that display Engel effects in agricultural and in informally produced goods. Besides showing that the informal sector's importance diminishes over time as the economy grows, the results from the model demonstrate that a country can successfully reduce its informal employment by reducing tax on employment in the formal sector.

Keywords: Informal Sector, Economic Growth, Employment tax, Middle East, Turkey

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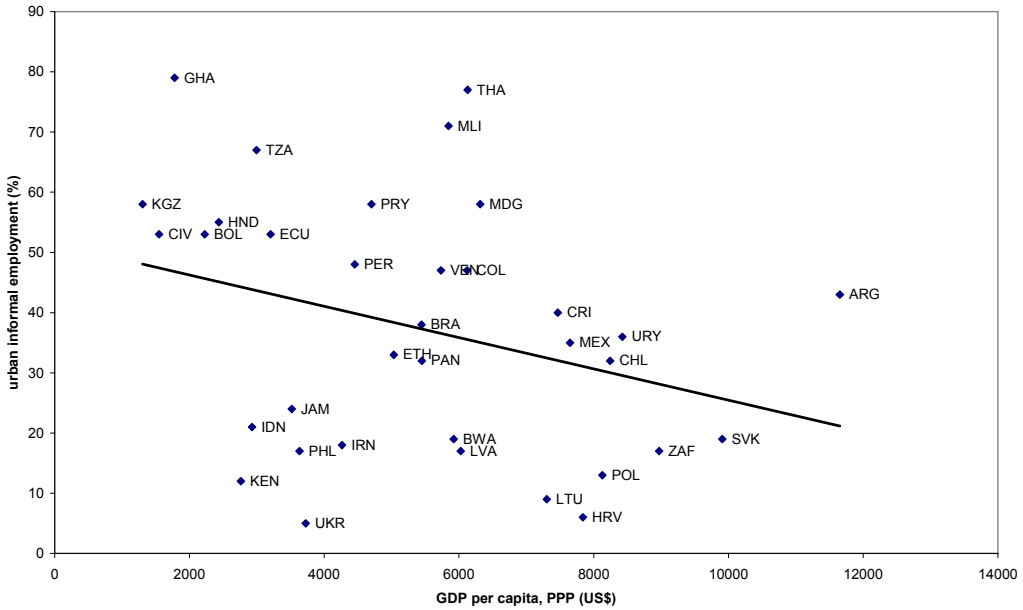
1. Introduction

Until the early 1970's, less developed countries were often characterized by dual economies, with a traditional agricultural sector and a more modern, urban sector. The dichotomy within the urban sector (traditional urban versus modern urban) in these countries was considered to be a temporary phenomenon by most authors, that is, the traditional urban employment was considered to be a temporary mode of employment for the unskilled agricultural labor en route to a permanent modern urban employment (Lewis, 1954; Ranis and Fei, 1961; Todaro, 1969). However, studies first by Hart (1973) on urban employment in Ghana and later by International Labour Office (1973) redefined the traditional urban sector as the 'informal' sector, and argued that in less developed countries, informal sector employment was a permanent rather than a temporary source of employment, and should be examined separately from employment in the 'formal' sector. Following these studies, the analysis of the dualism between formal and informal sectors, particularly analyzing the informal sector in less developed countries, has gained much momentum, and created a sizeable literature[1].

In the literature, several terms have been used to describe informal economic activity around the world: unofficial, shadow, hidden, underground, illegal, unrecorded, unreported, parallel, and black. Although there may be nuances in these terms, they all have a common denominator: "those engaged in (such) activities circumvent, escape, or are excluded from the institutional system of rules, rights, regulations and enforcement penalties that governs those agents engaged in formal production and exchange" (Feige, 1990). Particularly in less developed and developing countries, informal economic activity, or the term "informal sector" has additional connotations: this term usually describes a small scale, traditional industry sector, characterized by ease of entry, reliance on indigenous resources, family ownership of enterprises, labor intensive technologies, skills acquired outside the formal

school system, and unregulated and competitive markets (Bromley, 1978). Several empirical studies (including Schneider and Enste, 2000; Loayza, 1996; Friedman, et al., 2000; World Bank World Development Report, 2002) have found a large informal sector to be an important characteristic of less developed and developing economies. Schneider and Enste compare the size of the informal economy in 76 countries between 1989 and 1993, and find that on average, in developing countries (Africa, Central and South America, Asia), the size of the informal economy is between 35% and 44% of official GDP, in transition countries (former Soviet Union and Eastern Europe), between 21% and 35% of official GDP, whereas in OECD countries, it is about 15%. Loayza estimates the size of the informal sector in Latin America to be 39% of official GDP on average for the early 1990's, ranging from 18% in Chile to 66% in Bolivia. In his famous study on Lima, Peru, de Soto (1989) estimates the size of the informal sector to be 39% of official GDP in the early 1980's, and to grow to 61% in year 2000. He has also reported that some 61% of total work hours have been devoted to informal economic activity during the early 1980's in Lima. These findings, among others, imply a strong negative relationship between the level of economic development and the size of the informal sector. Furthermore, a negative relationship can be observed between GDP per capita (US$, PPP adjusted) and the share of informal urban employment in total urban employment (as an indicator of informal activity) amongst developing countries, as depicted by Figure 1 for the 1995-1999 average (World Development Indicators, 2003):



Source: WDI (2003) and WDI Online (2004), World Bank

Figure 1: GDP per capita vs. informal employment

In the light of such observations, using a dynamic general equilibrium framework, this study firstly demonstrates that the size of informal activity diminishes as a country accumulates capital and grows towards the long-run equilibrium. A multi-sector dynamic general equilibrium model with consumer optimization is developed, in which consumers have non-homothetic preferences. Production occurs in three sectors, agricultural, formal and informal[2], employing the three factors of production owned by consumers, i.e. land, labor, and capital. Production sectors are differentiated from each other by the type of the goods they produce, and also by their relative factor intensities. One identifying feature of the formal sector is that firms in this sector face regulations in the form of employment taxes; agricultural and informal sector firms evade such regulatory measures, which can be regarded as a common characteristic of developing countries. As the economy transitions into the long-run equilibrium, in addition to the supply-side effects implied by relative factor

intensities, the demand side of the economy is expected to have a substantial impact on how the economy proceeds, as well.

In the literature, theoretical studies linking the informal sector to the macroeconomy include Kelley (1994), Loayza (1996), and Ihrig and Moe (2001, 2004), among the few. In particular, Kelley investigates the macroeconomic implications of the informal sector using a multi-sector computable general equilibrium model for Peru for 1985. With the help of this model, Kelley is able to trace the role of the informal sector in the macro adjustment process and also conversely, examine how the informal sector reacts to changing macroeconomic conditions. By its very nature, Kelley's model is static, and does not capture how the informal sector evolves through time in an economy.

Within the framework of an endogenous growth model based on the AK-model, Loayza shows that informal activity arises when governments with limited enforcement capacity impose excessive taxes and regulations on the economy. As pointed out in Ihrig and Moe (2004), Loayza's study, being an AK-model, does not depict the transitional dynamics of the informal sector detected in actual economies. Ihrig and Moe[3] construct a homogenous-consumption-good, inter-temporal model in which the agents in the economy choose to allocate time between working in the capital intensive-formal and labor intensive-informal sectors. In this model, formal sector firms pay taxes to the government, while informal sector firms pay taxes only when they are caught by the authorities. They demonstrate that as an economy grows; holding all else constant, the informal sector employment and thus the size of the informal sector activity naturally diminishes[4], as observed in actual data. Furthermore, this study indicates that tax policies play a more crucial role than enforcement policies in attracting people out of the informal sector into the formal sector, and raising the standard of living in the long-run.

In contrast to Ihrig and Moe[5], our study incorporates heterogeneous goods and an endogenous price for the informal sector good. As a result, we will be able to trace the evolution of the informal sector vis-à-vis the other sectors in the economy depending also on the movement of the relative prices as capital accumulates and the output in each sector changes[6].

The next section introduces the theoretical model and its basic properties, and additionally defines and characterizes the competitive equilibrium for the model economy. In Section 3, the case of Turkey is presented. Section 4 applies the model to Turkey, exhibiting how the economy evolves over time, and how this process is affected by policy changes, particularly by a reduction in employment tax rates. Section 5 concludes this study.

2. The Basic Model

This section introduces the model environment, assumptions about consumer preferences and production technologies. A small open economy with three production sectors is described. These three sectors capture the two types of dualism in developing countries: dualism between traditional agricultural and modern sectors, and dualism within the modern sector, formal versus informal production. In each period, production of formal and informal sector goods requires the use of capital and labor, and production of agricultural goods requires labor, capital, and land, which is a fixed, sector-specific factor. Firms in all sectors are perfectly competitive in both goods and factors markets. Agricultural sector produces a pure consumption good that can be internationally traded; on the other hand the informal sector produces a pure consumption good that can be traded only domestically. Formal sector produces both a consumption and an investment good that can be traded internationally. Another identifying characteristic of the formal sector is that formal sector

firms pay labor taxes to the government, while agricultural and informal sector firms evade such taxes. Labor and capital are perfectly mobile across all sectors; and land can be rented in or out only within the agricultural sector. There is no mobility of the labor and capital across nations.

2.1. Theory

There is a representative household who consumes and realizes expenditures on all three types of consumption goods: agricultural good (food), a formally produced good, and an informally produced good, and she wishes to maximize the present value of discounted intertemporal utility, U, as given by the function

$$U = \int_0^{\infty} \frac{c(t)^{1-\theta} - 1}{1-\theta} e^{-\rho t} dt \tag{1}$$

subject to

$$\begin{aligned} \dot{k}(t) &= \omega(t) + r(t)k(t) + s(t)\tau + \psi(t) - E(c(t), p(t)) \\ k(0) &= k_0 \end{aligned} \tag{2}$$

and

$$\lim_{t\to\infty} k(t) e^{-\int_0^t r(v)dv} = 0 \tag{3}$$

where at time t, $c(t)$ is an index of intra-temporal per capita consumption composite, $k(t)$ is the capital per capita, $\omega(t)$ is the wage, $r(t)$ is the return on per unit of capital, $s(t)$ is the return in land, $\psi(t)$ is the per capita lump-sum transfers from the government, equal to labor taxes paid by formal sector firms, $E(c(t), p(t))$ is the aggregate household expenditure on consumption, $p(t)$ is a vector of output prices, $1/\theta$ is the elasticity of intertemporal substitution, and ρ is the time preference rate. The representative household faces a two-stage consumption choice problem: an inter-temporal problem where she decides on how

much to save and how much to expend on aggregate consumption and an intra-temporal problem where she decides on how much to spend on each consumption item.

The instantaneous consumption composite of the representative household is of Stone-Geary form:

$$\begin{aligned} & c = B(c_1 - \gamma_1)^{\lambda_1}(c_2)^{\lambda_2}(c_3 - \gamma_3)^{\lambda_3} \\ & c_1 > \gamma_1 \\ & c_2 > 0 \\ & c_3 > \gamma_3 \end{aligned} \tag{4}$$

where c_j is the consumption of good *j, j=1,2,3, B*>0 is a constant[7] and $\lambda_1 + \lambda_2 + \lambda_3 = 1$. In this study, the non-homotheticity of the Stone-Geary preferences are meant to capture the Engel effects, i.e. the household devotes a smaller portion of her total expenditures on consumption of agricultural and informal sector goods as her income increases[8]. Furthermore, these preferences imply that the income elasticities of the demand for agricultural and informal sector goods are less than one, and that for the formal sector goods is equal to one. Here, γ_1 of agricultural good can be interpreted as the level of subsistence food consumption, while γ_3 of informal good may be interpreted as the purchases of the household from informal goods markets before any substantial purchases are made in the formal goods markets.

At each period in time, the representative household chooses consumption bundles of three types of goods so as to minimize her per period expenditures, given her instantaneous consumption composite, *c*. Given the prices $p = (p_1, p_2, p_3)$ and aggregate consumption *c*, the minimized total expenditures are

$$E(c, p) = p_1^{\lambda_1} p_2^{\lambda_2} p_3^{\lambda_3} c + p_1\gamma_1 + p_3\gamma_3 \tag{5}$$

Accordingly, the conditional demands for each consumption item are

$$c_1 = \frac{\lambda_1[E(c,p) - p_1\gamma_1 - p_3\gamma_3]}{p_1} + \gamma_1 \tag{6.1}$$

$$c_2 = \frac{\lambda_2[E(c,p) - p_1\gamma_1 - p_3\gamma_3]}{p_2} \tag{6.2}$$

$$c_3 = \frac{\lambda_3[E(c,p) - p_1\gamma_1 - p_3\gamma_3]}{p_3} + \gamma_3 \tag{6.3}$$

Solution to the intertemporal problem of the representative household yields the Euler equation, or the Ramsey rule for optimal saving in simplified form[9]

$$\frac{\dot{c}}{c} = \frac{1}{\theta}\left[r - \rho - \lambda_3 \frac{\dot{p}_3}{p_3} \right] \tag{7}$$

In order to be able to numerically solve the model presented above for equilibria, we specify the production parameters of the model economy in detail. In particular, the production functions of the firms representing each sector are of the constant-returns-to-scale, Cobb-Douglas type. The production of the agricultural firm is represented by

$$Y_1 = b_1 B_1 L_1^{\alpha_1} K_1^{\alpha_2} T^{\alpha_3}$$

where $b_1, B_1 > 0$ are scaling constants[10], $\alpha_1, \alpha_2, \alpha_3 \in (0,1)$ and $\alpha_1 + \alpha_2 + \alpha_3 = 1$. Note that since the land input *T* is fixed, the returns to labor and capital in agriculture are diminishing. The Cobb-Douglas production functions of the formal and informal representative firms are

$$Y_2 = b_2 B_2 L_2^{\beta} K_2^{1-\beta}$$
$$Y_1 = b_1 B_1 L_3^{\delta} K_3^{1-\delta}$$

respectively. Similar to the agricultural production function, here, $b_j, B_j > 0, j = 2,3$ are the scaling constants in the formal and informal sector production functions[11], and $\beta, \delta \in (0,1)$.

2.2. Competitive Equilibrium

Definition A competitive equilibrium for this economy is a list of sequences of output prices, consumption levels, wage rates, capital and land rental rates, and production plans for each sector such that

i) given output and input prices, the representative household maximizes the present value of her discounted intertemporal utility;

ii) given output and input prices, representative firms in each sector maximize profits;

iii) market clears in the non-tradable (informal) goods market;

iv) labor and capital markets clear;

vi) Walras' Law holds;

vii) no-arbitrage condition holds between capital and land assets; and

viii) total taxes (contributions towards employee's social security premiums) paid by formal sector firms equal total transfer payments.

2.2.1. Characterization of Competitive Equilibrium

In equilibrium, profit maximization in formal and informal sectors implies[12]

$$MC_2(\tilde{\omega}, r) = 1 \tag{8.1}$$

$$MC_3(\omega, r) = p_3 \tag{8.2}$$

where $MC_2(\tilde{\omega}, r)$ and $MC_3(\omega, r)$ denote the marginal cost in each sector, and p_3 is the relative price of the informal good. The formal sector firms pay labor taxes in the form of contributions towards the employees' social security premiums (τ_f), hence per unit labor cost of the formal sector firm is $\tilde{\omega} = \omega(1 + \tau_f)$. Using (8.1) and (8.2), wages and informal good prices are expressed as functions of capital rental rate,

$$\omega = \mathrm{w}(r) \tag{9.1}$$

$$p_3 = \mathrm{p}(r) \tag{9.2}$$

Factor market clearing conditions allow us to solve for functions for output levels in formal and informal sectors in terms of capital rental rate and capital[13]:

$$y_2 = \mathrm{y}_2(r,k) \tag{10.1}$$
$$y_3 = \mathrm{y}_3(r,k) \tag{10.2}$$

From the informal goods market clearing condition $c_3 = y_3$, and (6.3), we have

$$y_3 = \frac{\lambda_3[E(c,p) - p_1\gamma_1 - p_3\gamma_3]}{p_3} + \gamma_3 \tag{11}$$

which yields

$$E(r,k) = \frac{\mathrm{p}(r)}{\lambda_3}(\mathrm{y}_3(r,k) - \gamma_3) + p_1\gamma_1 + \mathrm{p}(r)\gamma_3 \tag{12}$$

After substituting equation (12) for household expenditures, the intertemporal budget constraint for the household can be written as:

$$\begin{aligned}\dot{k} &= \mathrm{w}(r) + rk + s\tau + \psi(r,k) - E(r,k) \\ &= f_1(r,k)\end{aligned} \tag{13}$$

Total time-differentiating the informal goods market clearing condition (11), we obtain

$$\begin{aligned}&\lambda_3 c p_1^{\lambda_1}\mathrm{p}(r)^{\lambda_3}\left(\frac{\dot{c}}{c} + \lambda_3\frac{\partial \mathrm{p}(r)}{\partial r}\frac{r}{\mathrm{p}(r)}\frac{\dot{r}}{r}\right) \\ &= \frac{\partial \mathrm{p}(r)}{\partial r}\dot{r}(\mathrm{y}_3(r,k) - \gamma_3) + \mathrm{p}(r)\left(\frac{\partial \mathrm{y}_3(r,k)}{\partial r}\dot{r} + \frac{\partial \mathrm{y}_3(r,k)}{\partial k}\dot{k}\right)\end{aligned} \tag{14}$$

in which

$$\lambda_3 c p_1^{\lambda_1}\mathrm{p}(r)^{\lambda_3} = \mathrm{p}(r)(\mathrm{y}_3(r,k) - \gamma_3) \tag{15}$$

and

$$\frac{\dot{c}}{c} = \frac{1}{\theta}\left(r - \rho - \lambda_3\frac{\partial \mathrm{p}(r)}{\partial r}\frac{r}{\mathrm{p}(r)}\frac{\dot{r}}{r}\right) \tag{16}$$

Finally, after substituting for (15) and (16) in (14) the resulting differential equation $\dot{r}$ is obtained:

$$\dot{r} = f_2(r,k) \tag{17}$$

The reduced system of two differential equations (13) and (17) together with an initial condition for capital, k_0 and the transversality condition completely characterize the dynamic competitive equilibrium.

2.2.2. Steady State Equilibrium and the Transition path

In the long-run equilibrium in this economy, all endogenous variables are constant for all *t*, under the assumption that $\dot{k} = 0$, in particular. Such an equilibrium is called the steady state equilibrium.

By definition, at the steady state, it must be the case that

$$\dot{k} = 0$$
$$\dot{r} = 0$$
$$\dot{c} = 0$$

Then, from the Euler condition (7),

$$r_{ss} = \rho \tag{18}$$

must be true at the steady state, where r_{ss} denotes the steady state value of the capital rental rate. Knowing r_{ss} and that $\dot{k} = 0$, the intertemporal budget constraint of the household can be rewritten as

$$0 = \mathrm{w}(r_{ss}) + r_{ss}k_{ss} + s(p_1, r_{ss})\tau + \psi(r_{ss}, k_{ss}) - E(c_{ss}, \mathrm{p}(r_{ss})) \tag{19}$$

where k_{ss} and c_{ss} are the steady state values of aggregate capital and the household's consumption, respectively. However, (19) still leaves us with two unknowns at the steady state, namely k_{ss} and c_{ss}. We know that for every point in time, including the steady state, the informal goods market clearing condition must hold:

$$c_{3,ss} = y_3(r_{ss}, k_{ss}) \tag{20}$$

From (20),

$$c_{ss} p_1^{\lambda_1} \mathrm{p}(r_{ss})^{\lambda_3} = \frac{\mathrm{p}(r_{ss})}{\lambda_3}(\mathrm{y}_3(r_{ss}, k_{ss}) - \gamma_3) \tag{21}$$

We know that

$$E(c_{ss}, \mathrm{p}(r_{ss})) = c_{ss} p_1^{\lambda_1} \mathrm{p}(r_{ss})^{\lambda_3} + \mathrm{p}(r_{ss})\gamma_3 \tag{22}$$

Then, the expenditures of the household at the steady state can be represented by the function

$$E(r_{ss}, k_{ss})) = \frac{\mathrm{p}(r_{ss})}{\lambda_3}(\mathrm{y}_3(r_{ss}, k_{ss}) - \gamma_3) + p_1\gamma_1 + \mathrm{p}(r_{ss})\gamma_3 \tag{23}$$

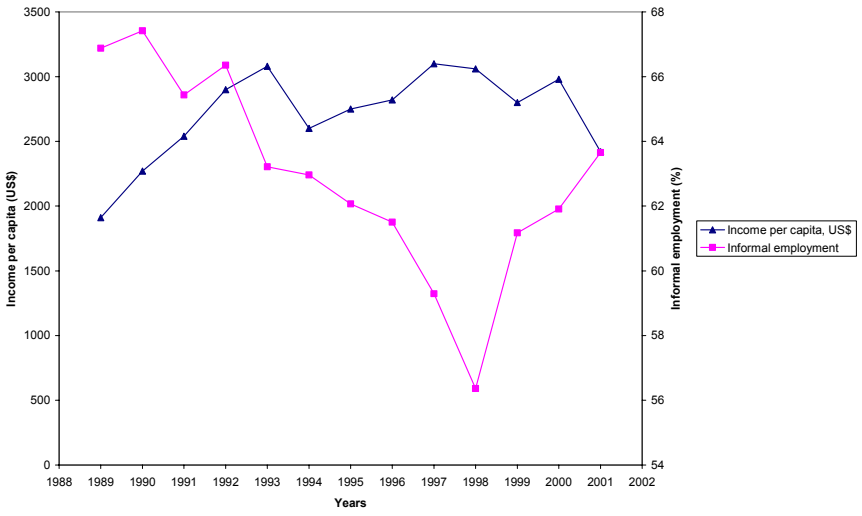
After plugging (23) in (19), one can solve (19) for the only unknown k_{ss}. By substituting r_{ss} and k_{ss} for *r* and *k*, the steady state values of the other endogenous variables can be found. Given the steady state values and initial conditions, the Time-Elimination Method is adopted (under the Eigenvalues-Eigenvectors Approach) to numerically solve for the transition path equilibrium (Mulligan and Sala-i-Martin, 1991; Barro and Sala-i-Martin, 1995).

3. The Case of Turkey

Informal sector activity, as in other developing economies, has remained significant in Turkey over the years[14]. According to a publicized report by the Tax Inspectors Board, the factors that promote informal activity in Turkey include low per capita income, low institutionalization rate in the private sector, underdeveloped capital and money markets, an inefficient tax system, and high tax rates, as well as high social security premium contributions[15]. An important indicator of volume of informal activity is the extent of employment that eludes government's regulatory realm. In fact, the percentage of non-agricultural workers not covered by the Social Security system can be taken as a proxy for the share of informal employment in the national economy (Loayza, 1996). According to State Institute of Statistics (SIS) employment figures for the year 2000, 35.3% of employed

persons in Turkey were employed in agriculture (only 0.89% of which were insured through the Social Security system), 24.7% of total employed persons were employed in non-agricultural sectors and insured through the Social Security system, and the remaining 40% of employed persons were not insured, at all. For the remainder of the study, we will denote the insured workers as the 'formally employed'. More strikingly, when we examine the breakdown of uninsured or 'informally employed', we see that 74.6% of the non-agricultural informal workforce was employed in the services sectors, hence we can regard the services sector as most concentrated in non-agricultural informal activity.

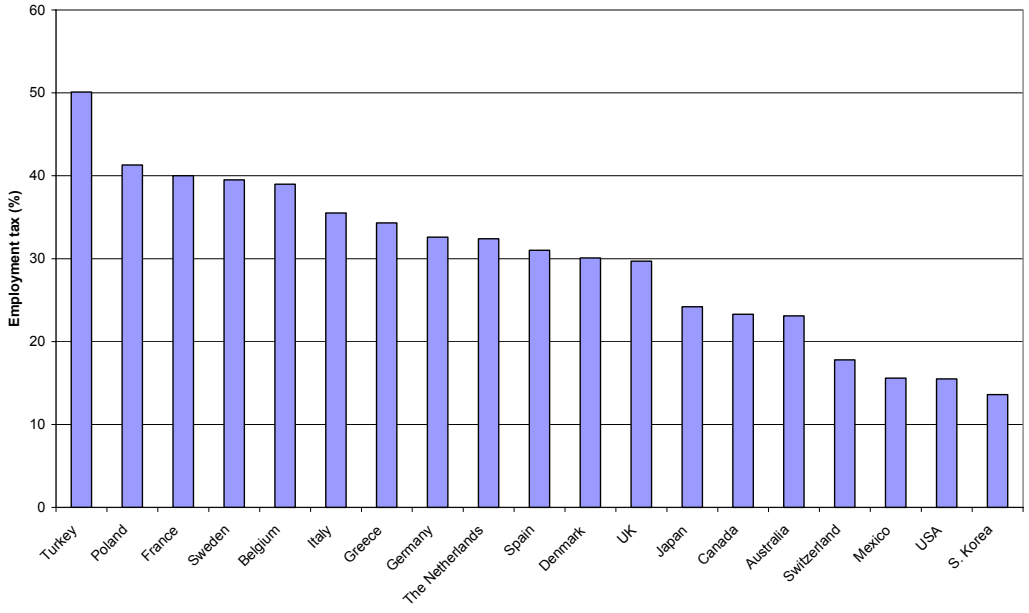
Figure 2 depicts the counter-movement of income per capita and informal employment, over the period 1989-2001 in Turkey[16]. For most of the years, we casually observe that during the years of relative prosperity, the share of informal employment in non-agricultural employment has declined, and during years of economic downturn, it has increased. One explanation we can provide is that those who lose their jobs in the formal sector during economic downturns are willing to work informally with relatively low pay and without any insurance coverage.



Source: WDI Online (2004) and Statistical Yearbook of Turkey (SIS), various issues

Figure 2: Income per capita vs. informal employment, Turkey

One of the highly debated factors that contribute to the size of the informal sector is the high employment taxes in Turkey. In a report on informal employment by Ankara Chamber of Commerce[17], it is stated that employment taxes in Turkey are among the highest in OECD countries (Figure 3). In this report it is stressed that besides leading to a large informal sector, high employment taxes in Turkey give rise to an unfair competition between those businesses which pay these taxes and those which don't. According to the same report, high employment taxes along with limited enforcement lead to progressively heavier burdens on those businesses which do pay taxes, and eventually cause a strain on the Social Security system.



Source: Deep Employment Report (2004), Ankara Chamber of Commerce

Figure 3: Tax on Employment, Selected OECD Countries

4. Model Calibration

The model is calibrated to the Turkish economy for the year 2000. A simple aggregated Social Accounting Matrix with three production sectors, three consumption goods, and a representative household has been constructed based on National Accounts, employment and consumption statistics for the year 2000 (SIS, 2002). To estimate the size of informal sector

output, the procedure introduced in Kelley (1994) was followed. However unlike Kelley, instead of unpaid employment as a proxy for informal employment, uninsured non-agricultural employment is taken as a proxy in this study[18]. It is found that in 2000, uninsured, informally employed persons in Turkey produce about 29.9% of the total output in the economy. Insured, formally employed persons produce about 53.7% of the total GDP, and the remaining 16.4% of the total GDP is the agricultural output.

Table 1 summarizes production share parameters in each sector[19]:

	Agriculture	Formal Sector	Informal Sector
Labor	0,46	0,26	0,58
Capital	0,39	0,74	0,42
Land	0,15		

Table 1: Factor elasticities

These factor elasticities are such that relatively, informal sector has the highest labor intensity, and formal sector has the highest capital intensity. In the formal sector, the labor cost to the firm includes the contributions of the employer towards employee's social security and unemployment insurance premiums. In Turkey, as per the Article 73 of the Social Insurance Act, this contribution ranges from 21.5% to 27% of the employee's earnings[20]. In this study, the average 24.25% is chosen, and is considered to be a proxy for employment taxes paid by employers.

As for the consumption patterns in Turkey, we can see that a large fraction of total expenditures (35.8%) are devoted to goods and services from the informal markets produced using labor intensive technologies[21], along with food products (36.6%), and a relatively small proportion of expenditures on formally manufactured goods produced using capital intensive technologies, which include expenditures on durable consumer goods (27.6%). Table 2 summarizes the parameters that characterize consumer behavior in the model. Here, supernumerary expenditures of the household refer to the expenditures made after setting

aside budget for the purchases of goods j in accordance with the parameters γ_j at their respective prices. Essentially, the fraction parameters above reflect the consumption choices of the households when the economy is in the long-run, in other words, when the expenditures on subsistence consumption are insignificant enough in total expenditures[22].

Parameter	*Symbol*	*Value*
Fraction of Supernumerary Expenditures spent on Good-1	λ_1	0.15
Fraction of Supernumerary Expenditures spent on Good-2	λ_2	0.70
Fraction of Supernumerary Expenditures spent on Good-3	λ_3	0.15
Rate of time preference	ρ	0.042
Elasticity of intertemporal substitution	$1/\theta$	1

Table 2: Consumption parameters

4.1. Simulation Results

In Table 3, the simulation results from the baseline economy are presented. According to the model, development implies that the share of the agricultural sector in GDP falls from 16.4% to a negligible amount, that of the informal manufacturing falls from 29.9% to 21.8%, and that of the formal manufacturing rises from 53.7% to 78% (Figure 4). As capital accumulates, agricultural sector loses labor to the formal sector which uses labor most efficiently among all sectors. Furthermore, agriculture also loses capital to both formal and informal sectors, thus agricultural output declines substantially. Even though it has a lower degree of capital intensity than the formal sector, informal sector is capable of competing for capital as the price of its product relative to the price of the formal product rises during the transition process.

As capital accumulates over time, the increase in the productivity of labor causes wages to increase. As income of the household increases, level of expenditures in consumption for all goods increase, however, there is a decrease in the share of expenditures spent on

agricultural goods and on informally produced goods, and an increase in the share of formal sector goods, due to non-homothetic preferences (Figure 5). Thus, the drop in the share of agricultural output and in the informal sector output, and the rise in the share of formal sector output in GDP are reinforced by the non-homotheticity of preferences.

Not surprisingly, these shares of labor and capital evolve in the same pattern as their respective sectors' output evolves over time, that is, the uses of labor and capital in agricultural and informal sectors diminish as a share in total labor and capital, whereas the uses of labor and capital in formal sector increase, as shown in Figure 6 (sectoral capital shares not shown). In particular, as the economy transitions into the long-run equilibrium with the process of growth, the share of informal sector employment in non-agricultural employment (sum of informal and formal sectors' employment) diminishes over time. Recall that one could detect an apparent negative relationship between per capita income and informal employment in the Turkish economy in the mid-1990's to early 2000's, as depicted in Figure 2.

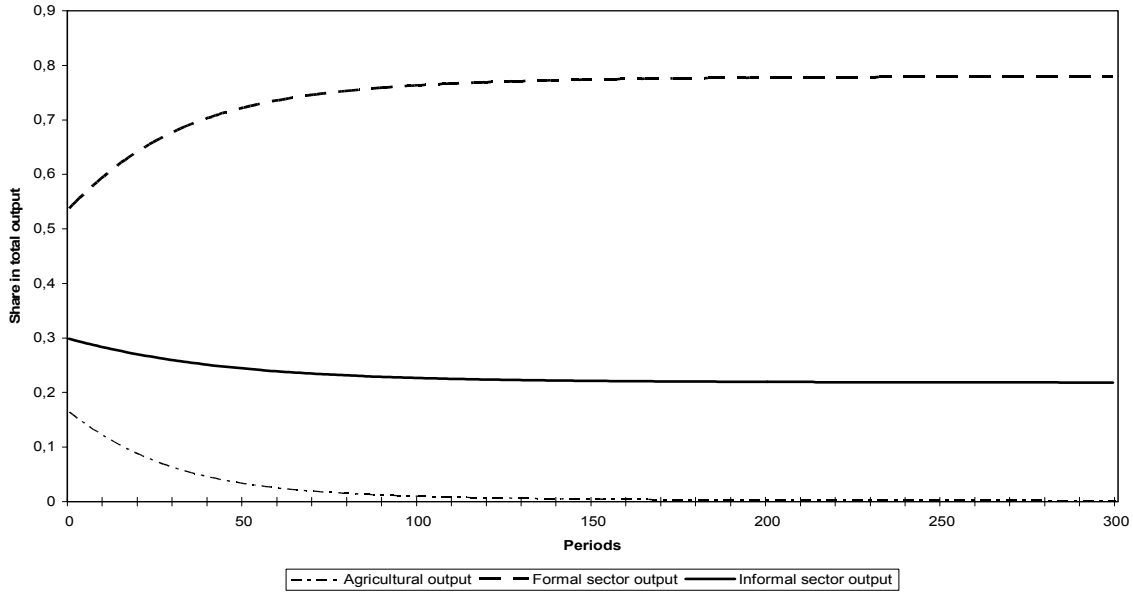


Figure 4: Sectoral shares in total output

	t=0	*Steady State*
Shares in GDP (%)		
Agricultural output	16.4	0.16
Formal output	53.7	78
Informal output	29.9	21.8
Consumption shares in Expenditures (%)		
Agricultural good	36.6	17.9
Formal sector good	35.8	60.2
Informal sector good	27.6	21.8
Sectoral allocation of labor (%)		
Agriculture	20.4	0.25
Formal sector	31.5	56.5
Informal sector	47.8	43.3
Share of Informal labor in non-agr. Labor (%)	60.3	43.3
Sectoral allocation of capital (%)		
Agriculture	11	Negligible
Formal sector	67	86
Informal sector	22	14

Table 3: Baseline model simulation

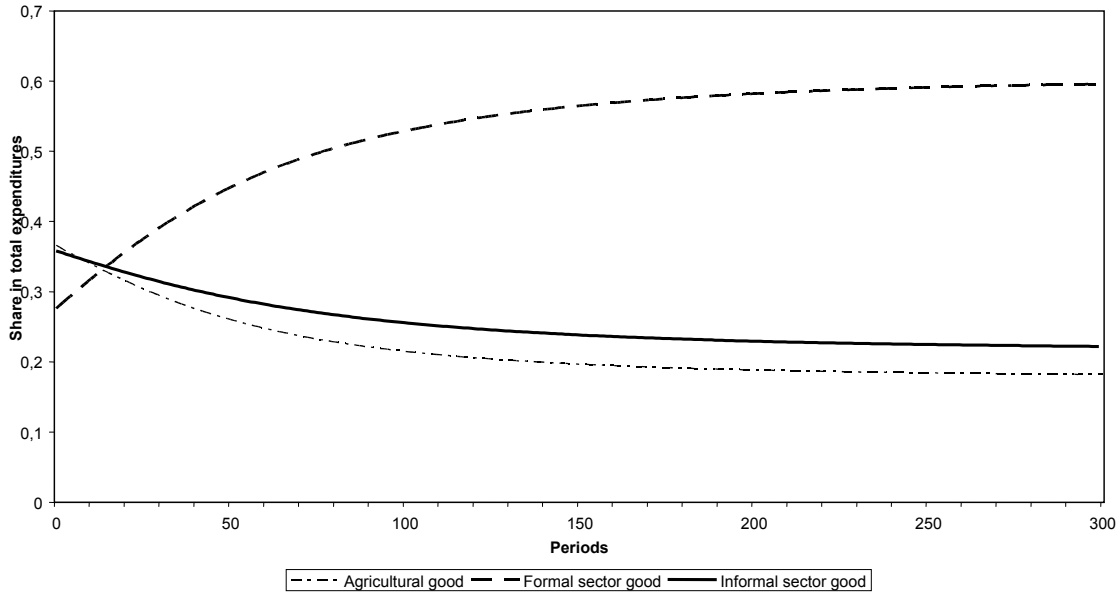


Figure 5: Shares in expenditure

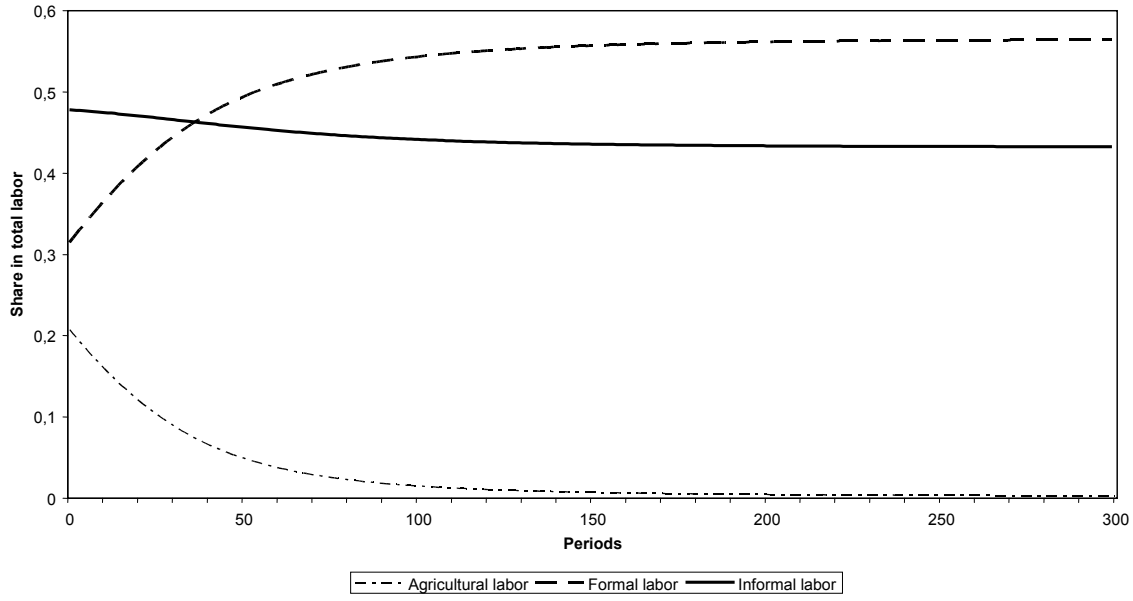


Figure 6: Sectoral labor shares in total labor

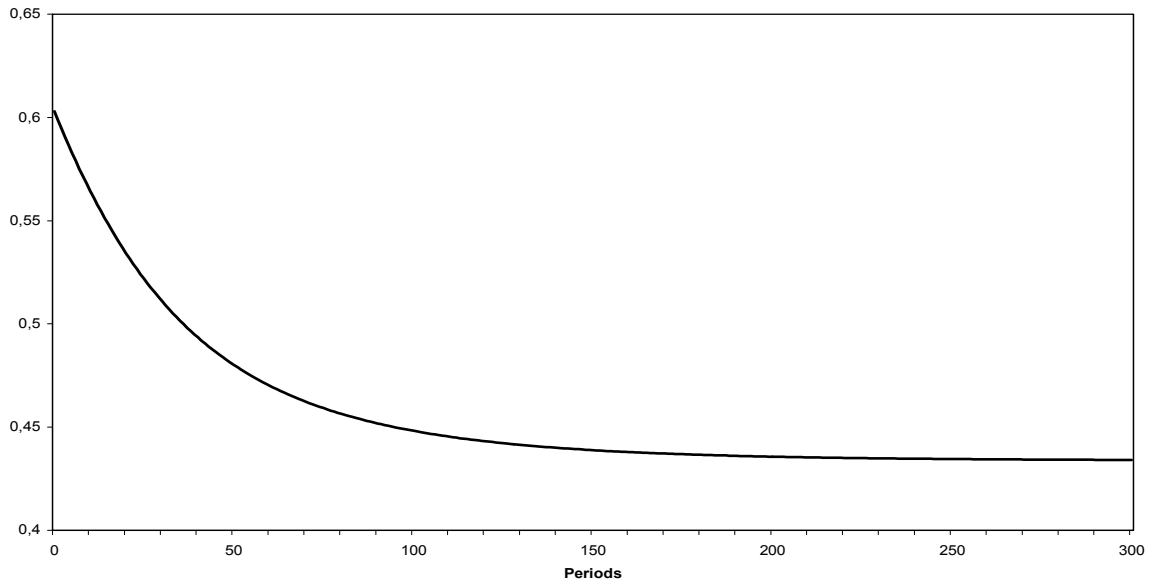


Figure 7: Share of informal employment in non-agricultural employment

4.2. Experiments with lower tax rates on employment

Table 4 reports the steady-state effects of lowering the formal sector employer's rate of contribution towards employee's social security premiums. When this rate is lowered from 24.25% in the baseline economy, increases in formal sector output level as well as in capital stock and level of GDP can be observed. Particularly, when the tax rate is lowered to 20%, the long run values of formal output, capital stock and GDP all increase by 1.5%, whereas almost a 9% increase is detected in these variables when employment tax is completely eliminated.

Tax rate	0.20	0.10	0.00
GDP	1.46	5.07	8.95
Capital stock	1.44	5.00	8.81
Formal output	1.42	4.88	8.56
Informal output	-0.31	-1.18	-1.53
Share of informal labor in non-agricultural labor	-1.8	-6.24	-10.97

(Percent change in steady state values from the baseline model.)

Table 4: Results under alternative employment tax rates

Lower employment tax rates in the formal sector encourage a more efficient allocation of labor, and labor is reallocated into formal sector from the informal sector[23]. As a result, the fraction of informal labor in non-agricultural labor diminishes, first by 1.8% when the tax rate is reduced to 20%, and by 11% when the tax is completely eliminated. As labor moves out of the informal sector, this sector accommodates the loss of labor by hiring more capital services (informal sector firm maintains competitiveness in the capital market by increasing prices in the informal goods market to be able to afford increased use of capital), output in this sector drops as the increased use of capital cannot fully compensate for the loss of labor. As the employment tax rate is lowered, the total amount of tax collected from the formal sector gradually drops, hence the transfers to households drop, as well. On the other hand, as a source of income, increases in wages and particularly increases in capital earnings overwhelm the cut in transfers, therefore we see increases in income up to 9% for the representative household when employment tax is eliminated.

5. Concluding Remarks

In developing countries, the informal sector is a large and a significant part of the economic life. The importance of the informal sector in terms of quality of institutions, employment, and also the effectiveness of economic policies has recently attracted many economists to conduct both empirical and theoretical research on the subject. However, what has been lacking in the literature so far was the study of the informal sector with the inclusion of the household demand perspective, and the study of the evolution of the informal sector vis-à-vis other sectors of the economy, in the process of economic growth as capital accumulates. In this study, highlighting the demand-side of the economy, we introduce a three-sector growth model with production in agricultural, formal and informal sectors: households prefer to devote a larger share of their expenditures on formal goods, and less on agricultural and informal goods as their incomes increase. This structure of the preferences

aptly summarizes the behavior of the various groups of consumers in developing countries: as income increases, consumers prefer less to buy from informal markets such as street bazaars and outdoor markets, and more from supermarkets and shopping malls. Although it can also be affected by numerous other factors, such as the quality of institutions, it is well observed that the size of the informal sector is closely related to income per capita.

Within the framework of the model, we are able to trace the evolution of the three production sectors over time, as an economy accumulates capital and grows. In addition to tracing the evolution in each of the sectors, the model allows us to explain the evolution by studying the effects of factor movements between the sectors and the demand patterns of the households. Finally, it is shown that holding all else constant; a developing country can successfully reduce the fraction of informally employed in total employment by reducing the labor costs in the formal sector, and thus promote employment and production in this sector.

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Notes:

[1] Please see Danesh (1991) as a comprehensive research guide on the informal economy.
[2] In their article, Gang and Gangopadhyay (1990) have a similar structure in the supply side of the economy; however, they do not present demand-side relationships in their model economy.
[3] ibid.
[4] In Ihrig and Moe (2004), informal activity remains to be a part of the economy even in the long-run equilibrium; that is, as seen in the data, informal activity does not completely die out even in the developed economies.
[5] ibid.
[6] In fact, Ihrig and Moe (2004) mention in their study that having heterogeneous goods and endogenous prices would indeed affect the evolution of the informal sector as relative prices change due to capital accumulation over time, but they do not show this result explicitly.
[7] For algebraic simplicity, the scale parameter B is set at $B \equiv \lambda_1^{-\lambda_1}\lambda_2^{-\lambda_2}\lambda_3^{-\lambda_3}$.
[8] Similar Engel effects are mentioned in Tybout (2000) for those goods produced using "cottage technologies", implying small scale informal production, and studied in Irz and Roe (2001) for agricultural goods, and Echevarria (1997, 2000) for all types of goods.
[9] The Euler equation from the intertemporal problem is obtained as

$$\frac{\dot{c}}{c} = \frac{1}{\theta}\left[r - \rho - (\lambda_1 \frac{\dot{p}_1}{p_1} + \lambda_2 \frac{\dot{p}_2}{p_2} + \lambda_3 \frac{\dot{p}_3}{p_3}) \right]$$

The Euler is simplified since the world price of the agricultural good, p_1 and the price of the formal good p_2 are taken exogenously, with $\frac{\dot{p}_1}{p_1} = \frac{\dot{p}_2}{p_2} = 0$.

[10] For algebraic simplicity, the scaling parameter B_1 is set at $B_1 \equiv \alpha_1^{-\alpha_1}\alpha_2^{-\alpha_2}\alpha_3^{-\alpha_3}$.
[11] For algebraic simplicity, the scaling parameters B_2 and B_3 are set at $B_2 \equiv \beta^{-\beta}(1-\beta)^{\beta-1}, B_3 \equiv \delta^{-\delta}(1-\delta)^{\delta-1}$.
[12] Formal sector output is assumed to be the numeraire, and we set $p_2 \equiv 1$.
[13] Factor market clearing conditions can be summarized as:

$$-\frac{\partial s(p_1,\omega,r)}{\partial \omega} + \frac{\partial MC_2(\tilde{\omega},r)}{\partial \tilde{\omega}} y_2 + \frac{\partial MC_3(\omega,r)}{\partial \omega} y_3 = 1 \qquad \text{(Labor market)}$$

$$-\frac{\partial s(p_1,\omega,r)}{\partial r} + \frac{\partial MC_2(\tilde{\omega},r)}{\partial r} y_2 + \frac{\partial MC_3(\omega,r)}{\partial r} y_3 = k \qquad \text{(Capital market)}$$

[14] For a comprehensive analysis of the informal sector and informal employment in Turkey, see Bulutay (2000).
[15] Hürriyet News (11.03.2003), Internet resource: www.hurriyetim.com.tr/haber/0,,nvid~241170,0.asp
[16] Informal employment as "share of non-agricultural uninsured employment in total non-agricultural employment"
[17] Deep Employment Report by Ankara Chamber of Commerce (2004) at Internet source www.atonet.org.tr.
[18] In fact, in developing countries during the 1990's, the correlation between the share of urban informal sector employment (in total urban employment) and the share of uninsured employment (i.e. share of pension non-contributors) is quite high (The World Bank, World Development Indicators, 2003).
[19] About labor shares: we consider only the paid employed persons, because the unpaid family workers in agriculture skew the results for labor share in agriculture. Unpaid family workers most heavily work in agriculture. Compensation of employees in government services are also excluded, since this figure highly skews results for labor share as well . One striking feature of the agricultural sector is that as of 2000, only 46.1% of employed persons in this sector are paid, the rest are unpaid family workers.
[20] Social Security Institution Internet source: www.ssk.gov.tr/wps/sskroot/bilgibankasi /mevzuat /506eng/chapter8.jsp
[21] Since the informal sector produces a non-tradable home-good, the expenditures must be equal to value of output in this sector.

[22] When $\gamma_j = 0$, the preferences are of the Cobb-Douglas form. In our model, these values are obtained from calibration of the base model for Turkey, for the year 2000, *t=0*:

$$\frac{\lambda_1(E_0 - p_1\gamma_1 - p_3\gamma_3) + \gamma_1}{E_0} = \frac{p_1 c_{1,0}}{E_0} = 0.366$$

$$\frac{\lambda_2(E_0 - p_1\gamma_1 - p_3\gamma_3)}{E_0} = \frac{p_2 c_{2,0}}{E_0} = 0.276$$

$$\frac{\lambda_3(E_0 - p_1\gamma_1 - p_3\gamma_3) + \gamma_3}{E_0} = \frac{p_3 c_{3,0}}{E_0} = 0.358$$

The values on the RHS are the initial share of expenditure on the consumption of each good by the household. Since the values of E_0 are obtained from the data, γ_j can be easily calculated.

[23] We cannot see large changes in agricultural sector employment since this sector is already allocating a very small fraction of total employment in the baseline economy in the long run.