Economics Bulletin

Volume 36, Issue 4

Is Informality a Barrier to Convergence?

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Abstract

In this paper we ask whether informal economy acts as a barrier to growth of GDP per-capita. Cross-country panel regressions for the period between 1960 and 2012 including 160 countries provide evidence for a robust negative relationship between size of informal economy and relative per capita income. Building on this evidence we simulate a simple two-sector (formal and informal) dynamic general equilibrium model and show that under the presence of an informal sector a larger fraction of the observed per capita income differences across countries can be accounted for.

Citation: Ceyhun Elgin and Ferda Erturk, (2016) "Is Informality a Barrier to Convergence?", *Economics Bulletin*, Volume 36, Issue 4, pages 2556-2568
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Submitted: September 29, 2016. **Published:** December 29, 2016.

1. Introduction

The main determinants of long-run economic growth still remain as a central item in the macroeconomic agenda. In this study, our intention is to contribute to this strand of literature by questioning whether the prevalence of informal sector acts as a barrier to growth, more specifically a barrier to per capita income convergence.

Considering the current literature, there are two separate aspects when one intends to investigate the relationship between growth and informality: On the one hand, a larger informal economy could be associated with lower growth for a number of different reasons: First, a third factor, such as excessive regulation, could lead to a larger informal sector as well as reduce economic growth (Sarte 2000). Second, a large informal economy could severely limit government resources to finance several public goods (Loayza, 1997; Johnson et al. 1997) such as education, health, or infrastructure investment, thereby reducing potential growth. Besides these macro level evidences, some micro-level studies suggest that informal economy is a growth obstacle due to a number of different reasons. Regarding the influences of informality on economic performance, De Soto (1989) states that, the fear of detection by authorities forces informal firms to operate on a smaller scale, which prevents them from attaining efficient scale and therefore reduces economic growth. Raj and Seethamma (2007), Byiers (2009), Amin (2009), Taymaz (2009) as well as Benjamin and Mbaye (2010) can be given as further examples from this literature. In addition to efficiency differences between formal and informal firms, access to credit provides yet another channel that might associate larger informality to lower growth. For example, Massenot and Straub (2011) conclude that in an open economy, it is better to have a larger formal sector for economic growth because formality facilitates firms to collateralize their assets in a more efficient way leading to more investment and higher productivity. Similarly, Gatti and Honorati (2008) find that tax compliance (or formality) is positively and significantly correlated with access to credit which is identified as a fundamental source of growth. Straub (2005) is yet another example illustrating the credit market channel in identifying the negative effect of informality on growth. Furthermore, Caro, Galindo and Melendez (2012) find that labor informality is negatively and significantly correlated with access to credit, firm performance and employment growth in Colombia.[1] All these findings indicate that the informal sector size might severely affect the capital accumulation process in an economy thereby reducing the capital output ratio.

On the other hand, some economists argue that having a larger informal sector might bring some benefits for economic growth. Firms in the informal sector tend to be less productive (Levy 2008; La Porta and Shleifer 2008), employ lower-skilled workers, operate with less capital (Amaral and Quintin 2006) and are generally less able to absorb the cost of operating in the formal sector. This adverse selection in itself could raise productivity levels in the formal economy in countries with larger informal economies (D'Erasmo and Moscoso Boedo, 2011). However, the impact on productivity growth is unclear. For instance, Nabi and Drine (2009) conclude that an increase in the size of shadow economy could be accompanied by higher economic growth if a subsequent reduction in the size of the formal economy is offset by the increase in productivity of the formal sector. In yet another study by Eliat and

[1] Moron, Salgado and Seminario (2012) obtain a similar finding for Peru.

Zinnes (2000) the authors show that the presence of a large shadow economy decreases the amplitude of a recession in official GDP. Furthermore, Eliat and Zinnes (2002) list several potential factors that associate larger informal sector both with higher and lower growth and also provide some evidence for transition economies and illustrate that the relationship between growth and informality might actually be non-linear. Finally, Elgin and Uras (2013) show that if the capacity constraints of the formal financial institutions are binding, lowering the size of the informal sector would retard the level of financial development and therefore would harm economic growth.

The barriers to growth literature investigates what accounts for the observed income disparities across countries. For example, Parente and Prescott (1994) argue that the standard neoclassical growth model falls short of explaining the actual income differences as opposed to a model that takes barriers to technological adoption into account. Moreover, Ngai (2004) argues that the differences in income across countries are mostly transitory. In this paper the barriers are introduced as exogenous parameters that reduce the capital-output ratio therefore affect the endogenously determined date of the turning point and steady state levels of model variables. Similarly, Restuccia (2004) incorporates barriers in the form of a technology parameter that lowers the rate at which output is transformed into capital or equivalently increases the relative price of investment. In this setting, the presence of barriers works at expense of a technological choice that employs modern technology more intensely compared to the traditional sector. This in turn leads to a lower economy wide aggregate total factor productivity.

Our study employs a two sector dynamic general equilibrium model where production either occurs in formal or the informal sector. While the formal sector is subject to taxation, for the informal sector there is only partial tax enforcement. In this setting, household chooses how much time to allocate in leisure, formal sector and informal sector. The tax rate and tax enforcement parameter affect the labor allocation and the size of the informal sector, therefore the formal output. In such an environment, we show that informality poses a threat to per capita income convergence. Our paper aims to contribute to the literature on the convergence effects of informality by utilizing the largest available macroeconomic dataset. To the best of our knowledge, our paper is unique in the literature in investigating the empirical relationship between convergence and informality using an annual cross-country panel dataset of 161 countries with a 61-year time series span. Moreover, our main result indicating that the main channel behind this facts is the informality's adverse effect on the relative capital-output ratio and motivated both theoretically and empirically is also novel and has the potential to open up further contributions in the literature. Finally, our empirical results also have serious repercussion on the design of economic policy that aims to reduce informality and achieve optimal growth and convergence.

2. Data and Facts

In our empirical analysis, we use the dataset provided by Elgin and Oztunali (2012). This dataset comprises of model-based estimates of informal sector size for 160 countries covering the period 1950-2012. The authors employ a two sector (formal and informal) dynamic general equilibrium model where they calibrate the key parameters of the model that yield the observable data, which in turn are used to calculate the size of the shadow economy as

% of formal GDP. The empirical counterparts of the model variables such as growth, GDP per capita, population, employment, investment are obtained through World Development Indicators (WDI) of the World Bank and PWT 8.0. Using these, the capital stock series for the countries are constructed by using the conventional perpetual inventory method. As an initial attempt to motivate our study, the following three figures illustrate the evolution of GDP per capita over time for countries ranked according to their respective informal sector size for each year. We then regroup countries into deciles, quintiles and quartiles. The average GDP per capita for each group is plotted against time. It can be seen that countries with relatively smaller informal sectors perform better in terms of their relative GDP per capita whereas for the countries with relatively larger informal sector size, relative GDP per capita tends to be almost stagnant over the course of time. The take off of relative income in higher income countries as opposed to the stagnation in lower income countries points out that informality can very well be a barrier to convergence of per capita income.

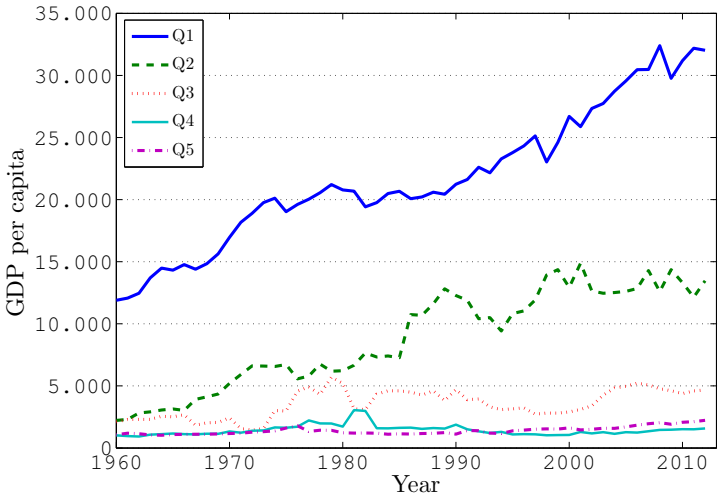


Figure 1: Evolution of unweighted GDP per capita for countries ranked and classified in quintiles according to their informal sector size

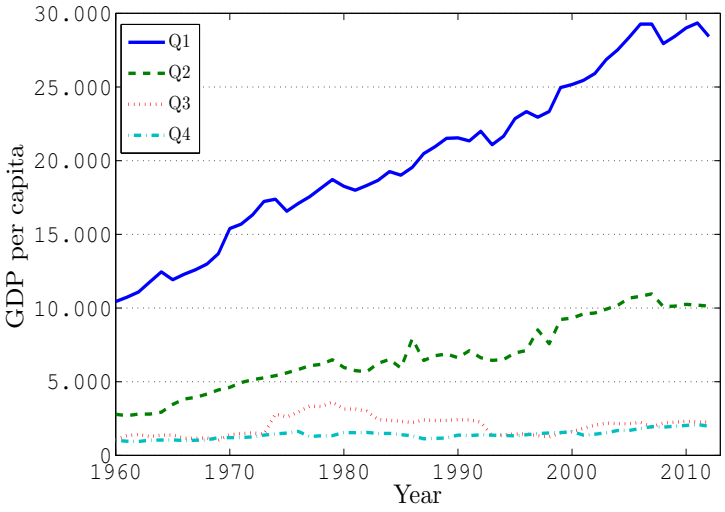


Figure 2: Evolution of unweighted GDP per capita for countries ranked and classified in quartiles according to their informal sector size

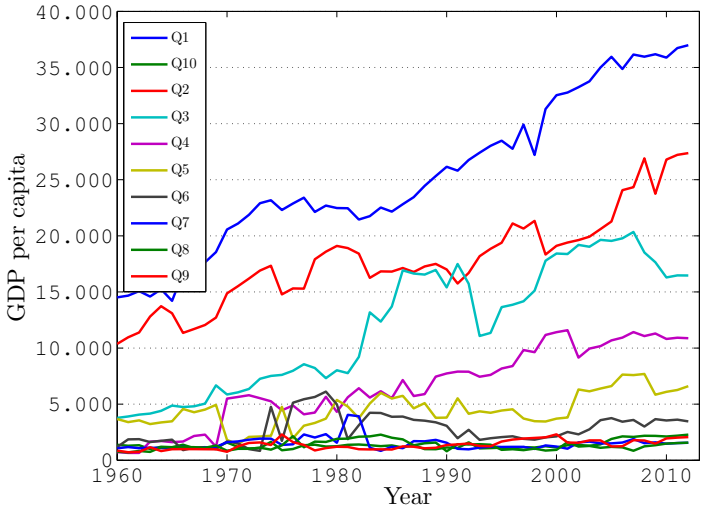


Figure 3: Evolution of unweighted GDP per capita for countries ranked and classified in deciles according to their informal sector size

3. Further Empirical Analysis

3.1. Relative GDP per capita and Informal Sector

In this subsection we will present results of regression of relative GDP per-capita (relative to US GDP per-capita) on informal sector size in a panel data setting. Moreover, in the next subsection we will also decompose relative GDP per-capita on three different factors (relative

TFP, relative employment per capita and relative capital-output ratio) and investigate how each of these factors is associated with informal sector size. Table 1 summarizes the dataset which will be used throughout this section.

Table 1: Complete Dataset Summary Statistics

	Mean	Std. Deviation	Minimum	Maximum
Informal Sector Size (in % GDP)	34.65	14.75	7.97	113.00
(Real) GDP per-capita (thousand USD)	8.42	12.35	0.05	87.72
Relative GDP per-capita (to US)	0.26	0.38	0.001	3.30
Relative TFP	0.37	0.33	0.01	2.15
Relative H/N	0.86	0.25	0.32	5.44
Relative K/Y	0.95	0.51	0.002	11.06

First, we regress relative GDP per-capita on informal sector size. In this case, the benchmark regression we run is of the following form:

$$rel\_gdp\_cap_{i,t} = \beta_0 + \beta_1 is_{i,t} + \gamma_i + \theta_t + \epsilon_{i,t} \tag{1}$$

In this specification γ_i and θ_t refer to country and year fixed-effects respectively. The results of all the regressions are reported in Table 2. The first panel regression below is a fixed-effect estimation using 5-year averaged data to rule out possible business cycle effects in the relative GDP per-capita. The second column stands for a fixed effect panel regression with 5-year averaged data but this time includes the lag of dependent variable. The third column is a GMM estimation with 5-year averaged data and lagged dependent variable. The fourth column is an IV estimation with 5-year averaged data and lagged value of the independent variable (IS) is used as an instrument for its level.[2] The fifth column is an OLS estimation with country averaged informal sector size and relative gdp per capita data. The sixth column is a fixed effect estimation with the whole data set under the presence AR(1) disturbances. The seventh column is a fixed effect estimation with 5 year averaged data using data for countries below the median median level of GDP per-capita whereas column 8 gives the results of the same estimation using above median countries. The main observation one can make regarding Table 2 is that the coefficient of the size of the informal sector is consistently negative and significant for all of the different specifications.

[2]Finding a widely accepted IV for informal sector size using a panel macroeconomic data is quite difficult, if not impossible. That is why we used lagged informal sector size as an IV here. Exogeneity tests for this estimation are available upon request from the corresponding author.

Table 2: Relative GDP per-capita and Informal Sector Size

Dep. var. Rel. GDP per-capita

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IS	-0.24*	-0.06*	-0.11*	-0.26*	-1.62*	-0.17*	-0.09*	-0.58*
	(0.07)	(0.02)	(0.02)	(0.05*)	(0.07)	(0.03)	(0.01)	(0.23)
Rel GDP-cap (-1)		0.74*	0.90*					
		(0.01)	(0.01)					
Constant	0.34*	0.08*	0.06*	0.34*	0.8*	0.31*	0.08*	0.63*
	(0.03)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.09)
R-squared	0.35	0.98	0.99	0.36	0.32	0.35	0.02	0.36
Observations	1405	1266	1107	1347	161	6175	700	705
F-Test	3.66	310.16	1998	20353	51.67	369.47	12.78	2.96

All panel regressions include a country fixed effect and year dummies (except specification 5). Robust standard errors are reported in parentheses. * denotes 5% confidence level.

3.2. Relative Income Accounts and Informal Economy

We will now decompose relative (to US) income per capita for 160 countries into 3 income accounts: relative TFP, relative capital-output ratio, relative employment per capita. To make this decomposition, we make use of the capital series created with perpetual inventory method. We assume a Cobb-Douglas production function of the form $Y_t = A_t K_t^{\alpha} H_t^{1-\alpha}$ and using the employment and income data from PWT 8.0 we obtain total factor productivity (TFP) series for 160 countries. Transforming the production function in per capita terms and then taking the natural logarithm yields:

$$ln(y_t) = ln(A_t) + \alpha ln(k_t) + (1-\alpha) ln(h_t) \tag{2}$$

Rearranging we get:

$$ln(y_t) = ln(h_t) + \frac{\alpha}{1-\alpha} ln(\frac{k_t}{y_t}) + \frac{1}{1-\alpha} ln(A_t) \tag{3}$$

For the country pair i-j, j being USA, the above equation becomes:

$$ln(\frac{y_i}{y_j}) = \frac{1}{1-\alpha}\{ln(A_i) - ln(A_j)\} + \frac{\alpha}{1-\alpha}\{ln(k_i/y_i) - ln(k_j/y_j)\} + ln(h_i) - ln(h_j) \tag{4}$$

Table 3 summarizes different specifications with each of the three income account series created. The first column for each account represents a panel regression with fixed effect estimation using the whole data set under the assumption of AR(1) disturbances. The second column for each account is a fixed effect estimation with the lagged value of the corresponding account included as dependent variable. The third columns are IV estimations using the lagged values independent variable. Out of the three accounts examined, we observe that relative employment per capita and relative TFP do not seem to have a strong relationship with size of the informal economy. For specifications with relative capital to output as the

dependent variable, on the other hand, there is a significant and negative relationship. The estimated equations are as follows:

Table 3: Relative Income Accounts and Informal Sector

Dep. var. Income Accounts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	TFP	TFP	TFP	K/Y	K/Y	K/Y	H/N	H/N	H/N
IS	0.13*	0.004	0.004	-2.65*	-0.28*	-0.34*	0.09	-0.003	-0.004
	(0.05)	(0.006)	(0.005)	(0.24)	(0.03)	(0.03)	(0.14)	(0.02)	(0.02)
Rel TFP(-1)		0.95*	1.00*						
		(0.003)	(0.002)						
Rel K/Y(-1)					0.92*	0.83*			
					(0.005)	(0.006)			
Rel H/N(-1)								0.97*	0.97
								(0.004)	(0.005)
Constant	0.78*	0.026*	0.005	1.66	0.17*	0.27*	-0.70*	0.038*	-0.06*
	(0.002)	(0.004)	(0.08)	(23.08)	(0.02)	(0.01)	(0.005)	(0.01)	(0.008)
R-squared	0.0041	0.99	0.80	0.09	0.95	0.94	0.005	0.94	0.94
Observations	6019	6020	5863	6019	6020	5863	6019	6020	5863
F-Test/Wald	9.81	1249.61	571108	6.42	654.71	471182	12.85	887.28	1240000

All panel regressions include country fixed effect and year dummies. Robust standard errors are reported in parentheses. * denote 5% confidence levels.

4. Model

Infinitely lived representative household is endowed with K_0 units of productive capital and a total of $T > 0$ units of time each period. The agent chooses how much time to allocate in leisure, formal and informal sector. The formal sector, denoted by F, has a standard Cobb-Douglas production function and is subject to taxation. On the other hand, the informal sector, denoted by I, uses only labor as input. It is plausible to assume that the informal sector is more labor intensive compared to the formal sector. A possible interpretation of this assumption might be that the informal sector has a fixed amount of productive capital (Ihrig and Moe, 2004). Moreover, the informal sector is subject to taxation only when it is caught by the authorities. Thus we introduce a tax enforcement parameter ρ which captures the event of being caught. We assume that the tax revenue collected by the government is

spent for unproductive activities.[3] The model is characterized as follows:

$$\max_{\{C_t,K_{t+1},l_t,N_{It},N_{Ft}\}_{t=0}^{\infty}} \quad \sum_{t=0}^{\infty}\beta^t U(C_t,l_t) \tag{5}$$

$$\text{s.t.} \quad C_t + K_{t+1} - (1-\delta)K_t = (1-\tau)\theta_{F_t}K_t^{\alpha}N_{Ft}^{1-\alpha} + (1-\rho\tau)\theta_{I_t}N_{It}^{\gamma} \tag{6}$$

$$N_{It} + N_{Ft} + l_t = T \tag{7}$$

Assuming logarithmic utility, the maximization problem of the household yields:

$$\frac{C_{t+1}}{C_t} = \beta[(1-\tau)\theta_F\alpha K_{t+1}^{\alpha-1}N_{Ft+1}^{1-\alpha} + 1 - \delta] \tag{8}$$

Since at equilibrium marginal products of two sectors must be equal, we have:

$$(1-\tau)\theta_F(1-\alpha)K_t^{\alpha}N_{Ft}^{-\alpha} = (1-\rho\tau)\theta_I\gamma N_{It}^{\gamma-1} \tag{9}$$

By rearranging the Euler equation, one can obtain:

$$K_{t+1} = N_{Ft+1}\left[\frac{(1-\tau)\theta_F\alpha}{(1+g_c)/\beta - 1 + \delta}\right]^{\frac{1}{1-\alpha}}. \tag{10}$$

Moreover, the time spent on informal labor can be obtained as follows:

$$N_{It+1} = \left\{\frac{(1-\rho\tau)\gamma\theta_I}{(1-\tau)(1-\alpha)\theta_F}\left[\frac{(1+g_c)/\beta - 1 + \delta}{\alpha(1-\tau)\theta_F}\right]^{\frac{\alpha}{1-\alpha}}\right\}^{\frac{1}{1-\gamma}} \tag{11}$$

So at the steady state, the informal and formal labor become:

$$N_I = \left\{\frac{(1-\rho\tau)\gamma\theta_I}{(1-\tau)(1-\alpha)\theta_F}\left[\frac{1/\beta - 1 + \delta}{\alpha(1-\tau)\theta_F}\right]^{\frac{\alpha}{1-\alpha}}\right\}^{\frac{1}{1-\gamma}} \tag{12}$$

$$N_F = \frac{(T-N_I)\gamma(1-\rho\tau)\theta_I N_I^{\gamma-1} - \phi(1-\rho\tau)\theta_I N_I^{\gamma}}{\gamma(1-\rho\tau)\theta_I N_I^{\gamma-1} + \phi[(1-\tau)\theta_F(\frac{\alpha(1-\tau)\theta_F}{1/\beta-1+\delta})^{\frac{\alpha}{1-\alpha}} - \delta(\frac{\alpha(1-\tau)\theta_F}{1/\beta-1+\delta})^{\frac{1}{1-\alpha}}]} \tag{13}$$

5. Simulations

5.1. Income difference between Bolivia and Korea

[3] This simple model does not include productive government spending as we assume that the tax revenue collected by the government is simply wasted. One could well generalize this simple model and incorporate productive public spending within the model. This would create yet another channel as a larger informal sector size would reduce public capital stock, thereby further harming formal GDP and convergence. However, to the best of our knowledge, panel data (at least as larger as we use in the current paper including many developing economies) of decomposed public spending unfortunately does not exist and we could not empirically justify this even if we extend the model to include public capital.

According to the model based estimates of informal sector size as % of GDP, Korea and Bolivia had similar sizes of informal sector in 1960, around 70%. In 2012 while the size of informal economy in Korea has decreased to 25%, Bolivia could only reach 61%. In the meantime the GDP per capita ratios of these countries rose from 1.7 to 25. For the period 1960-2012 this translates into an average of 8.92 GDP per capita ratio. In order to simulate this income difference, following Restuccia (2004) we allow for total factor productivity differences across countries. We ask what is the exogenous TFP difference we need to impose in order to generate an income ratio of 8.9. Assuming that we have full tax enforcements both in Bolivia and Korea, i.e., $\rho_B = \rho_K = 1$, we need TFP_K/TFP_B=3.13. Yet if we take $\rho_B = 0.4$, that is we raise the barriers, this time we need TFP_K/TFP_B=2.84, which corresponds to the TFP_K/TFP_B ratio that we observe in data (obtained using perpetual inventory method).(See Table 4) So a larger informal sector size in Bolivia, reduces the need for larger TFP differences in these countries to account for the observed income difference.

Table 4: Income difference between Bolivia and Korea

$\frac{y_K}{y_B}$	ρ_B	TFP_K/TFP_B
8.9	1	3.13
8.9	0.9	3.08
8.9	0.8	3.03
8.9	0.7	2.99
8.9	0.6	2.93
8.9	0.5	2.88
8.9	0.4	2.84
8.9	0.3	2.80

For $\rho_B = 1$, $\tau_B = 0.35$, $\tau_K = 0.25$

We should also note that capital-output ratio's for Korea and Bolivia supports our empirical findings from the last section. Capital-output ratio for Bolivia is around 1.76 whereas for Korea the same ratio is 2.04. These results are very similar to those we observe in data, 1.71 and 2.45 respectively. So besides from generating the observed income difference; the model economy is also able produce a capital-output ratio that is close to what we observe in data.

5.2. Impulse Responses

This section will illustrate impulse responses of two economies; one with $\tau = 1, \rho = 1$ the other with $\tau = 0.25, \rho = 0$, otherwise identical. We will introduce a 5% TFP shock (to both sectors) in both environments. The results are given in Figure 4 and Figure 5. For the economy with high tax-full tax enforcement we observe that formal output starts at a 0.025 higher level compared to low tax-no tax enforcement economy. When the TFP shock kicks in, the former elevates to 0.0909 whereas the latter can only reach 0.0707. The observation to be made is that in face of a TFP shock, the increase in formal output is more significant for the former environment with high tax- full tax enforcement. The pattern of capital after the shock is introduced is another interesting part of this exercise. We observe that for the high

tax-full tax enforcement environment capital elevates to higher levels whereas the movement in capital for the low tax-no tax enforcement is relatively smaller. This fact supports the evidence provided in Section 3.2.

Figure 4: Impulse Responses for $\tau = 1, \rho = 1$

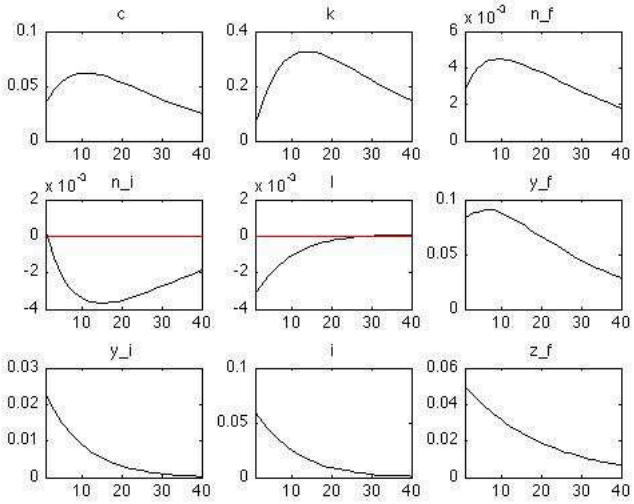
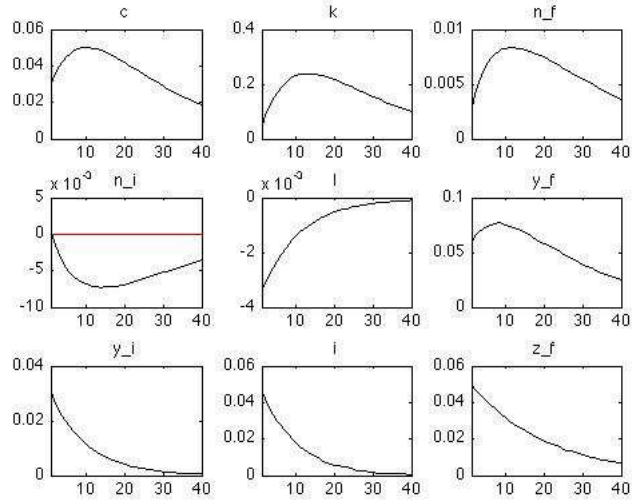


Figure 5: Impulse Responses for $\tau = 0.25, \rho = 0$



6. Concluding Remarks and Discussion

In this study we aimed to establish the negative relationship between informal sector size and relative GDP per capita, hence convergence and contribute to the barriers to growth

literature by pointing out the prevalence of informality as a major determinant that obstructs growth of relative income per capita. Policy-wise our results imply that reducing informal sector size might create crucial benefits for a developing economy or emerging market aiming to converge to advanced economies. Considering the well-established fact from the growth literature that the most of the growth differences across countries emerge through TFP differences, our results imply that the need to rely on TFP is reduced with reducing informality. This suggests that governments of emerging markets shall give more emphasis to policy tools aiming to reduce informality, not only to generate revenue but also to create beneficial convergence effects.

What is however missing in the current paper and we intend to study in the future is to identify the exact economic mechanism behind our observations. Future research should focus on developing economic models to further account for this observation. For example employing an endogenous growth model would enable the growth rate to be determined endogenously and make it a function of several exogenous parameters possibly varying across countries. Yet another analysis that can further our understanding in this regard could use industry-level data. This would be very helpful in unraveling informality's effects on convergence varying across different industries.

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