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Challenging the popular wisdom. New estimates of the unobserved economy.

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Abstract

We estimate the unrecorded economy in 49 economies from 1981 to 2005. Our study is based on electricity consumption series which are filtered to account for technological change and for the changing weight of the energy-intensive industrial sector. In contrast with studies based on the MIMIC method, we obtain a reduction in the weight of the unobserved economy. Unlike La Porta and Shleifer (2008), we identify measures of institutional quality which are significantly related to the shadow economy even after controlling for per-capita GDP. Thus the shadow economy should not be dismissed as the unpleasant side effect of underdevelopment. Instead it is related to some specific institutional aspects that may well survive even when the economy reaches higher development stages. We identify strong substitution effects between official and unofficial sectors both in the long run and over the business cycle. This has important implications for income convergence and for the relationship between volatility and growth.

1 Introduction¹

The unobserved or shadow economy accounts for between a third and a half of total GDP in developing countries (La Porta and Shleifer, 2008). Even in developed countries like Italy and Spain, recent estimates set the weight of the shadow economy at around 20% (Dell'Anno, 2003; Alañón and Gómez-Antonio, 2005). Economists disagree about the determinants and the effects of the unofficial sector. De Soto (1989, 2000) argues that excessive taxes and regulations confine firms to the fringe of markets, limiting access to public goods and wasting their productive potential. Others (Farrell, 2004; Farrell, Baily and Remes, 2005) see informal firms as gaining a substantial cost advantage relative to "official" firms. Finally, La Porta and Shleifer (2008) look at the formal and informal sectors as two parallel economies, where the inefficient informal sector is bound to recede when growth-enhancing policies raise the quality of the public goods accessible to official firms.

Empirical analysis is obviously crucial for a better understanding of the phenomenon. Researchers² who adopt the MIMIC latent variable method represent the shadow economy in terms of two sets of variables, respectively labeled as "causal variables" (taxation, the regulatory burden, attitudes toward the state) and "likely indicators" (changes in the demand for currency, in the labour force participation rate and in official GDP). Studies based on this approach report that the shadow economy has been on the rise since the 1990s (Schneider and Enste, 2000). The method has been criticized because the choice of "causal variables" and "likely effects" appears arbitrary (Helberger and Knepel, 1988; Smith, 2002; Hill, 2002; Breusch, 2005). Moreover, the use of variables like taxes and government regulation as determinants of the unrecorded economy leads to almost tautological results when one interprets the obtained estimates on the grounds of economic and institutional factors. Consider for instance the set of variables that identify a country's institutional quality (Kaufmann, Kraay and Mastruzzi, 2007). These are also typically related to the size of the public sector and to market regulation. Thus, measures of the unrecorded economy based on these two latter variables are bound to exhibit the correlation with measures of institutional quality found in Schneider and Torgler (2007).

Alternatively, the Electricity Consumption (EC) approach does not require theoretical priors on the causes of the unobserved economy. In fact, it obtains the shadow economy as the difference between an estimate of total (observed

¹We gratefully acknowledge comments from A. Bollino, A. Buhen, F. Busato, M. Damiani, E. Feige, B. Mróz, P. Polinori, F. Revelli, F. Schneider and participants to the conferences "Macroeconomic and Policy Implications of Underground Economy and Tax Evasion", Bocconi University, Milan 2009, "Annual Meeting of the European Public Choice Society", Athens 2009, "The Shadow Economy, Tax Evasion and Social Norms", Muenster 2009, and to seminars given in Turin and Perugia.

²Loayza, 1996; Giles, 1999a, 1999b, 1999c; Chatterjee, Chaudhury and Schneider, 2002; Giles, Tedds and Werkneh, 2002; Tedds and Giles, 2002; Dell'Anno, 2003; Bajada and Schneider, 2005; Schneider, 2004, 2005, 2008; Alañón and Gómez-Antonio, 2005; Buehn, Karmann and Schneider, 2007; Dell'Anno, Gómez-Antonio and Alañón-Pardo, 2007; Brambila-Macias, 2008.

and unobserved) GDP and official GDP figures. Estimates of total GDP growth are directly inferred from electricity consumption growth by imposing a constant electricity-consumption-to-GDP ratio. This assumption has been widely criticized (Lacko 1998, 1999; Hanousek and Palda, 2006), because it implies that the size of the informal economy will be biased down by energy-saving technological progress. Some authors have therefore chosen *ad hoc* country-specific values for the ratio of electricity consumption to GDP (Kaufmann and Kaliberda, 1996; Johnson, Kaufmann and Shleifer, 1997). More recently, Chong and Gradstein (2007) impose a 5% per-decade decrease in the elasticity of electricity consumption to GDP for all countries. Unfortunately, their method in several cases generates negative values for the relative size of the unrecorded economy (see our discussion in Section III below). This inevitably weakens the robustness of their conclusions about the institutional determinants of the shadow economy.

In the paper we obtain measures of the shadow economy which, unlike MIMIC estimates, are independent from theoretical priors and yet avoid the *ad hoc* assumptions that plague previous applications of the EC method. To begin with, note that the overall effects of technological change on electricity consumption are in fact ambiguous. The Jevons' Paradox suggests that the role of energy-saving innovations is probably limited. (Jevons, 1865, 1965; Iorgulescu and Polimeni, 2007; Polimeni and Iorgulescu, 2007). In addition, labour-saving innovations are likely to increase energy consumption. Finally, variations in the weight of the energy-intensive industrial sector should also affect electricity consumption. We therefore apply a version of the Modified Total Electricity (MTE) approach proposed by Eilat and Zinnes (2002). This involves a two-stages procedure. In the first stage the series of electricity consumption growth is filtered to remove the influence of changes in the weight of the industry sector and in relative electricity prices. Empirical studies (Popp, 2001, 2002; Linn, 2008) show that energy-saving technological change is mainly driven by changes in energy prices, whereas autonomous innovations play a lesser role. In the second stage, the growth rate of the shadow economy is obtained by subtracting the growth rate of the official economy from the filtered series of electricity consumption growth - where the latter proxies the growth rate of the overall economy.

We consider 49 economies over the period 1981-2005. Since the time series dimension of the panel is significantly long, the choice of the econometric methodology is based on a preliminary analysis about the stationarity and cointegration of the variables. The application of panel unit root and cointegration techniques is an important innovative aspect of this study.

Our estimates provide a suggestive and unprecedented description of the dynamics of the shadow economy, in contrast with pre-existing results. On the one hand, we find that the relative size of the shadow economy has decreased for most countries during the last decades. On the other hand, even if we observe a negative and statistically significant correlation between annual growth rates of official GDP and the share of unrecorded income, we identify measures of institutional quality which are significantly correlated to the shadow economy even after controlling for the effect of per-capita GDP. This latter result, in sharp contrast with La Porta and Shleifer (2008), suggests that the shadow

economy should not be dismissed as the unpleasant side effect of economic underdevelopment. Instead it is related to some specific institutional aspects that may well survive even when the economy reaches higher development stages. Finally, our method allows for the first time to compute cyclical gaps in the official and unrecorded GDP figures. In line with the theoretical model of Busato and Chiarini (2004), we find evidence of a double business cycle, where the correlation between the two gaps is negative and statistically significant.

The remainder of the paper is organized as follows. Section II describes the model and defines the empirical methodology. Section III presents the results. In Section IV we conclude and discuss the implications for income, the debate on income convergence and the relationship between volatility and growth.

2 Model identification, data description and econometric methodology

Any attempt to exploit electricity consumption to estimate the shadow economy should address the issue of the empirical stability of the energy-consumption-to-GDP ratio. Critics of the EC approach emphasize the potential downward bias caused by energy-saving technological change. The argument is straightforward and quite intuitive, but it neglects a long-standing debate on the Jevons' Paradox: it cannot be taken for granted that energy-saving technological change will reduce the energy intensity of aggregate production (Jevons, 1865, 1965). In fact, computable general equilibrium models support the view that energy consumption might "rebound" because energy demand is at best weakly correlated with a more efficient energy use. The reason why this might happen is easily explained. Following an improvement in energy efficiency, market forces drive some countervailing effects: (i) the fall in energy prices triggers a substitution effect towards more energy-intensive goods and production techniques; (ii) the income effect raises household consumption of all commodities, including energy consumption. The issue ultimately is an empirical one. Simulations in Grant, Hanley, McGregor, Swales and Turner (2007) obtain a rebound effect between 30 and 50%.³ In addition, the downward bias might be offset by other forms of technological change, such as labor-saving innovations, which increase the energy intensity of the production function. For instance, early econometric work has shown that in the US manufacturing sector technical change has been energy intensive (Jorgenson and Fraumeni, 1981; Hogan and Jorgenson, 1991). Finally, one should bear in mind that sectoral specialization might change as the economy develops, thereby affecting the energy intensity of production.

Our analysis is based on the assumption that changes in the domestic real price of electricity⁴ capture the effects of supply shocks and of long term efficiency gains caused by technical change, whereas changes in the industry share

³Dimitropoulos (2007) reports stronger rebound effects.

⁴The use of relative electricity prices obviously raises endogeneity problems. We address them in Appendix I below.

of GDP affect the component of electricity consumption which is directly related to the country-specific evolution in the composition of domestic output. The first stage of our application of the MTE procedure is therefore based on the following equation :

$$\Delta Elec_{i,t} = \alpha_i + \beta_1 \Delta Eprice_{i,t} + \beta_2 \Delta IndGdp_{i,t} + \varepsilon_{i,t} \quad (1)$$

where subscripts t, i are time and country indexes, $\Delta Elec$, $\Delta Eprice$ and $\Delta IndGdp$ respectively describe annual percentage changes in electricity consumption, in the real price of electricity and in the industry share of GDP.⁵

Once the relative-price and demand-composition effects have been identified, the residual changes in electricity consumption, $\Delta Elec^{res}$, may be used as a proxy for the growth rate in the overall (recorded and unrecorded) economic activity:

$$\Delta Elec_{i,t}^{res} = \Delta Elec_{i,t} - [\beta_1 \Delta Eprice_{i,t} + \beta_2 \Delta IndGdp_{i,t}] \quad (2)$$

Then, the growth rate of the unrecorded economy, ΔSH , is obtained as follows:

$$\Delta SH_{i,t} = \Delta Elec_{i,t}^{res} - \Delta Gdp_{i,t} \quad (3)$$

where ΔGdp denotes the official GDP growth rate. Finally, by applying ΔSH to pre-existing base-year estimates, we obtain our measures of the unrecorded economy as a share of official GDP.⁶

Panel composition, 49 economies⁷ over the period 1981-2005, depends on the availability of data about electricity consumption, electricity price and share of industry.⁸ Data on electricity consumption, real price of electricity, share of industrial income and official GDP have been obtained from Energy Information Administration, International Energy Agency, World Bank and United Nations, respectively (see Appendix II).

Since the time series dimension of the panel is relatively long, the econometric methodology is based on a preliminary stationarity and cointegration analysis of the relevant variables. Variables $\Delta Elec$, $\Delta Eprice$, $\Delta IndGdp$, $\Delta \Delta Elec$, $\Delta \Delta Eprice$ and $\Delta \Delta IndGdp$ exhibit non stationarity, tested using Im, Pesaran

⁵Eilat and Zinnes (2002) also consider the private sector share of total GDP, in order to capture privatization effects in transition economies. This additional factor is therefore not important for our panel, which includes only six transition economies.

⁶We have adopted the estimates of Johnson et al. (1997)- for the transition economies- and Lacko (1996, 1998)- for the OECD and Developing countries. The base-year estimate for Tanzania is from Bagachwa and Nasho (1995).

⁷Countries in the sample are Australia, Austria, Belgium, Botswana, Bulgaria, Brazil, Canada, Chile, Colombia, Costa Rica, Czech R., Denmark, Egypt, Finland, France, Germany, Greece, Guatemala, Hong Kong, Hungary, Ireland, Israel, Italy, Japan, Korea, Malaysia, Morocco, Mexico, Netherlands, Norway, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Singapore, Slovak R., Spain, Sri Lanka, Sweden, Switzerland, Tanzania, Tunisia, Thailand, United Kingdom, United States, and Venezuela.

⁸Due to lack of some observations about electricity consumption and the industry share, we have ruled out some of the countries for which base-year macroelectric figures were available: Azerbaijan, Belarus, Croatia, Estonia, Georgia, Kazakhstan, Lithuania, Latvia, Moldova, Russia, Ukraine, Uzbekistan, Cyprus, Mauritius, and Nigeria.

and Shin (2003), Pesaran (2003, 2007), Hadri (2000), Kwiatkowski, Phillips, Schmidt and Shin (1992), ADF and Phillips-Perron unit root tests (see Appendix I for details). A cointegrating relationships between $\Delta Elec$, $\Delta Eprice$ and $\Delta IndGdp$ has been detected using the residual-based procedure developed by Pedroni (1999, 2004).

Due to the presence of cointegrated time series, in our estimate of equation (1) we use the group-mean panel Fully Modified Ordinary Least Squares (FMOLS) method proposed by Pedroni (2000, 2001).⁹

3 Results

To gauge the relevance of the filtering procedure (2), in Figure 7 (Appendix III) we plot for each country the cumulated series for $\Delta Elec^{res}$ and $\Delta Elec$, starting from a common base (1981=100). It is easy to see that substantial and persistent differences exist for 50% of the countries in the panel. In Figure 8 (Appendix III) we provide a comparison between the EC and our MTE estimates. The MTE estimates obtained by filtering out separately the changes in electricity prices- MTE_P- and changes in output composition- MTE_I- are also reported. In some countries important differences between the two methods arise as a consequence of the changing weight of the industry share. In fact, we observe that in transition countries the standard EC method underestimates the relative size of unobserved sector after the end of communism, when the industry share of GDP decreased. A similar difference is detected in countries like Hong Kong, Italy and Japan, where the service sector as a percentage of GDP has significantly increased during the last decades. By contrast, the development process in countries like Thailand corresponds to an increase in the industry share of GDP. In this case the EC method overestimates the relative size of the unobserved sector. The relative price effect in energy consumption seems to play a lesser role: we could find important differences only for South Korea.

Table 1 presents the cross country distribution of the shadow economy (SH) and documents changes relative to the initial sample period.

⁹See Appendix I for a detailed description of our econometric methodology.

Table 1 Descriptive statistics of the MTE estimates (% GDP)

Country	$SH_{2001-2005}$	Δ	Country	$SH_{2001-2005}$	Δ
AU	9.1	-8.9	KR	23.1	-52.6
AT	10.9	-5.3	MY	24.2	-22.3
BE	17.9	-7.5	MA	37.8	-10.1
BW	18.9	-63	MX	38.5	-2.2
BG	31.8	-7.9	NL	9.9	-6.6
BR	26.7	-3.5	NO	4.3	-6.5
CA	6.8	-7.2	PA	21.1	-17.6
CL	22.1	-24.4	PY	36.2	15.6
CO	18.3	-19.1	PE	30.1	-3.5
CR	19.8	-18.7	PH	46.2	-2.7
CZ	6.2	0.5	PL	12.7	-10.8
DK	12.3	-7.2	PT	16	-4.5
EG	49.1	-46.7	RO	14.1	0.4
FI	11	-4.7	SG	5.8	-12.6
FR	10.4	-3.7	SK	5.3	-0.5
DE	10.9	-8	ES	19.7	-11.1
GR	17.4	-1.3	LK	28.9	-16.6
GT	56.7	9.5	SE	7.4	-4.6
HK	10.5	-6.4	CH	9.4	-2.1
HU	29.4	-6.2	TZ	16.7	-39.2
IE	6.4	-19.6	TH	50.4	-68.1
IL	18.8	-14.1	TN	31.5	-12.7
IT	20.9	-0.1	GB	8.5	-9.5
JP	13.7	-4.2	US	6.1	-7.6
			VE	27.8	0.4

Note: $\Delta = SH_{2001-2005} - SH_{1981-1985}$. Source: own calculations.

Our results are in sharp contrast with those obtained under the MIMIC method (Schneider, 2004, 2005, reported in Figure 9, Appendix III). In fact, we find that the relative importance of the unrecorded economy has fallen in all countries with the exceptions of Guatemala, characterized by an increase, and a small group of countries where SH was substantially stable (Italy, Romania, Venezuela, the Czech and Slovak Republics). In Figure 9 we also report shadow economy estimates obtained by Chong and Gradstein (2007) who adopt the EC method but impose a 5% per-decade decrease in the elasticity of electricity consumption to GDP.¹⁰ It is interesting to note that, for all their emphasis on energy-saving technical change, in several countries our estimates document a smaller reduction in SH .

To cross-check the plausibility of our results, we adopt a "narrative" approach, investigating whether episodes of institutional change, economic crisis and reform might be associated to the country-specific patterns of the unobserved economy emerging from our estimates. In Appendix IV we provide a detailed description of our findings. As an example, it is interesting to discuss here the case of transition economies (Bulgaria, Czech Republic, Hungary, Poland, Romania and Slovakia), where our estimates depict a "humpshaped" pattern for the dynamics of the shadow economy following the fall of the communist regime in 1989. The observed initial increase might be due to the economic and institutional disarray that followed the collapse of communism. The subsequent reversal might be related to consolidation of the state and to market-oriented reforms, based on price- and trade-liberalization measures, that were undertaken during the 1990s¹¹.

In Table 2 we document some basic dynamic panel correlations of our estimates with measures of development and official output volatility. A widely cited stylized fact is that the share of the unrecorded economy is inversely related to the stage of economic development (Amaral and Quintin, 2006). The theoretical model of Loyaza and Rigolini (2006) supports this view and also suggests that the share of the shadow economy should exhibit a countercyclical pattern. A similar conclusion about the cyclical substitutability between official and unrecorded activities obtains in the theoretical model of Busato and Chiarini (2004). In fact, we found that changes in SH correlate negatively with yearly growth rates of official GDP, and positively with standard development indicators such as the relative weight of agricultural production and the percent-

¹⁰The Chong and Gradstein (2007) method yields negative shares of the unrecorded economy in Canada, Norway, Poland, Romania and Sweden. These figures were kindly supplied by Alberto Chong.

¹¹Our results are quite similar to those obtained for transition countries by Feige and Urban (2008) using essentially similar methods. As noted by these authors, over the decades examined in our analysis, GDP accounting might have improved, reducing the amount of unrecorded income simply because of better and more inclusive national accounting techniques. Indeed, improved national income accounting could explain the declines in our estimated unrecorded income. Nevertheless, adding to our estimates the percentages of imputed unobserved income reported in Feige and Urban (2008), we found that, except for Romania in the years 1994-1996 and Slovakia in 1996, the two series follow similar dynamics.

age of active labor force that is self-employed ¹². Finally, we computed cyclical gaps in the official and unrecorded GDP figures, ¹³ obtaining evidence of a double business cycle, where the correlation between the two gaps is negative and statistically significant. As an example, Figure 1 plots official and unrecorded output gaps for United States.

Table 2- Correlation analysis

	Correlation coefficients
Δ Share unrecorded income-Official GDP growth	-0.55*
Share unrecorded income-Share agricultural income	0.46*
Share unrecorded income-Share self-employment	0.63*
Unofficial output gap-Official output gap ¹⁴	-0.39*

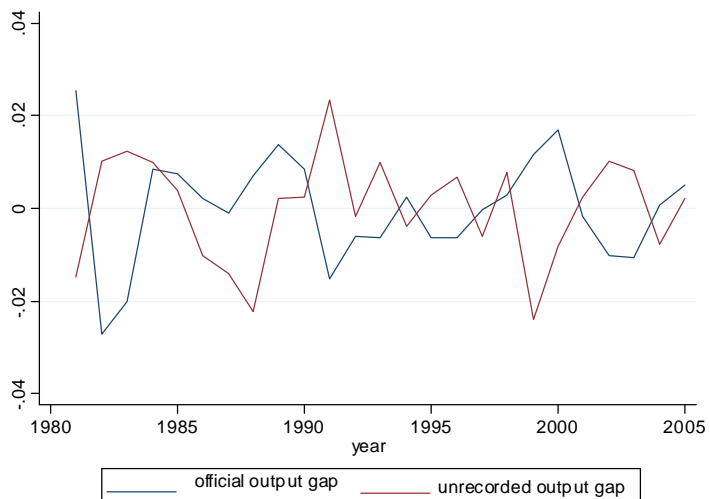
Note: * significant at least at the 5% level.

¹²As noted by Loayza and Rigolini (2006), in most developing countries there is a strong correlation between unobserved activity and self-employment, as most self employed tend to be low-skilled, unregistered workers.

¹³The two gaps are obtained detrending the series of unobserved economy and official GDP by using the Hodrick-Prescott filter.

¹⁴Czech and Slovak Republics are outliers and, therefore, excluded from this analysis.

Figure 1- Official and unrecorded output gaps- United States



3.1 Interpreting cross-country differences, preliminary results

La Porta and Shleifer (2008) group the determinants of the size of the unofficial economy into three broad categories: the cost of becoming formal, the cost of staying formal, and the benefits of being formal. Then, having identified proxies for these three categories, they explore cross-country correlations with several measures of the shadow economy. They find that most estimated coefficients fall in value and lose significance after controlling for per-capita GDP. This latter variable, in turn, is strongly significant. Their interpretation of this result is that the informal economy is a manifestation of underdevelopment, which recedes as the economy develops.

We adopt a similar approach, investigating whether measures of "institutional quality" may explain our estimates of the shadow economy. It should be noted from the outset that we are strongly constrained by data availability. In fact several measures of the costs and benefits from being formal are discontinuous and available only for the latter part of our sample. We cannot therefore exploit the time series dimension of the panel. To limit endogeneity problems the regressors¹⁵ are predetermined to the measures of the shadow economy which, in turn, are restricted to the 2001-2005 averages in order to overlap with the sample period in La Porta and Shleifer (2008). Since the number of country observations limits our degrees of freedom, we are forced to use existing synthetic measures of the pros and cons of informality, such as the "Index of Business Freedom" (*IBF*) and the "Index of Trade Freedom" (*ITF*). We also account for a specific measure of the cost of being formal, the log number of

¹⁵See Appendix II for a detailed description of the data.

procedures required to enforce a contract (*log PROC*). In addition, the benefits of formality may be captured by measures of government efficiency such as the "Index of Electoral Competition" (*IEC*) and an index of government stability (*STABS*). We also expect that the level of human capital (captured by the variable *EDU*) is inversely related to the weight of the shadow economy because more educated workers are less likely to be employed by the less productive firms that operate informally. To control for the stage of economic development we include the log of per-capita income (*log GDP*).

All our measures of institutional quality are significantly correlated to the shadow economy and exhibit the expected signs (Table 3). Unlike La Porta and Shleifer (2008) our results survive after controlling for the effect of percapita GDP (column 7). This suggests that the shadow economy should not be dismissed as the unpleasant side effect of economic underdevelopment. Instead it is related to some specific institutional aspects that may well survive even when the economy reaches higher development stages. To support intuition, in Figure 2 we show that, among OECD economies, countries like Belgium, Greece, Italy, Portugal and Spain are characterized by a relatively higher share of unrecorded income¹⁶ Other less developed economies, such as Tanzania and Botswana, benefit from relatively good institutional quality of and are characterized by a relatively small weight of the shadow economy¹⁷.

¹⁶Not surprisingly, these countries are also characterised by much worse average scores for *IBF* and *log PROC*.

¹⁷The Executive Index of Electoral Competitiveness is equal to 7 for Tanzania and Botswana. This is the largest possible score, given that the largest party got less than 75% (see Appendix II). Similarly, the measure of political stability is equal to 0 for both countries. This refers to the highest level of stability.

Table 3- OLS regressions with robust standard errors

Dependent variable: unrecorded economy (% of official GDP)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>IBF</i>	-0.67***	-0.4**	-0.39***	-0.43***	-0.34**	-0.27*	-0.29**
<i>ITF</i>		-0.57***	-0.61***	-0.53***	-0.43***	-0.28**	-0.33**
<i>STABS</i>			0.16**	0.16**	0.17**	0.1***	0.1***
<i>IEC</i>				-0.01	-0.01	-0.01*	-0.009
<i>log PROC</i>					0.16**	0.16***	0.16***
<i>EDU</i>						-0.12*	-0.16*
<i>log GDP</i>							0.01

Note: * significant at the 10% level. ** significant at the 5% level.*** significant at the 1% level.

Figure 2- Unobserved economy and GDP per capita- 2001-2005



3.2 Conclusions and extensions

We challenge two established views, i.e. that the shadow economy has been on a rising trend over the last decades and that it is inevitably bound to recede with economic development. In fact we show that for most countries the relative size of the unobserved economy has decreased. In addition we find that cross country differences remain correlated to measures of institutional quality even after controlling for the stage of economic development.

Our analysis has identified strong substitution effects between official and unofficial sectors both in the long run - when the share of the unrecorded economy is inversely related to official output growth - and over the business cycle. This implies an upward bias in official figures concerning per-capita income growth (Figure 3). The scatter diagram reported in Figure 4 shows that this bias is stronger for poorer countries, suggesting that established results on per capita income convergence should be reconsidered.

A similar conclusion applies to empirical analyses of the link between output volatility and growth (Ramey and Ramey, 1995; Hnatkovska and Loayza, 2004; Aghion, Angeletos, Banerjee and Manova, 2005; Chatterjee and Shukayev, 2006). For each country we computed the volatility of total (observed plus unobserved) output growth for each country, finding that it is lower than official output growth volatility in 43 out of the 49 countries (Figure 5).¹⁸ Figure 6 shows that the negative correlation between growth and volatility is much stronger if we take into account our estimates of the unrecorded economy.

Finally, since we use a measurement method which is not based on theoretical priors concerning the role of taxes and market regulations, our estimates pave the way for an investigation of the institutional determinants of the shadow economy. This is left for future research.

¹⁸The remaining 6 countries are Austria, Egypt, Guatemala, Paraguay, Sri Lanka and Tanzania.

Figure 3- Official and total per capita GDP growth- 1981-2005

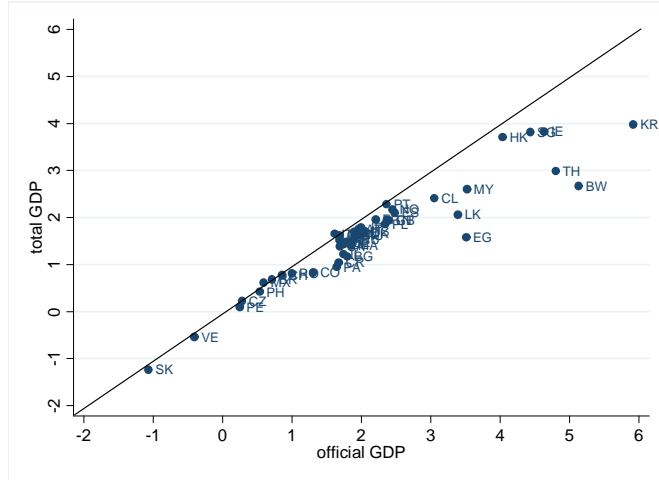


Figure 4

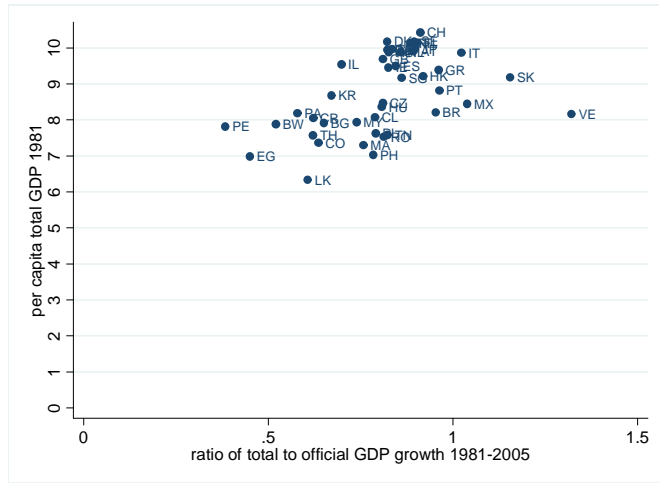
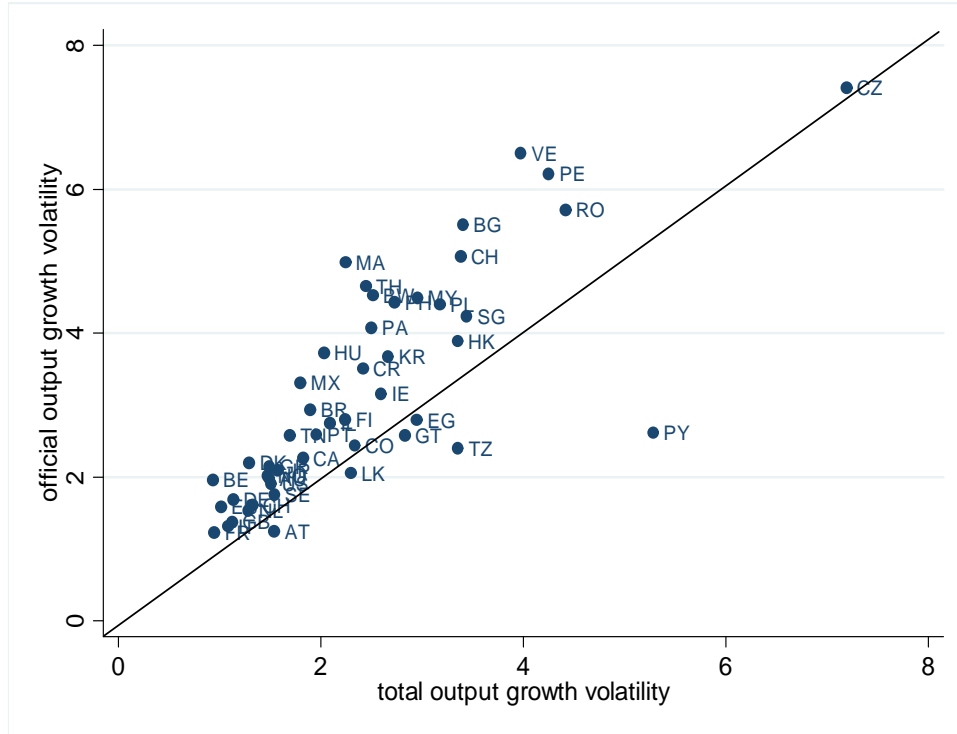
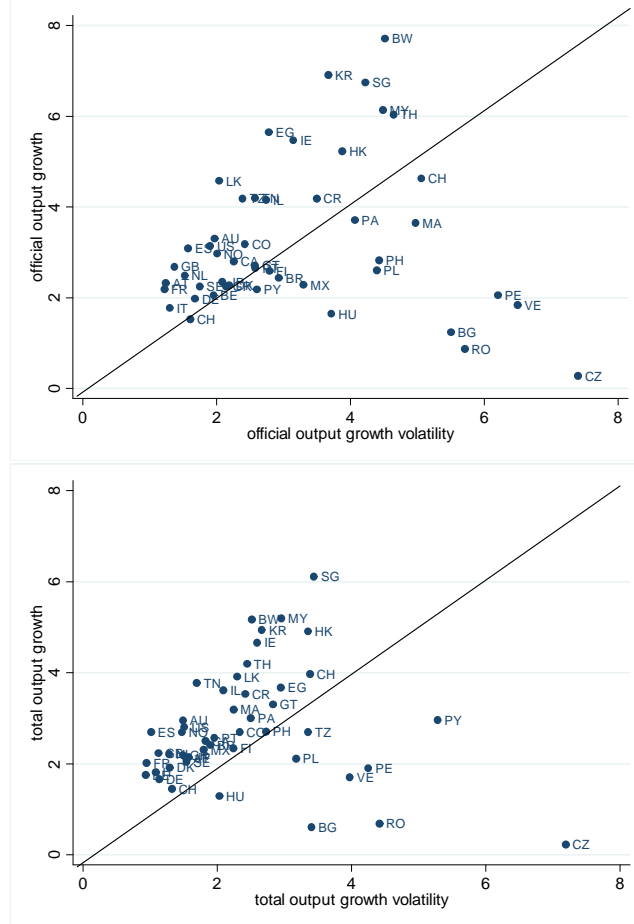


Figure 5- Official and total output growth volatility- 1981-2005



Note: Slovakia is an outlier and excluded from the graph.

Figure 6- Output growth volatility and output growth- 1981-2005



Note: Slovakia is an outlier and excluded from the graph.

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5 Appendix I- Econometric Methodology

5.1 Panel stationary tests

The stationarity of the variables $\Delta Elec$, $\Delta Eprice$, $\Delta IndGdp$, $\Delta\Delta Elec$, $\Delta\Delta Eprice$ and $\Delta\Delta IndGdp$ has been initially tested adopting the Im, Pesaran and Shin (IPS) methodology for the null of unit root in heterogeneous panels. This test is based on the hypothesis that the error terms are independent across cross-sections and may suffer from size distortions in the presence of cross-sectional dependence (Im, Pesaran and Shin, 2003). Therefore, to support the result of the IPS test, we performed the Pesaran test for unit roots in heterogeneous panels with cross-sectional dependence (Pesaran, 2003, 2007).¹⁹ Since these two tests reject the null of unit root even if only one series is stationary, we also performed the Hadri test for the null of stationarity in heterogeneous panels. This test rejects the null of stationarity even if only one series is not stationary and it is based on the assumption of cross-sectional independence of the error terms (Hadri, 2000)²⁰ Thus, to support the results of the Hadri test, we have finally performed separate Kwiatkowski, Phillips, Schmidt and Shin (1992) (KPSS), ADF and Phillips-Perron (PP) unit root tests.

Table 4 reports the results of the IPS and Pesaran tests. The null of unit root for all variables is rejected against the alternative hypothesis that at least one series is stationary.

Table 4- Panel unit root test

H_0 : all 49 timeseries in the panel are non-stationary processes; Lag selection: fixed at 1, τ =individual linear trends

	IPS	PES	IPS(τ)	PES(τ)
ΔEC	-14.6*	-11.9*	-13*	-10.3*
ΔPE	-12.3*	-9.2*	-13.9*	-5.2*
ΔI	-15.7*	-12.5*	-11.9*	-9.4*
$\Delta\Delta EC$	-29.4*	-24.3*	-25.3*	-21*
$\Delta\Delta PE$	-27.7*	-14.1*	-23.7*	-9.2*
$\Delta\Delta I$	-30.8*	-23.8*	-26.7*	-20.4*

Note: IPS = Im, Pesaran, Shin (2003), PES= Pesaran (2003, 2007). The statistics are asymptotically distributed as a standard normal with a left hand side rejection area. A * indicates the rejection of the null hypothesis of nonstationarity at least at the 5 percent level of significance.

¹⁹We have performed a truncated version of the CADF statistics which has finite first and second order moments. Pesaran (2003) suggests replacing extreme values of the test statistics by K1 or K2 such that $\Pr [-K1 < t_i(N,T) < K2]$ is sufficiently large, namely in excess of 0.9999. As noted by Pesaran, this truncated test statistic allows to avoid size distortions, especially in the case of models with residual serial correlations and linear trends.

²⁰Giulietti, Otero and Smith (2006) demonstrate that the Hadri test may suffer from size distortions in the presence of cross-sectional dependence when N=50 and T=25. However, also their alternative Bootstrap Hadri Test may suffer from size distortions in the presence of cross-sectional dependence when N=50 and T=25.

The results of the Hadry test are reported in Table 5. The statistics indicate that there is evidence of non stationarity for all variables $\Delta Elec$, $\Delta Eprice$ and $\Delta IndGdp$. For the differenced series $\Delta\Delta Elec$, $\Delta\Delta Eprice$ and $\Delta\Delta IndGdp$ there is evidence of non-stationarity only if the errors are assumed to be serially correlated.

Table 5- Hadri panel stationary test

H_0 : all 49 timeseries in the panel are stationary processes; *Homo*: homoskedastic disturbances across units; *Hetero*: heteroskedastic disturbances across units; *SerDep*: controlling for serial dependence in errors; τ =individual linear trends

		$Z(\mu)$	$Z(\tau)$
ΔEC	<i>Homo</i>	1.9*	0.4
ΔEC	<i>Hetero</i>	4.8*	4.6*
ΔEC	<i>SerDep</i>	5.5*	18.8*
ΔPE	<i>Homo</i>	14.8*	-3
ΔPE	<i>Hetero</i>	10.4*	2.9*
ΔPE	<i>SerDep</i>	8.9*	21.3*
ΔI	<i>Homo</i>	-1.3	2.8*
ΔI	<i>Hetero</i>	0.9	3*
ΔI	<i>SerDep</i>	2.7*	17.3*
$\Delta\Delta EC$	<i>Homo</i>	-6.3	-7.7
$\Delta\Delta EC$	<i>Hetero</i>	-5.8	-6.9
$\Delta\Delta EC$	<i>SerDep</i>	4.8*	24.6*
$\Delta\Delta PE$	<i>Homo</i>	-6.2	-7.9
$\Delta\Delta PE$	<i>Hetero</i>	-4.7	-6.6
$\Delta\Delta PE$	<i>SerDep</i>	7.9*	27.7*
$\Delta\Delta I$	<i>Homo</i>	-6.6	-7.6
$\Delta\Delta I$	<i>Hetero</i>	-5.9	-6.9
$\Delta\Delta I$	<i>SerDep</i>	3.1*	24.6*

Note: The statistics are asymptotically distributed as a standard normal with a right hand side rejection area. A * indicates the rejection of the null hypothesis of stationarity at least at the 5 percent level of significance.

Finally, according to the separate KPSS, ADF and PP unit root tests, a significant portion of series of each relevant variable have a unit root.

5.2 Cointegration statistics

With non-stationary pooled time series, the application of the OLS estimator may result in biased and inconsistent estimates (Granger and Newbold, 1974; Engle and Granger, 1987). To define an appropriate estimator for equation (1), it has been therefore necessary to turn to panel cointegration techniques. The presence of cointegrating relationships between $\Delta Elec$, $\Delta Eprice$ and $\Delta IndGdp$ has been tested using the residual-based procedure developed by Pedroni (1999, 2004).²¹ The Pedroni group tests have a null of no cointegration for all countries of the panel against the alternative hypothesis of cointegration for at least one country. Table 6 reports the results. All Pedroni group-statistics reject the null of no cointegration. These tests are based on the assumption of errors cross-sectional independence. As noted by Pedroni (2004), common time dummies can be included in the regression equation in order to eliminate some forms of cross-sectional dependence²². As Table 6 shows, including time dummies our results are confirmed. The null of no cointegration is rejected by all group statistics.

Table 6- Pedroni residual-based cointegration test

H_0 : no cointegration; Trend assumption: heterogeneous intercepts; Lag selection: fixed at 1

Group statistics	No time dummies	Time dummies
<i>Rho – statistic</i>	-10.8*	-10.5*
<i>PP – statistic</i>	-24*	-24.3*
<i>ADF – statistic</i>	-17.8*	-19.5*

Note: All reported values are asymptotically distributed as a standard normal. Panel statistics are weighted by long variances. The Pedroni tests are left-sided. A * indicates the rejection of the null hypothesis of no cointegration at least at the 5 per cent level of significance.

²¹Pedroni (2004) uses these cointegration tests for testing the weak form of purchasing power parity for the post-Bretton Woods period. In particular, he uses a panel of 25 countries for the period June 1973-December 1994 and reports the results for both annual, T=20, and monthly, T=246, data.

²²As noted by Pedroni (2004), for many cases this approach may be appropriate, as, for example, when common business cycle shocks impact the data for all individuals of the panel together. In other cases, additional cross-sectional dependencies may exist in the form of relatively persistent dynamic feedback effects that run from one country to another and that are not common across countries, in which case common time effects will not account for all the dependency. If the time series dimension is long enough relative to the cross-sectional dimension, the one practical solution in such cases may be to employ a GLS approach based on the estimation of the panel-wide asymptotic covariance for the weighting matrix. Most recently, Gengenbach, Palm and Urbain (2006) propose a common factor structure to model the cross-sectional dependence for panel no-cointegration tests. Moreover, a bootstrap test for the null hypothesis of cointegration in panel data is presented by Westerlund and Edgerton (2007).

The Pedroni cointegration test statistics may suffer from size distortions when the time dimension of the panel is not significantly large with respect to the cross sectional dimension (Pedroni, 2004). Therefore, the same cointegration analysis has been applied to seven subgroups of the panel with $T > N$.²³ These additional tests confirm the initial results. The null of no cointegration is always rejected. However, the test of Pedroni rejects the null of no cointegration even if the residuals of a pooled OLS estimation of equation (1) are stationary only for one country. Therefore, to determine whether the residuals of each of the 49 cross-sections of equation (1) are stationary we have performed separate ADF, Phillips-Perron and KPSS unit root tests. These values demonstrate that the OLS residuals are stationary for a significant portion of countries. In particular, there is evidence of non-stationarity in the residuals only for two countries, Canada and Hungary.

Due to the presence of cointegrated time series, for the estimation of equation (1) we have used the group-mean panel Fully Modified Ordinary Least Squares (FMOLS) method proposed by Pedroni (2000, 2001). The group-mean FMOLS estimator allows for the heterogeneity of the panel and adjusts for the effects of autocorrelation of the errors. This estimator also adjusts for the potential long-run endogeneity of the regressors.

In order to eliminate some forms of cross-sectional dependence, we have also included in the regression common time dummies (Pedroni, 2000, 2001). Table 7 reports the estimation results. The group-FMOLS estimates suggest that - considering the entire panel of 49 countries- a positive and statistically significant relationship exists between the changes in electric consumption and those in the share of industry. On the contrary, a negative and statistically significant relationship exists between the changes in electric consumption and those in electricity price²⁴.

As noted by Pedroni (2000), the group-mean FMOLS estimator may suffer from size distortions when N is large relative to T .²⁵ Thus, we have estimated the same regression equation considering four subgroups of countries with T large relative to N .²⁶ As Table 7 shows, including or not common time dummies, these

²³We have tested the presence of cointegration in 20 highly industrialized OECD countries, 16 European countries, 6 Transition countries, and 23 non OECD countries: 10 Latin American countries, 5 African countries, and 8 Asian countries.

²⁴To use changes in country-specific electricity price as an explanatory variable for changes in electricity consumption may generate problems of endogeneity. Firstly, we have re-estimated equation (1) adopting an alternative exogenous real price of energy for 26 OECD countries and a global index of energy price for the remaining 23 countries (see Appendix II for a description of the data). Second, we have used the global price of energy for the entire panel. In both situations we have obtained the same result. There is a positive and statistically significant relationship between changes in electricity consumption and changes in industry share of GDP. There is a negative and statistically significant relationship between changes in electricity usage and changes in the price of energy.

²⁵Using Monte Carlo simulations, Pedroni (2000) demonstrates that, in the bivariate case, the small sample distortion of the group-mean fully modified OLS estimator tends to be high when $N > T$, and decreases as $T > N$. This is a practical consequence of any fixed effects model.

²⁶We have employed the FMOLS estimation for 20 highly industrialized OECD countries, 16 European countries, 22 European countries (including 6 Transition countries), and 23 non

results are close to those obtained examining the entire panel. Only for the non OECD countries, the relationship between the changes in electric consumption and those in electricity price becomes positive and non-statistically significant in the presence of time dummies.

Table 7- FMOLS estimation

TD = Time dummies

Dep Var ΔEC	ΔI	ΔPE	$\Delta I (TD)$	$\Delta PE (TD)$
Entire panel	0.88* (6.8)	-0.09* (-6)	0.84* (6.7)	-0.02* (-3.5)
OECD	0.70* (3.6)	-0.10* (-4.7)	0.76* (4.6)	-0.05* (-2.6)
European	0.78* (3.9)	-0.10* (-4.4)	0.79* (4.1)	-0.06* (-2.3)
European*	0.83* (6.7)	-0.10* (-5)	0.80* (6.9)	-0.08* (-4.8)
Non OECD	1.03* (3.2)	-0.08* (-3.2)	0.79* (3.3)	0.07 (1.2)

Note: t-stats (in parenthesis) are for $H_0 : \beta_i = 0$ for all i vs $H_1 : \beta_i \neq 0$. "European*" indicate European countries including Transition economies; "Non OECD" indicate non OECD countries excluding Transition economies.

In the paper we present results based on country-specific FMOLS estimators for equation (1).²⁷.

OECD countries (African, Asian and Latin American countries).

²⁷We have also computed residual electricity consumption series using both the full panel FMOLS coefficients and separate subpanel coefficients (highly industrialized OECD non European, European, and Developing countries) reported in Table 8. The three series computed for electricity usage are quite similar (results available upon request).

What we know so far is that the residual changes in electricity consumption are stationary. To prove that also the dynamics of unrecorded income follow a stationary process, we tested the stationarity of the annual changes in official GDP, ΔGDP . According to the IPS, Pesaran and Hadri panel unit root tests (see Tables 9 and 10) and separate KPSS, ADF and PP unit root tests, a significant portion of series is stationary.

Table 9- Panel unit root test

H_0 : all 49 timeseries in the panel are non-stationary processes; Lag selection: fixed at 1; τ =individual linear trends

	IPS	PES	IPS(τ)	PES(τ)
ΔGDP	-12.4*	-7.6*	-9.2*	-4.9*
$\Delta\Delta GDP$	-24.9*	-18.6*	-20.6*	-14.9*

Note: IPS = Im, Pesaran, Shin (2003), PES= Pesaran (2003, 2007). The statistics are asymptotically distributed as a standard normal with a left hand side rejection area. A * indicates the rejection of the null hypothesis of nonstationarity at least at the 5 percent level of significance.

Table 10- Hadri panel stationary test

H_0 : all 49 timeseries in the panel are stationary processes; *Homo*: homoskedastic disturbances across units; *Hetero*: heteroskedastic disturbances across units; *SerDep*: controlling for serial dependence in errors; τ =individual linear trends

		$Z(\mu)$	$Z(\tau)$
ΔGDP	<i>Homo</i>	4.8*	8.2*
ΔGDP	<i>Hetero</i>	6.9*	8.6*
ΔGDP	<i>SerDep</i>	3.7*	18.2*
$\Delta\Delta GDP$	<i>Homo</i>	-6.1	-6.5
$\Delta\Delta GDP$	<i>Hetero</i>	-5.3	-5.3
$\Delta\Delta GDP$	<i>SerDep</i>	3.9*	24.6

Note: The statistics are asymptotically distributed as a standard normal with a right hand side rejection area. A * indicates the rejection of the null hypothesis of stationarity at least at the 5 percent level of significance.

6 Appendix II- description of data

6.1 Panel analysis

Total Electricity Consumption (kWh). *Source: Energy Information Administration (EIA).* This variable is obtained as the Net Total Electricity Generation *plus* Electricity Imports *minus* Electricity Exports *minus* Electricity Distribution Losses. We used this variable for 46 countries.

Total Final Electricity Consumption (ktoe). *Source: International Energy Agency (IEA).* This variable reflects the sum of the electricity consumption in the end-use sectors. Electricity used for transformation and for own use of the energy producing industries is excluded. Due to the lack of complete information, we used this variable- instead of Total Electricity Consumption (source: EIA)- for Germany, Czech Republic and Slovakia. Data for pre-unification Germany include electricity consumption in the Democratic Republic of Germany.

Index of Electricity End-Use Prices. *Source: International Energy Agency (IEA).* To calculate this real price index, the nominal prices were deflated with country-specific producer price indices for the industry sector and with country-specific consumer price indices for the household sector. We used this country-specific index for 26 OECD countries.

OECD Index of Electricity End-Use Prices. *Source: International Energy Agency (IEA).* This variable is the aggregate Index of Electricity End-Use Prices for 26 OECD countries.

World Index of Energy Prices. *Source: World Bank (WB), Commodity Price Data.* For 23 countries- for which country-specific data on electricity prices were not available- the relative electricity prices were proxied by this global index of real energy price.

Industrial Income. *Source: United Nations Statistics Division (UNSD).* Constant (1990) prices- US Dollars.

Official GDP. *Source: United Nations Statistics Division (UNSD).* Constant (1990) prices- US Dollars.

Agricultural Income. *Source: United Nations Statistics Division (UNSD).* Constant (1990) prices- US Dollars.

Self-employment. *Source: International Labour Organization (ILO).*

6.2 Cross-section analysis (Table 3)

Index of Business Freedom (IBF). *Source: Heritage Foundation.* Business freedom is a quantitative measure of the ability to start, operate, and close a business that represents the overall burden of regulation, as well as the efficiency of government in the regulatory process. The business freedom score for each country is a number between 0 and 100, with 100 equaling the freest business environment. The score is based on 10 factors, all weighted equally, using data from the World Bank's *Doing Business* study:

- Starting a business- procedures (number);

- Starting a business- time (days);
- Starting a business- cost (% of income per capita);
- Starting a business- minimum capital (% of income per capita);
- Obtaining a license- procedures (number);
- Obtaining a license- time (days);
- Obtaining a license- cost (% of income per capita);
- Closing a business- time (days);
- Closing a business- cost (% of estate); and
- Closing a business- recovery rate (cents on the dollar).

Each of these raw factors is converted to a scale of 0 to 100, after which the average of the converted values is computed. The result represents the country's business freedom score. Each factor is converted to a 0 to 100 scale using the following equation:

$$Factor\ Score_i = 50 \times factor_{average} / factor_i$$

which is based on the ratio of the country data for each factor relative to the world average, multiplied by 50.

In the paper we used the average values of *IBF* for the period 1997-2001.

Index of Trade Freedom (ITF). *Source: Heritage Foundation.* Trade freedom is a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. The trade freedom score is based on two inputs:

- The trade-weighted average tariff rate and
- Non-tariff barriers (NTBs).

The weighted average tariff uses weights for each tariff based on the share of imports for each good. Weighted average tariffs are a purely quantitative measure and account for the basic calculation of the score using the following equation:

$$TradeFreedom_i = (((Tariff_{max} - Tariff_i)/(Tariff_{max} - Tariff_{min})) * 100) - NTB_i$$

where *Trade Freedom_i* represents the trade freedom in country *i*, *Tariff_{max}* and *Tariff_{min}* represent the upper and lower bounds for tariff rates (%), and *Tariff_i* represents the weighted average tariff rate (%) in country *i*. The minimum tariff is naturally zero percent, and the upper bound was set as 50 percent. An NTB penalty is then subtracted from the base score. The penalty of 5, 10, 15, or 20 points is assigned according to the following scale:

- 20—NTBs are used extensively across many goods and services and/or act to effectively impede a significant amount of international trade;
- 15—NTBs are widespread across many goods and services and/or act to impede a majority of potential international trade;
- 10—NTBs are used to protect certain goods and services and impede some international trade;
- 5—NTBs are uncommon, protecting few goods and services, and/or have very limited impact on international trade;
- 0—NTBs are not used to limit international trade;

The extent of NTBs in a country's trade policy regime is determined using both qualitative and quantitative information. Restrictive rules that hinder trade vary widely, and their overlapping and shifting nature makes their complexity difficult to gauge. The categories of NTBs considered in our penalty include:

- Quantity restrictions—import quotas; export limitations; voluntary export restraints; import–export embargoes and bans; countertrade, etc.
- Price restrictions—antidumping duties; countervailing duties; border tax adjustments; variable levies/tariff rate quotas.
- Regulatory restrictions—licensing; domestic content and mixing requirements; sanitary and phytosanitary standards (SPSs); safety and industrial standards regulations; packaging, labeling, and trademark regulations; advertising and media regulations.
- Investment restrictions—exchange and other financial controls.
- Customs restrictions—advance deposit requirements; customs valuation procedures; customs classification procedures; customs clearance procedures.
- Direct government intervention—subsidies and other aid; government industrial policy and regional development measures; government-financed research and other technology policies; national taxes and social insurance; competition policies; immigration policies; government procurement policies; state trading, government monopolies, and exclusive franchises.

In the paper we used the average values of *ITF* for the period 1997-2001.

Stability (STABS). *Source: Database of Political Institutions (DPI).* This counts the percent of veto players who drop from the government in any given year. Veto players are defined as follows: for presidential systems, the veto players are the president, the largest party in the legislature, and the largest

party in the Senate; for parliamentary systems, veto players are defined as the prime minister and the three biggest coalition members. In the paper we used the values of *stabs* for 2000.

Executive Indices of Electoral Competitiveness (IEC). *Source: Database of Political Institutions (DPI).* For executives who are:

- elected directly by population, or
- elected by an electoral college that is elected by the people and has the sole purpose of electing the executive,
the same scale as Legislative Index of Electoral Competitiveness (source: DPI) is used:
- No executives = 1
- Unelected executive = 2
- Elected, 1 candidate = 3
- 1 party, multiple candidates = 4
- Multiple parties are legal but only one party won seats = 5
- Multiple parties won seats but the largest party received more than 75% of the seats = 6
- Largest party got less than 75% = 7

In the paper we used the values of *IEC* for 2000.

Number of procedures required to enforce a contract (log PROC). *Source: World Bank (WB), Doing Business Database.* We used the only available data for the period 2004-2005.

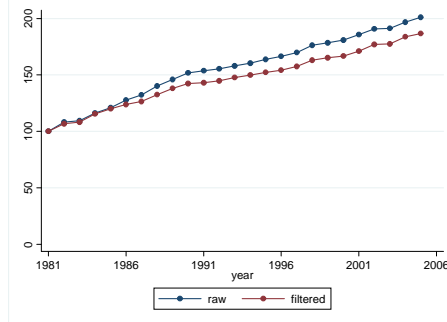
Level of education (EDU). *Source: Unesco.* The school life expectancy (primary to tertiary education) is defined as the total number of years of schooling which a child can expect to receive, assuming that the probability of his or her being enrolled in school at any particular future age is equal to the current enrolment ratio at that age. It is a synthetic summary indicator of the overall pattern of enrolment ratios at one particular point in time, and has no predictive value except in so far as it is believed that enrolment patterns will remain unchanged into the future.

In the paper we used the values of *education* for 2000.

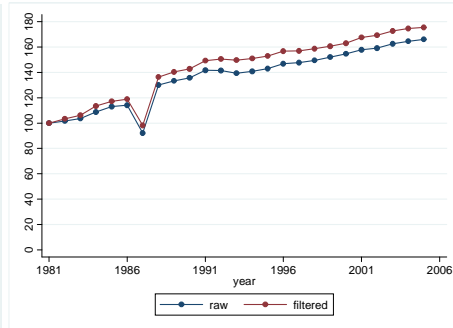
7 Appendix III- Graphical Analysis

Figure 6- Changes in electricity consumption raw *versus* filtered series

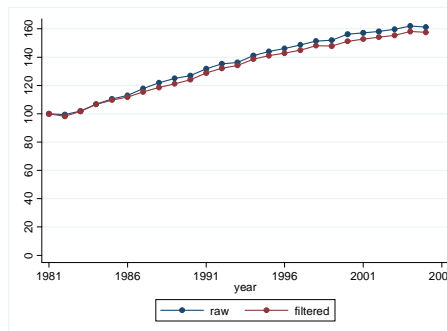
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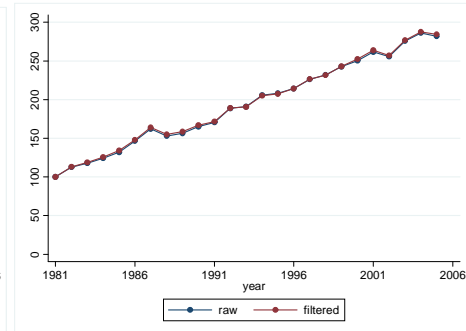
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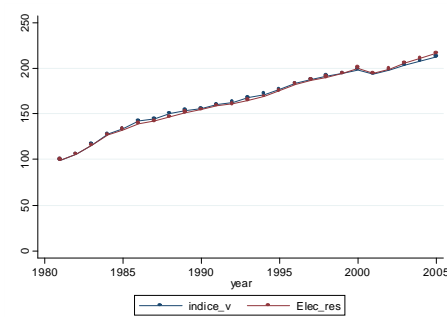
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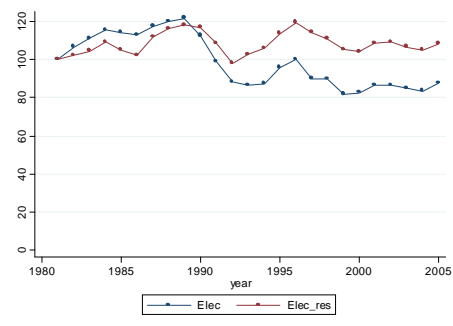
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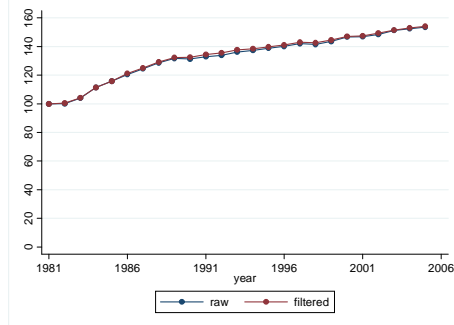
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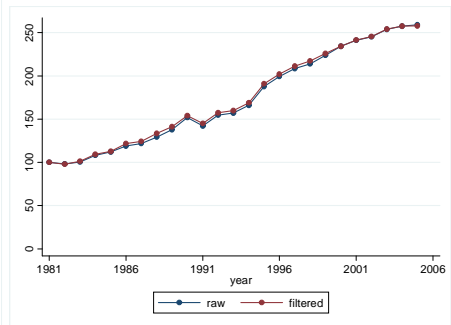
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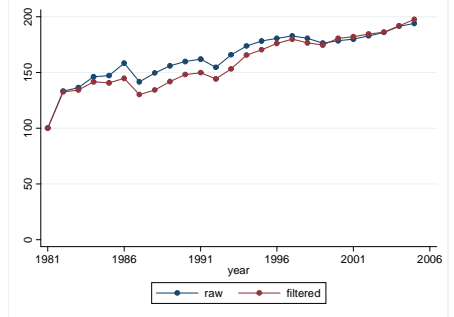
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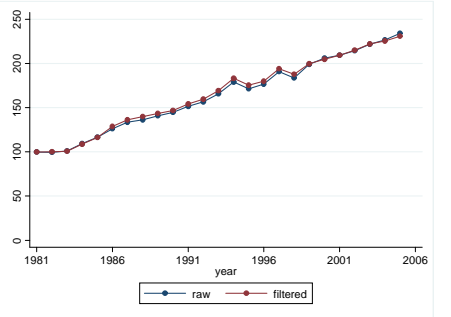
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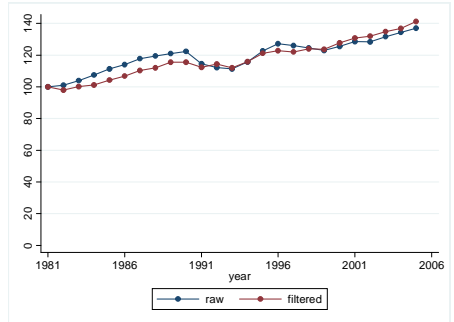
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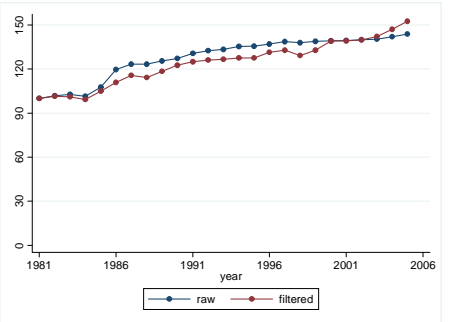
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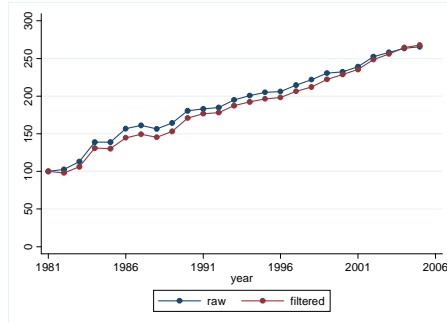
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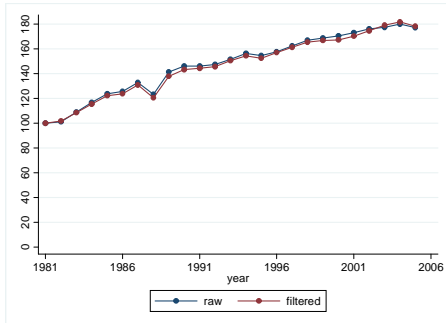
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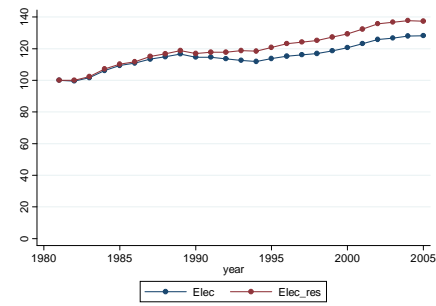
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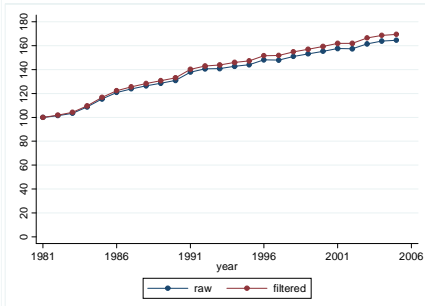
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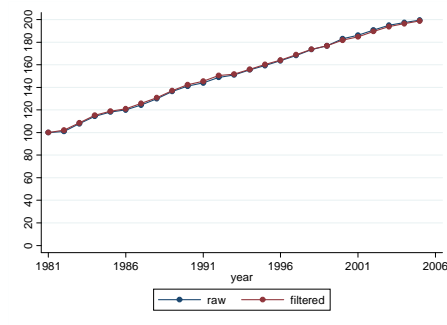
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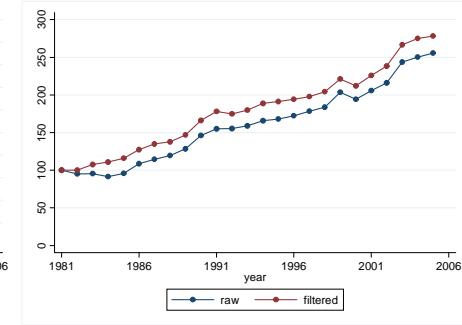
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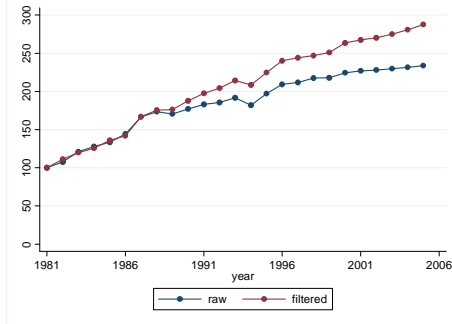
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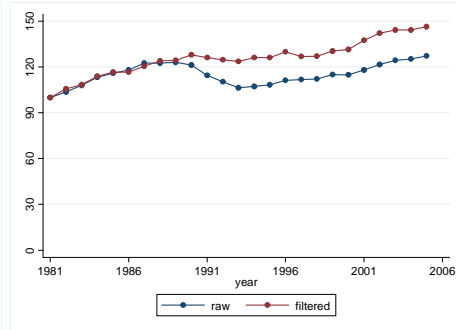
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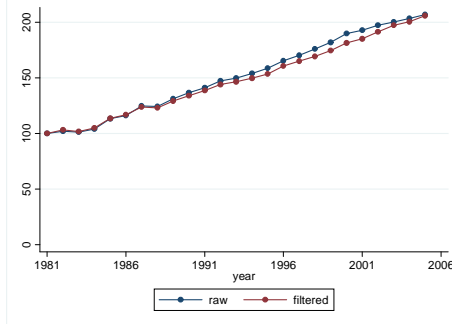
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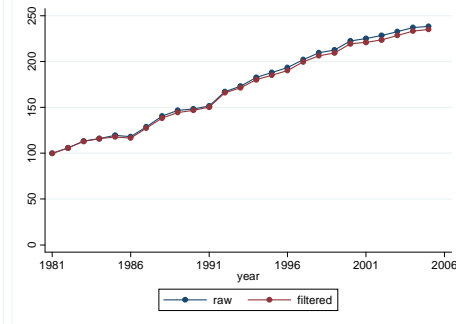
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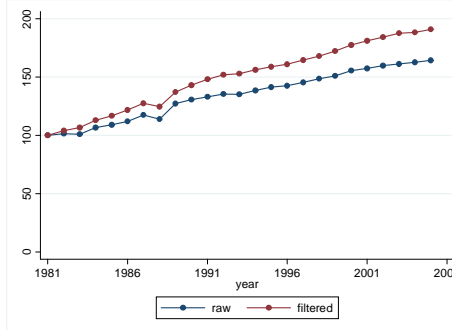
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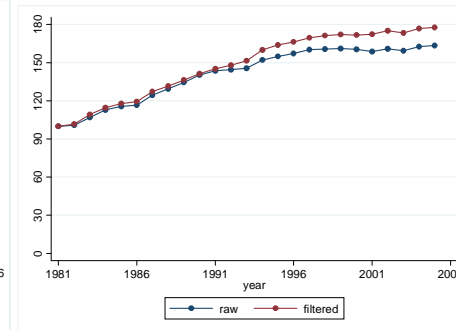
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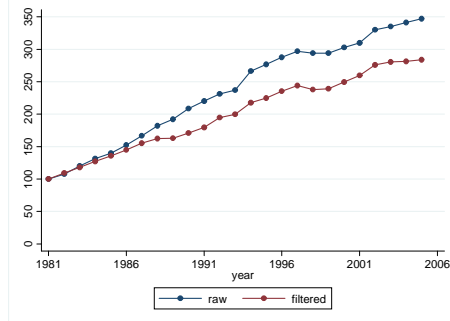
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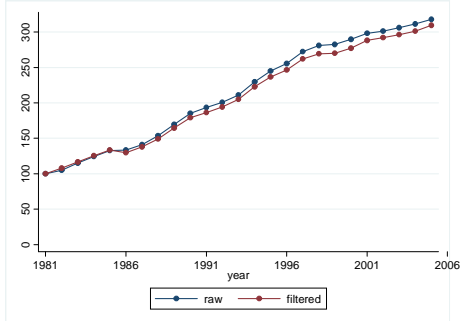
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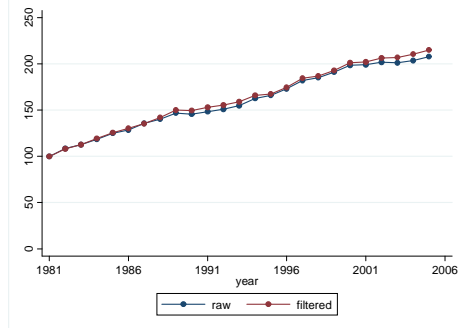
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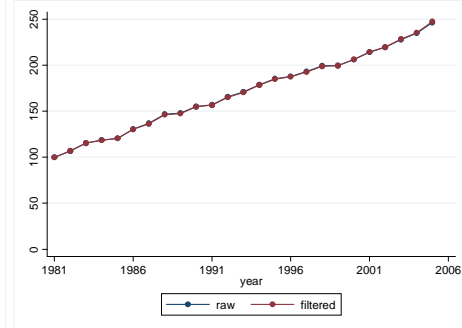
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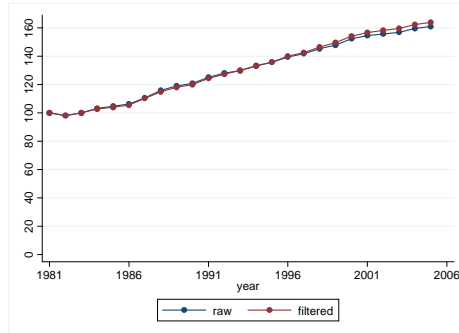
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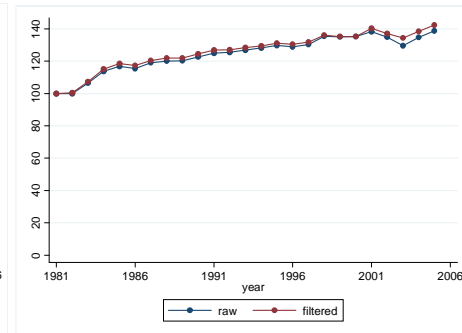
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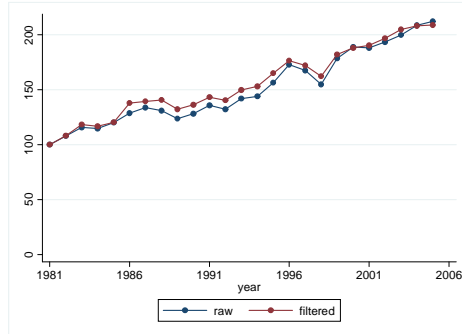
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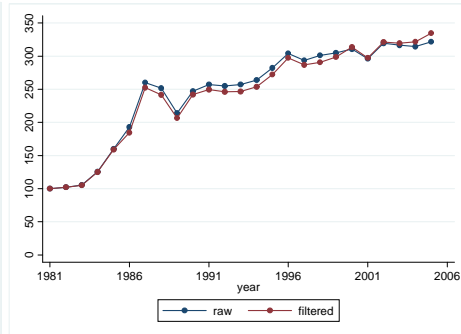
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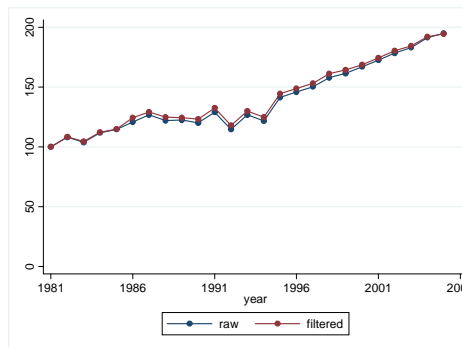
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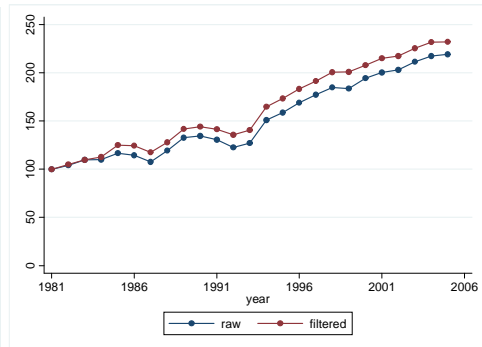
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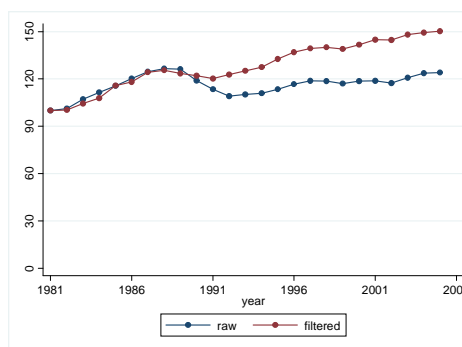
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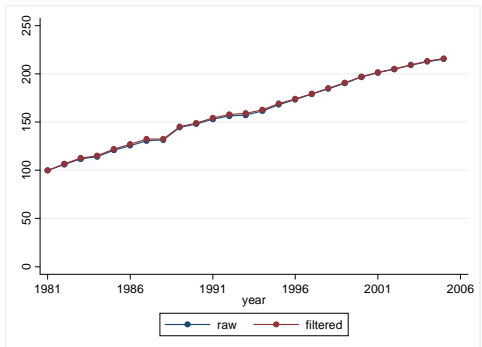
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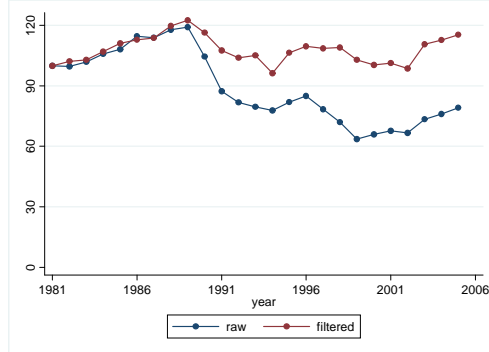
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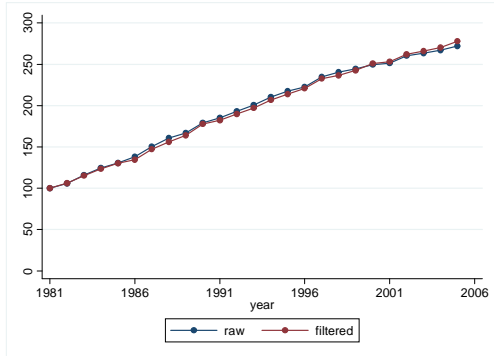
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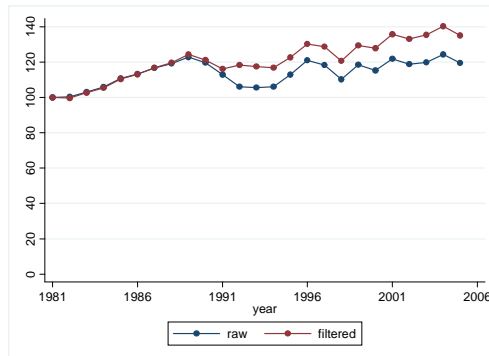
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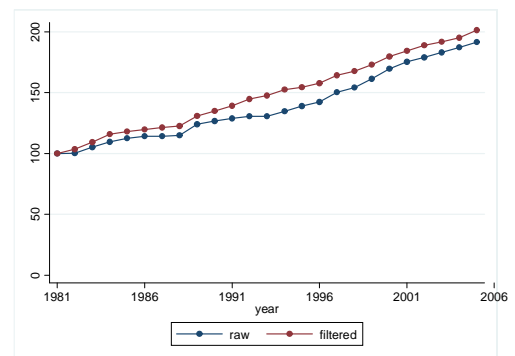
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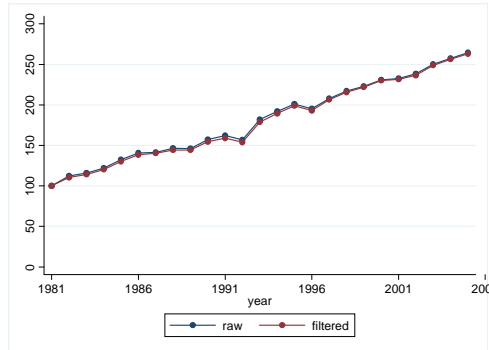
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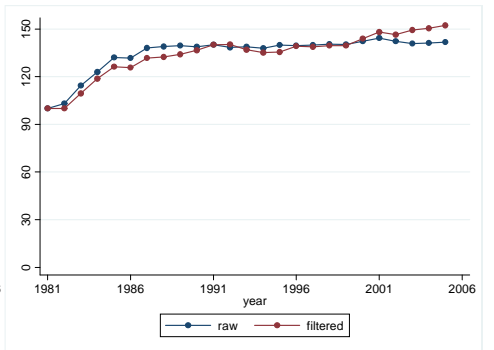
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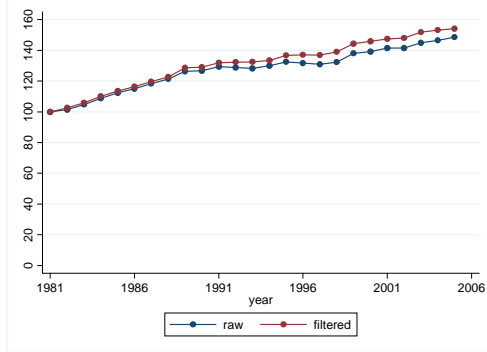
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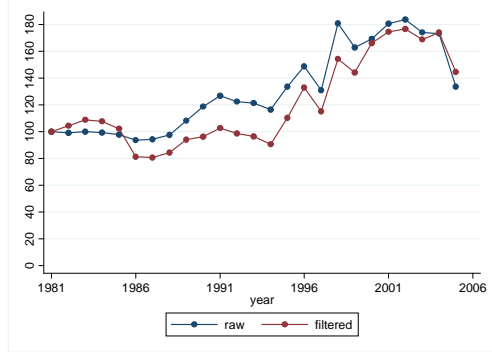
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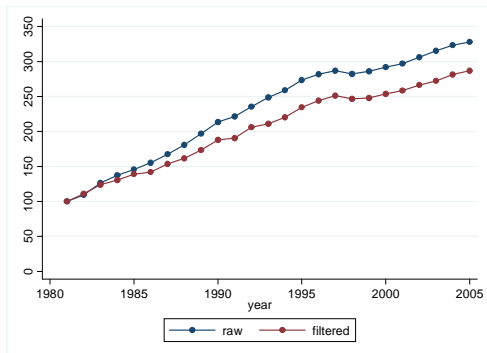
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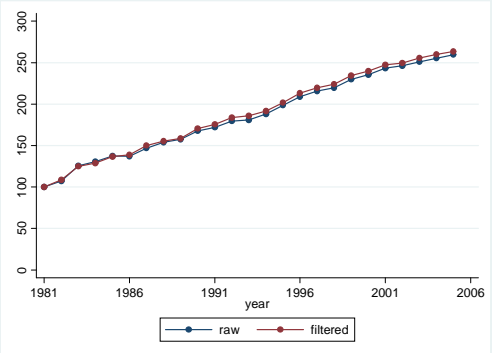
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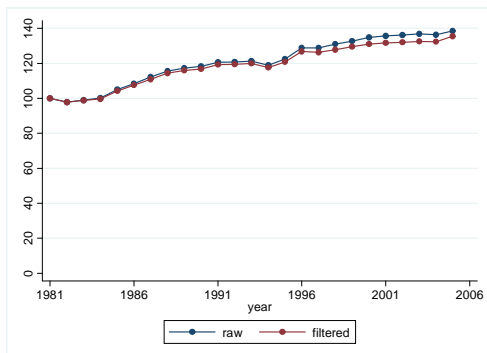
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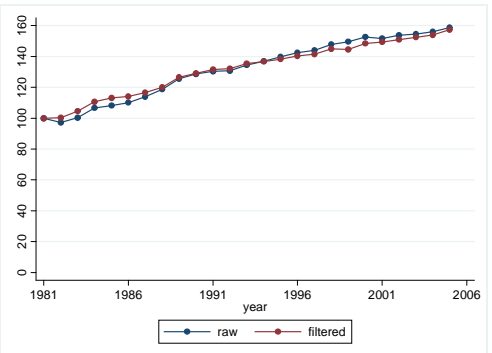
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United Kingdom



United States



Venezuela

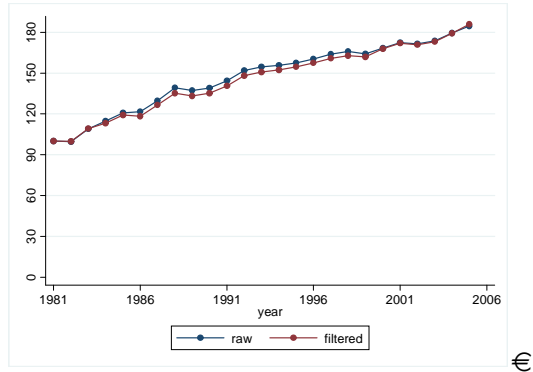
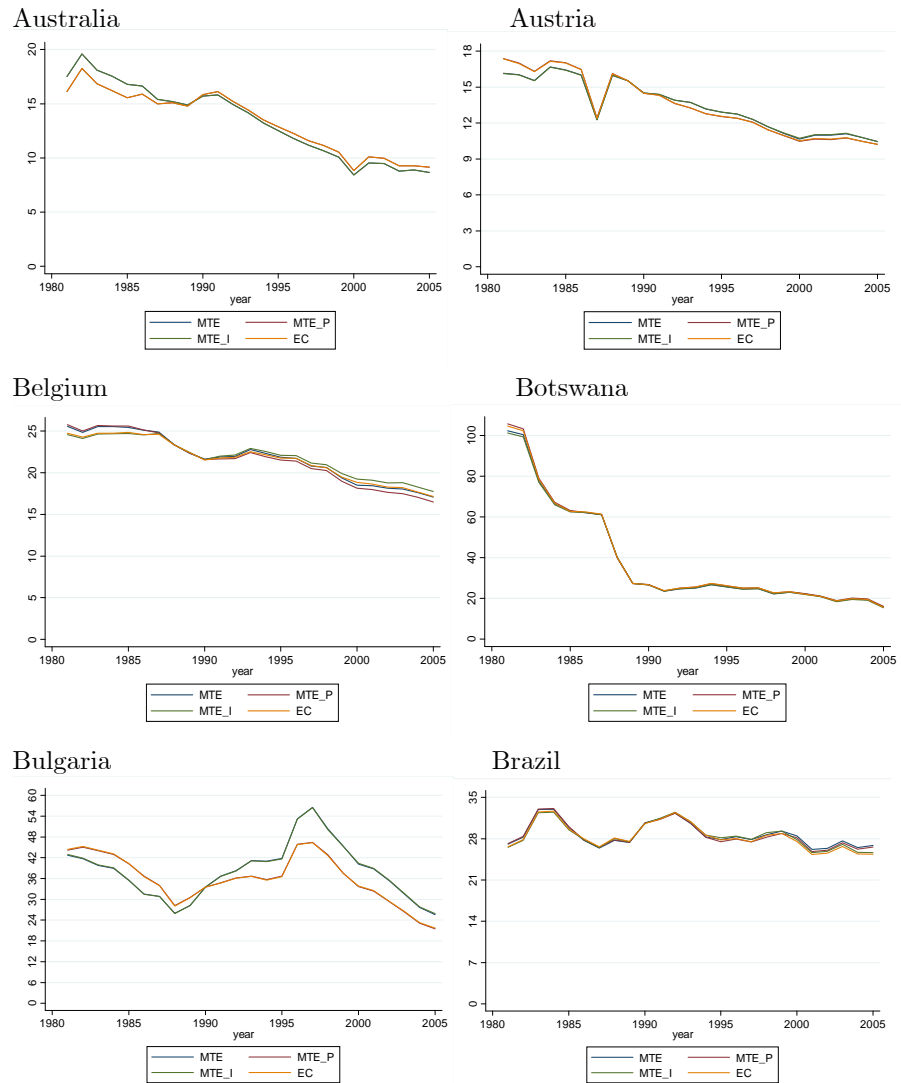
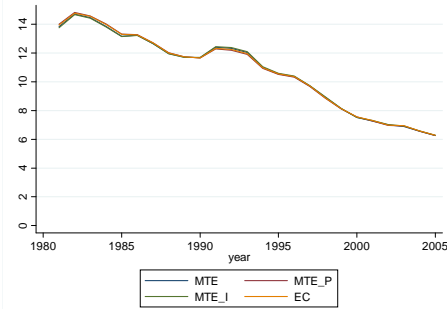


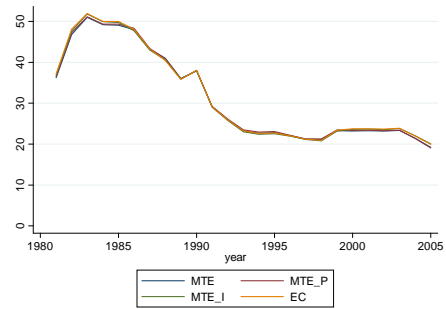
Figure 7- MTE versus ECM estimates (% official GDP)



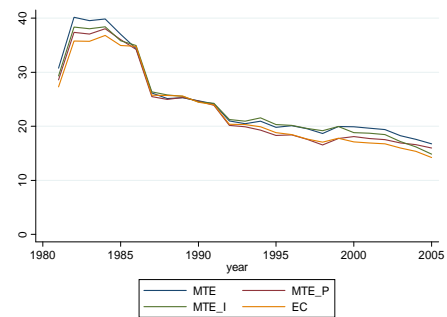
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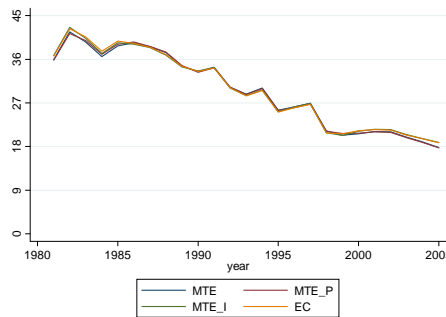
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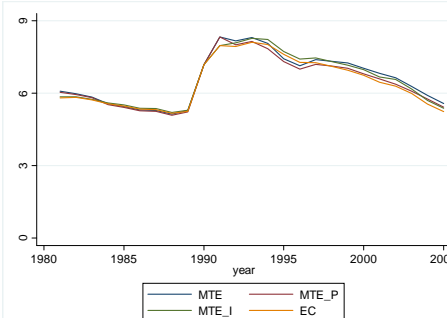
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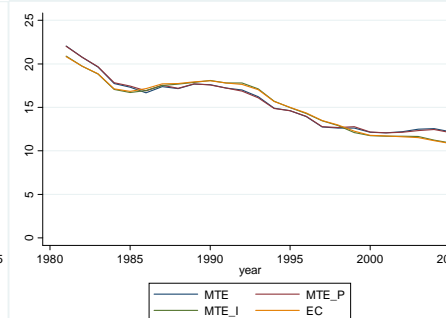
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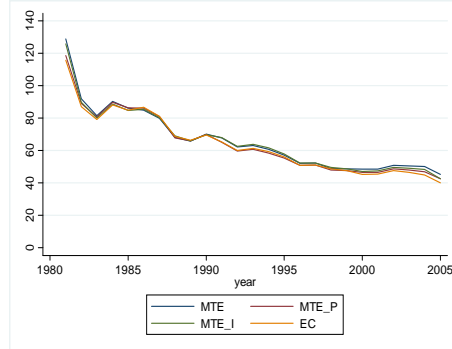
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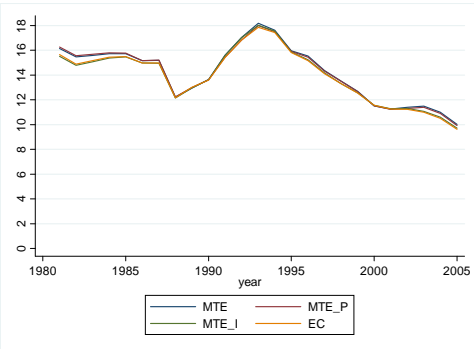
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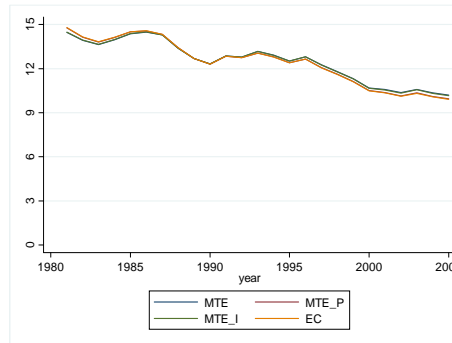
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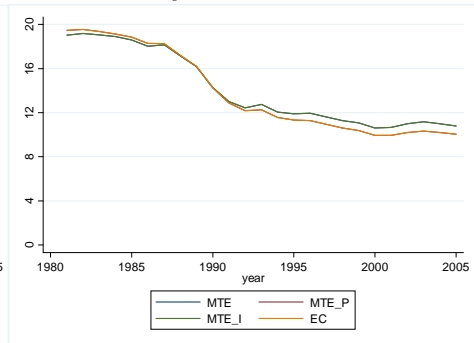
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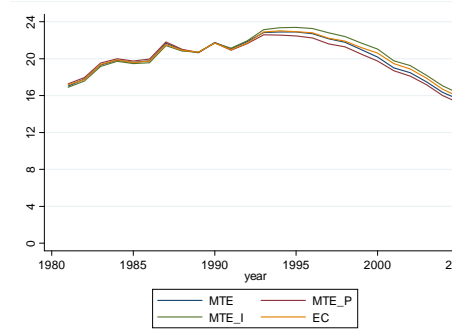
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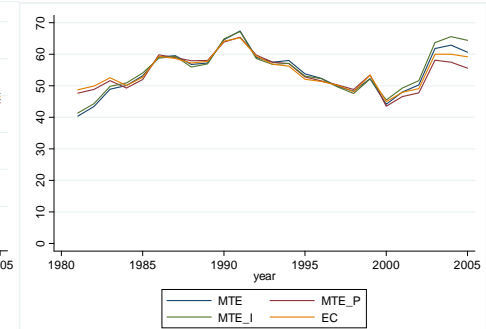
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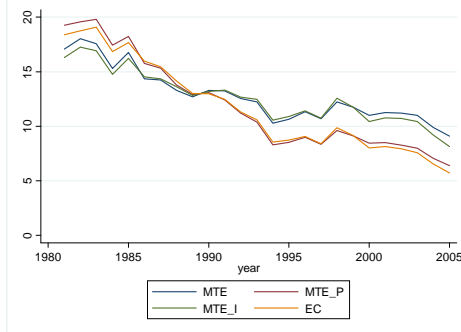
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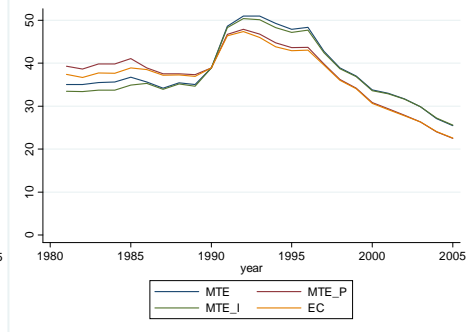
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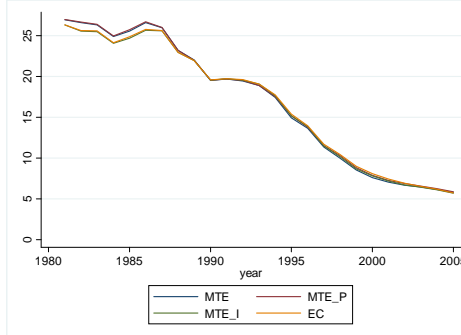
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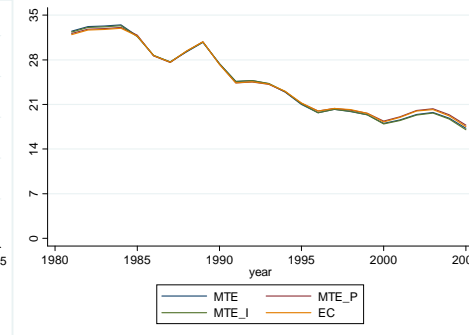
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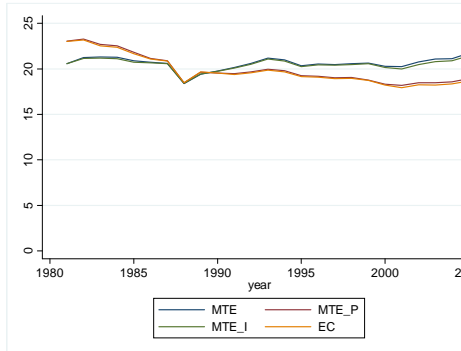
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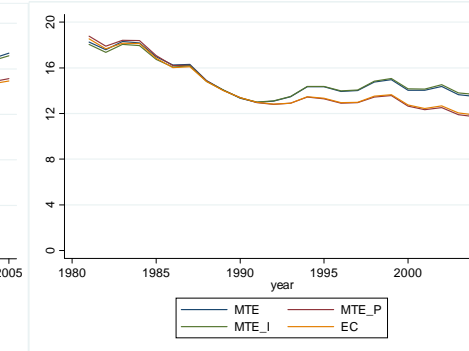
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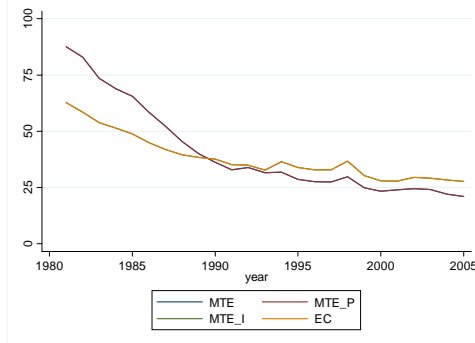
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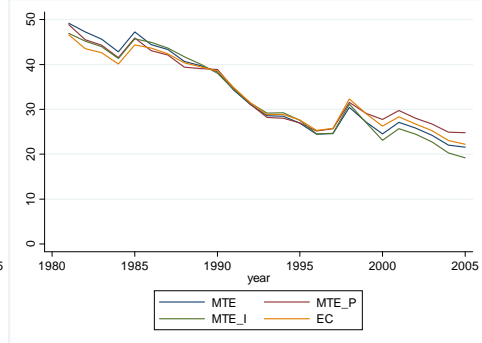
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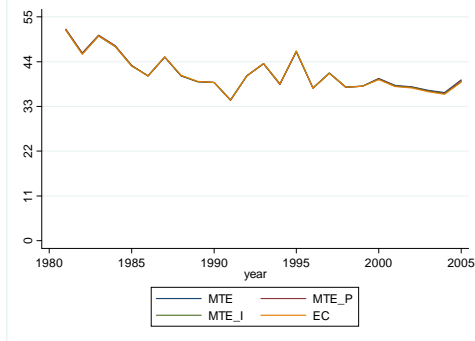
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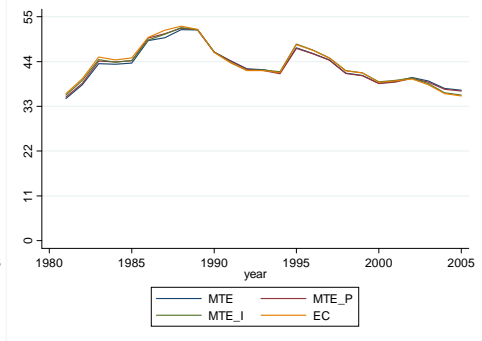
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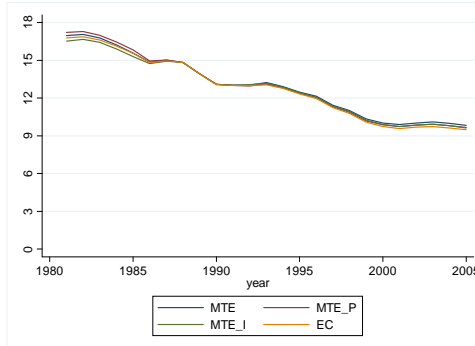
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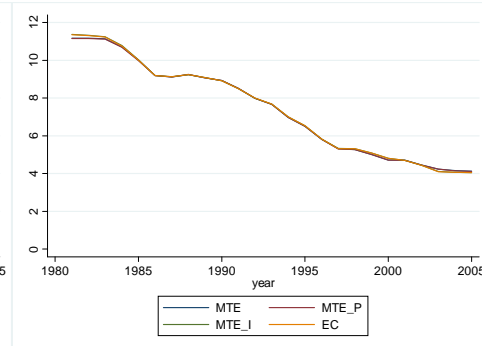
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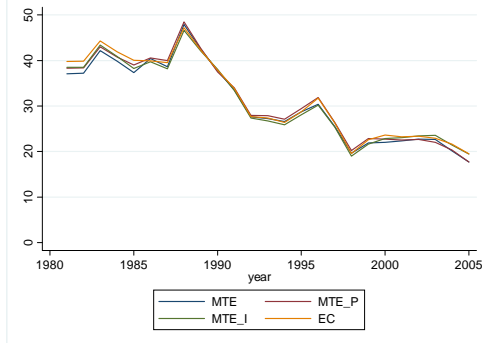
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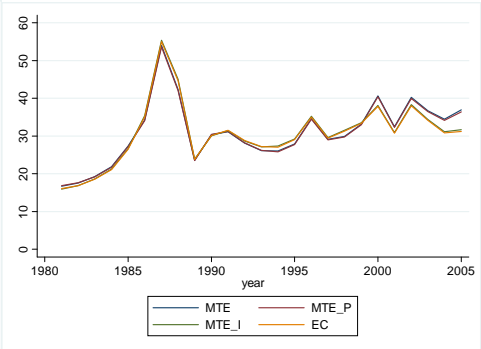
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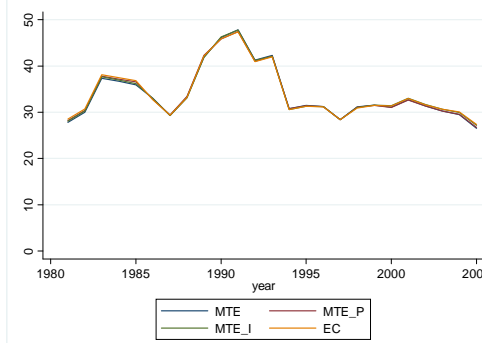
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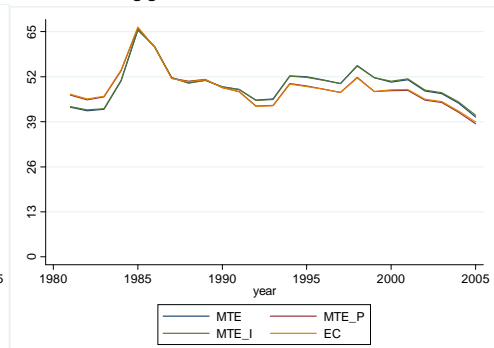
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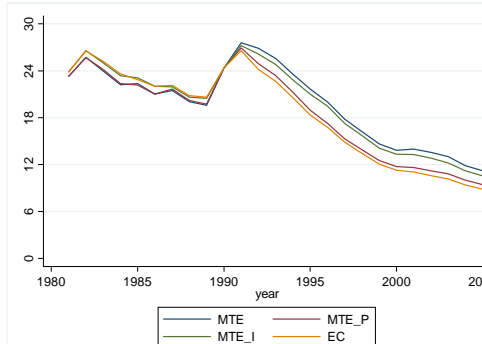
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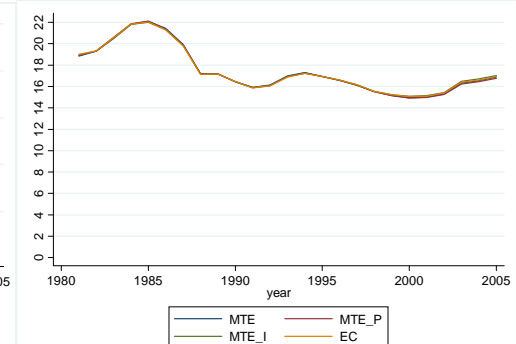
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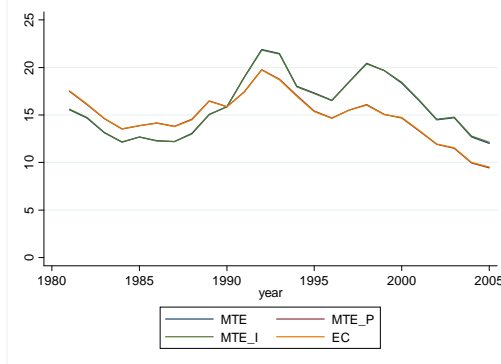
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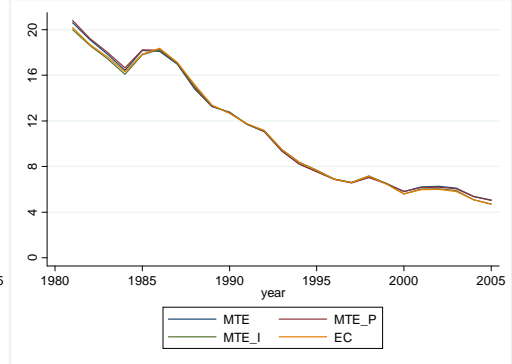
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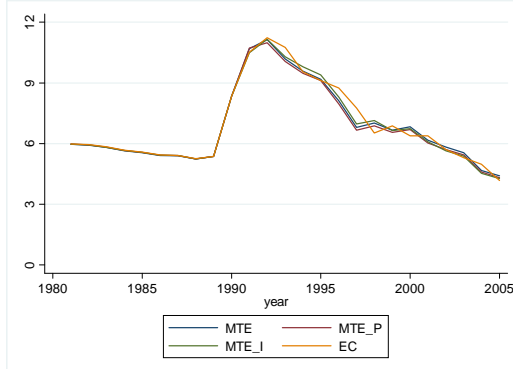
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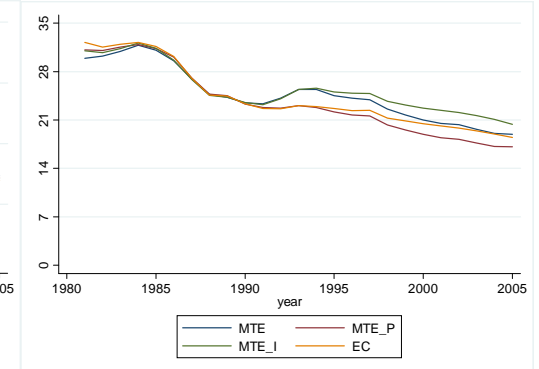
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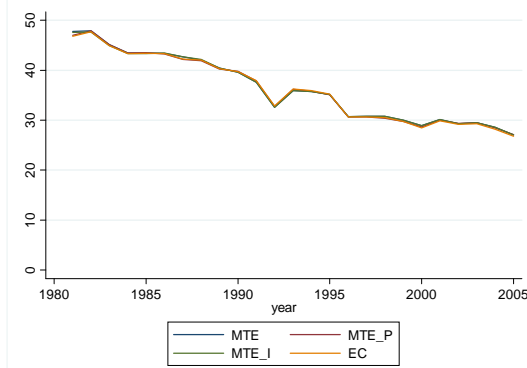
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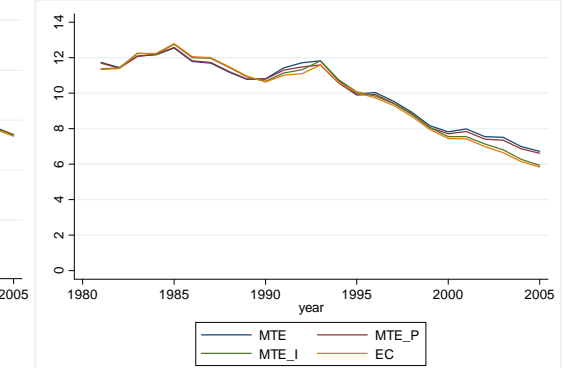
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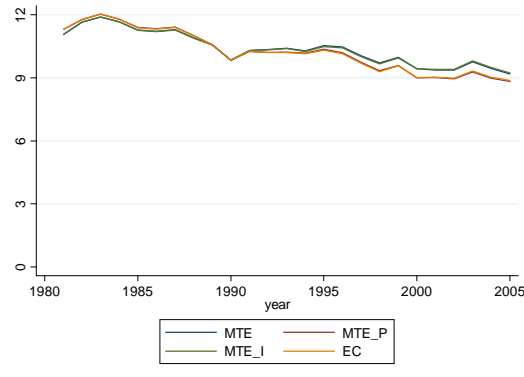
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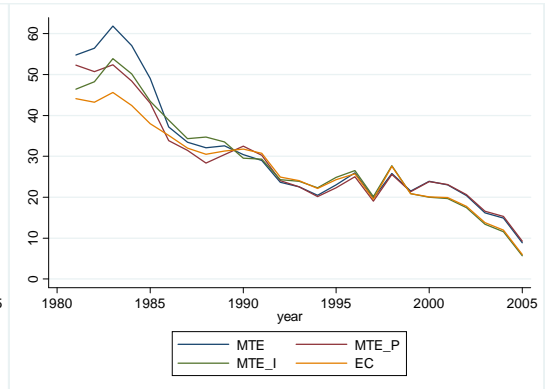
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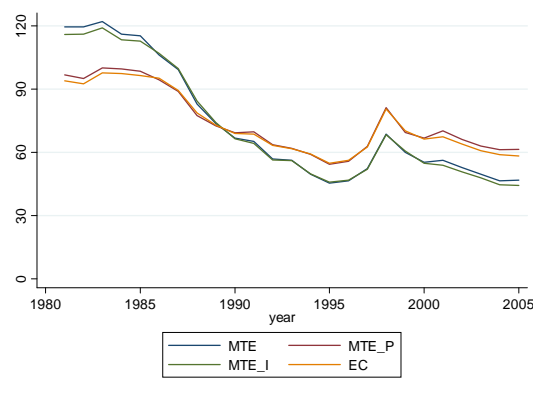
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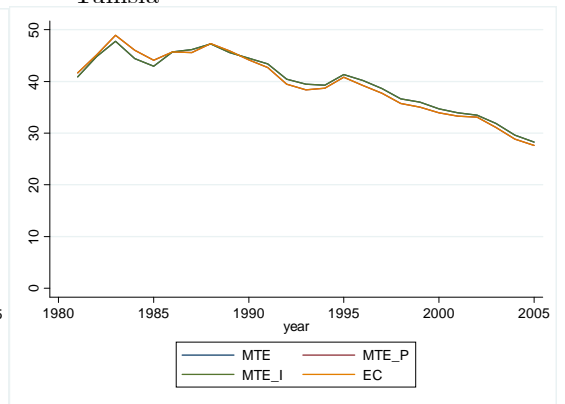
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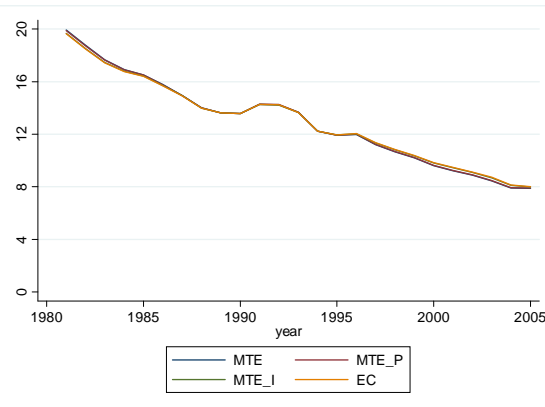
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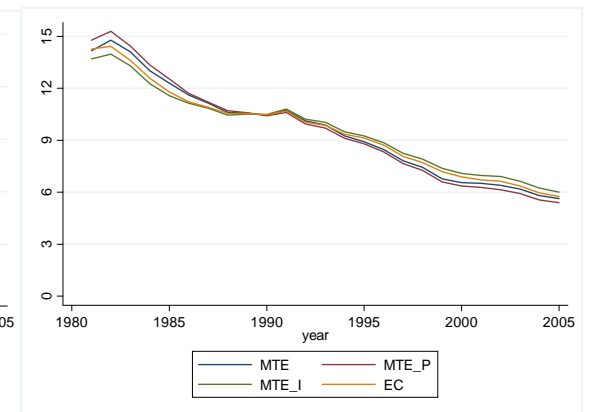
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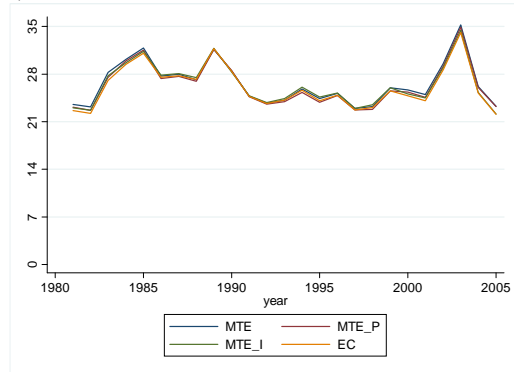
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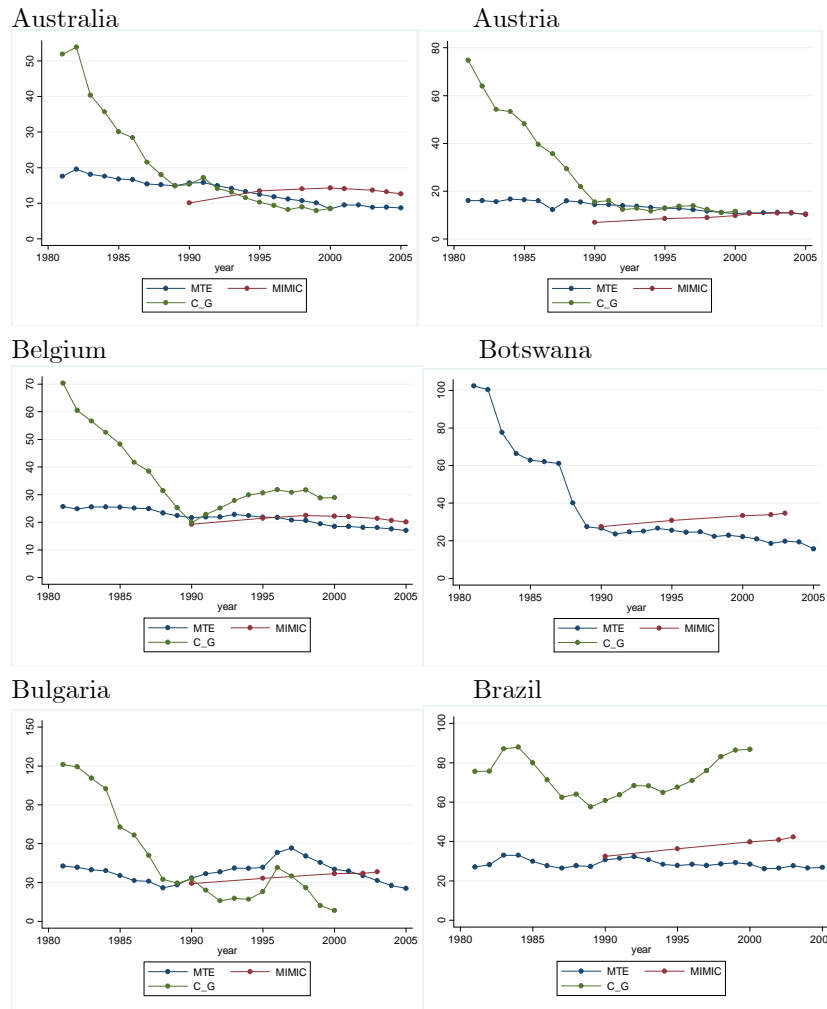


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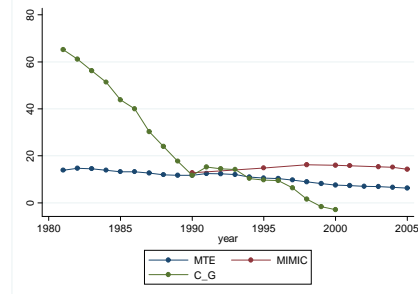


Source: own calculations

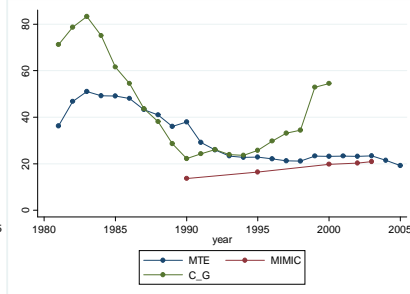
Figure 8- MTE, MIMIC and Chong and Gradstein's estimates (% official GDP)



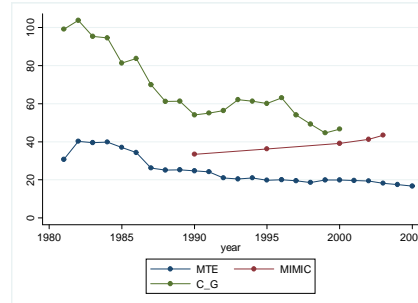
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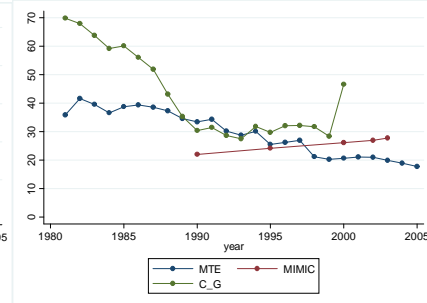
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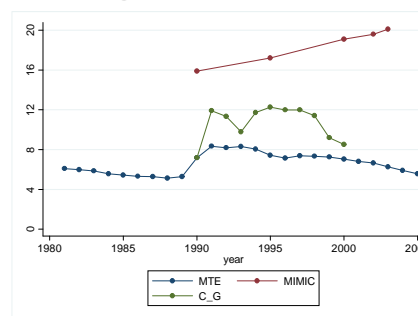
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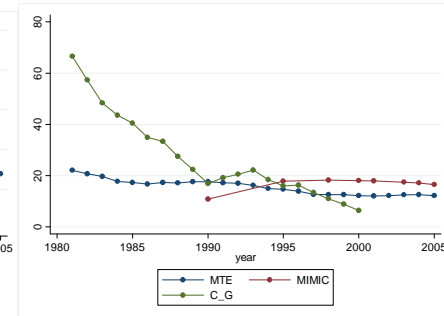
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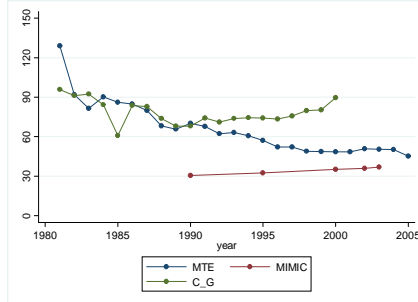
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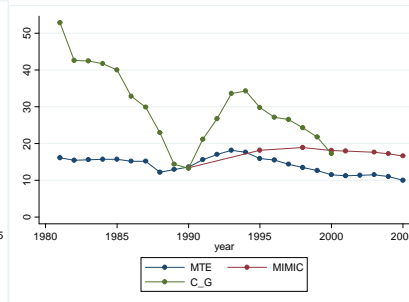
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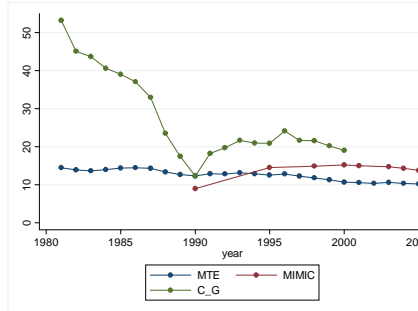
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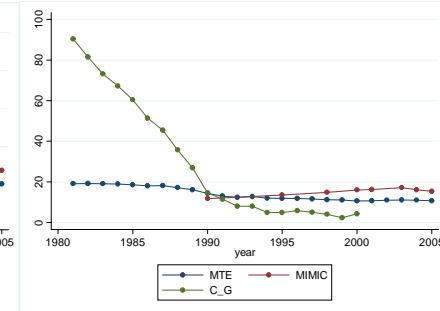
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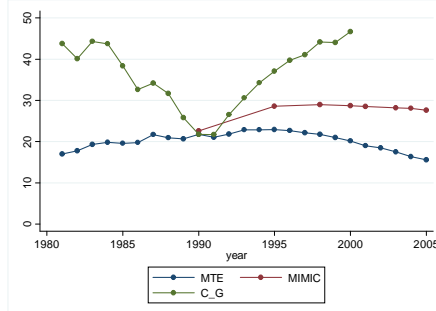
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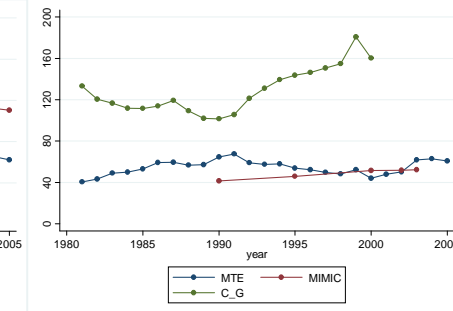
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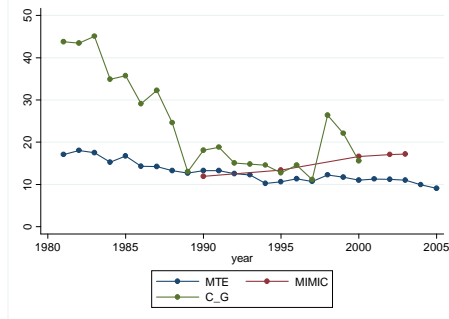
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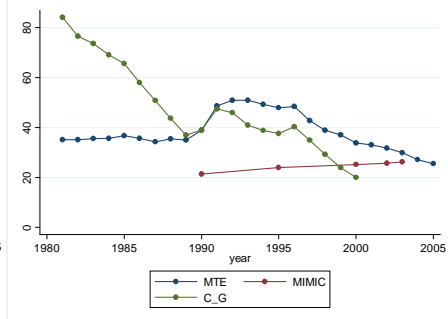
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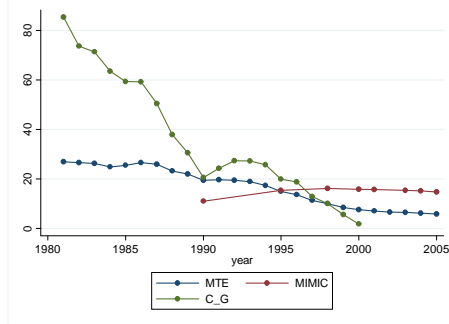
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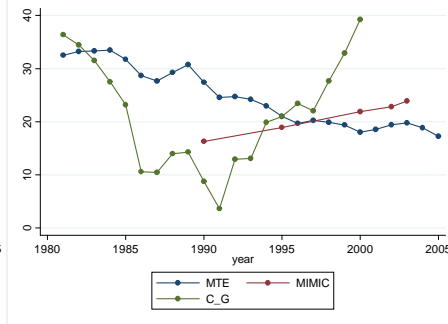
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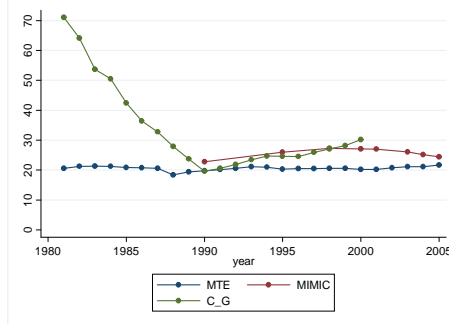
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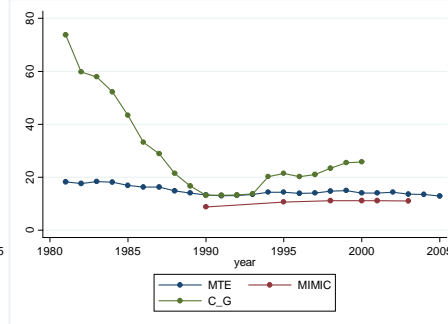
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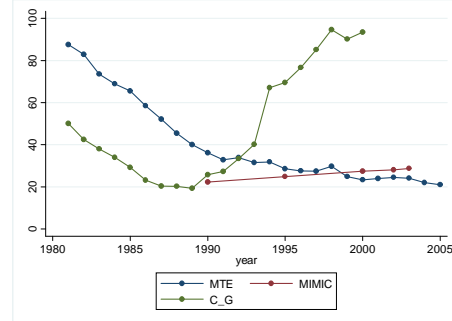
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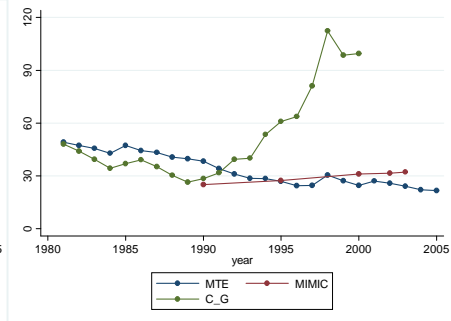
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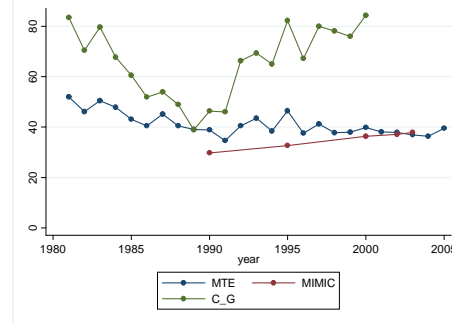
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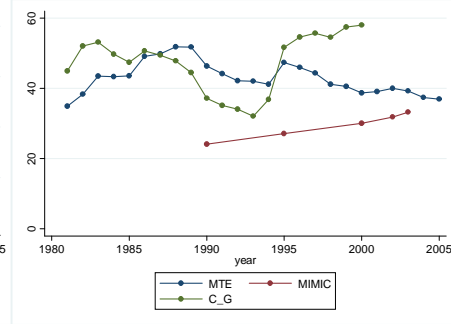
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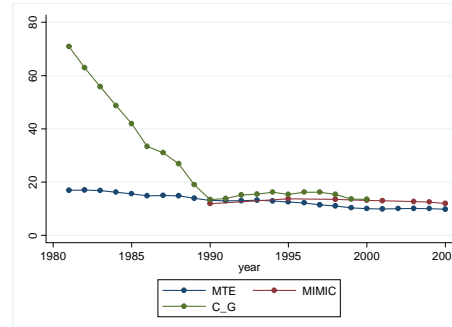
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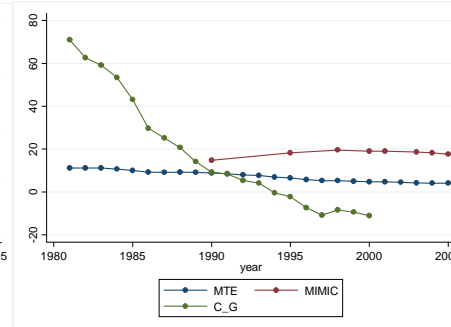
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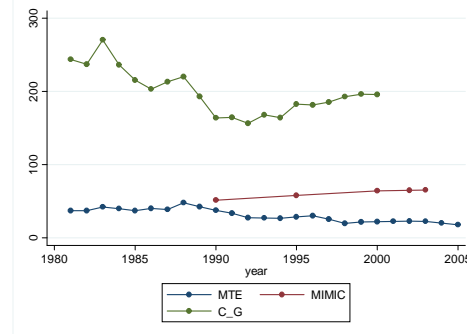
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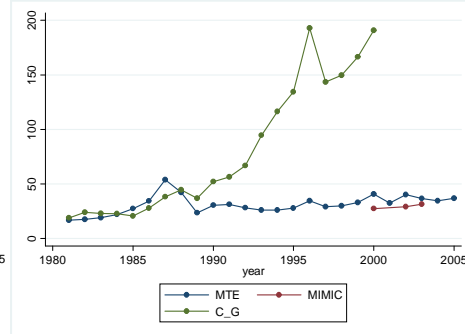
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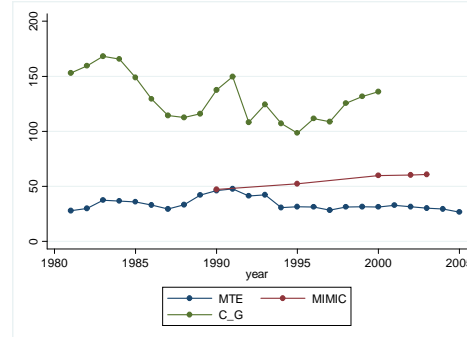
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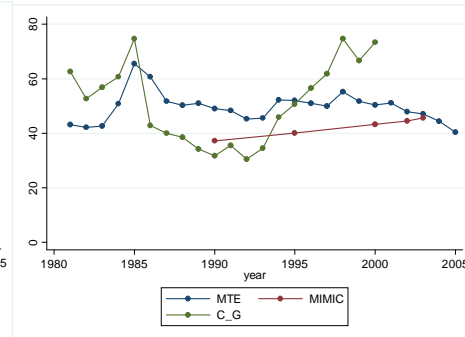
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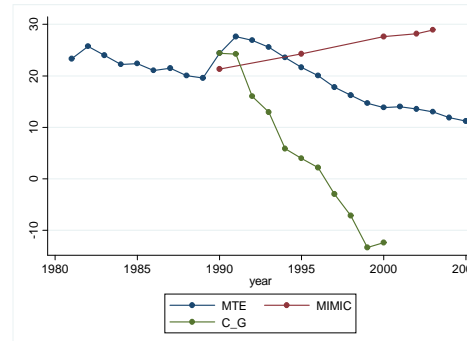
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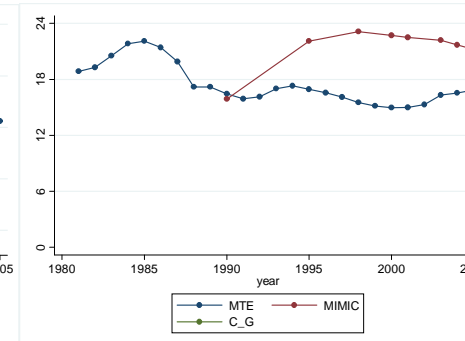
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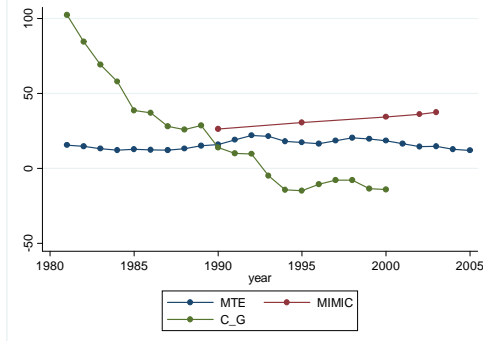
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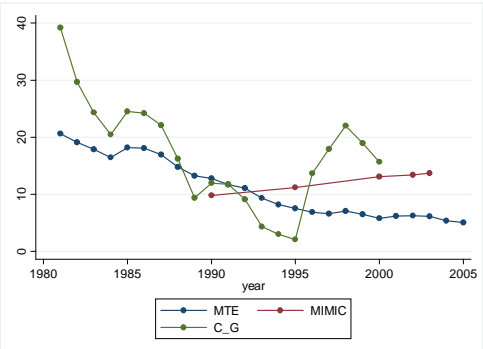
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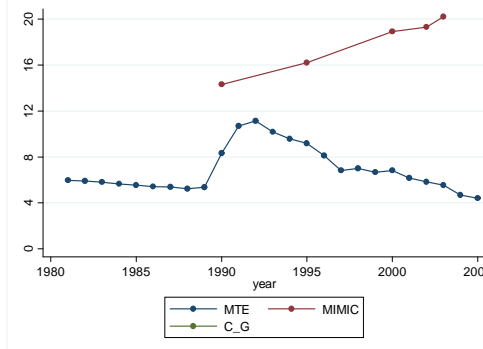
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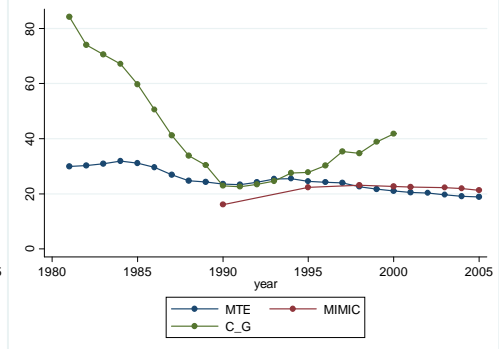
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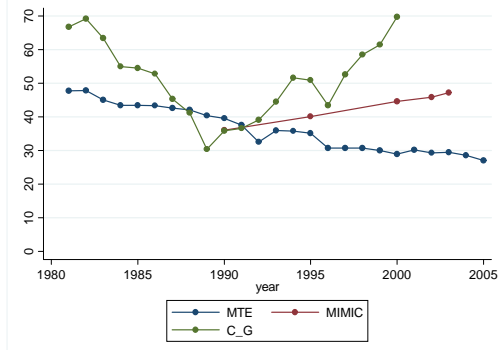
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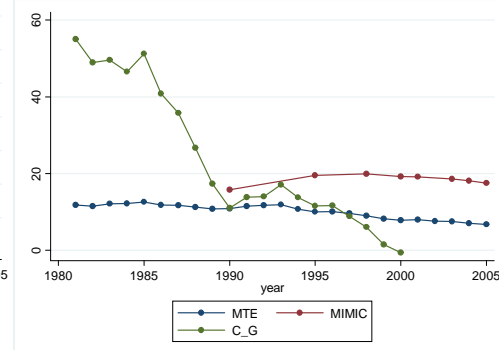
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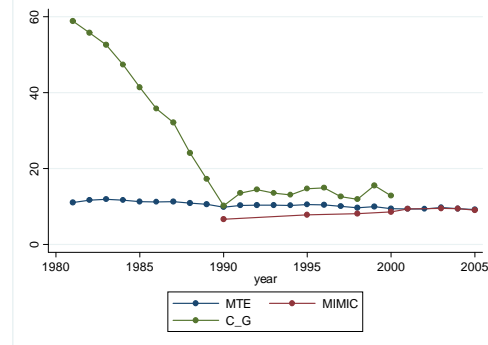
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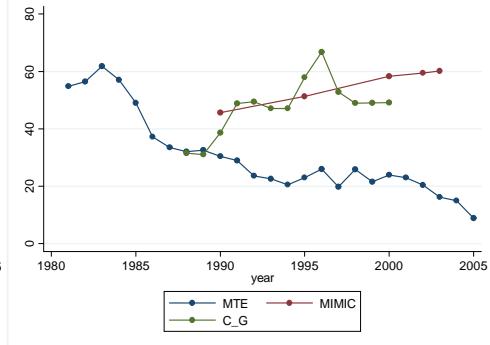
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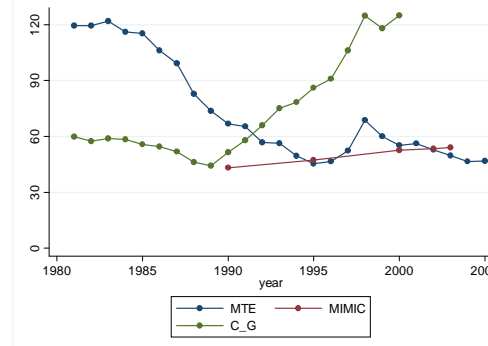
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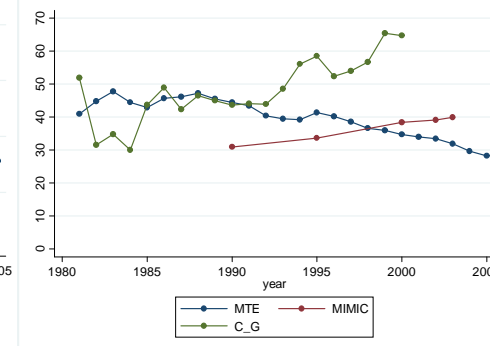
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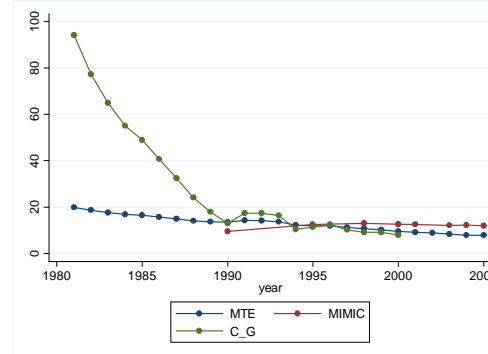
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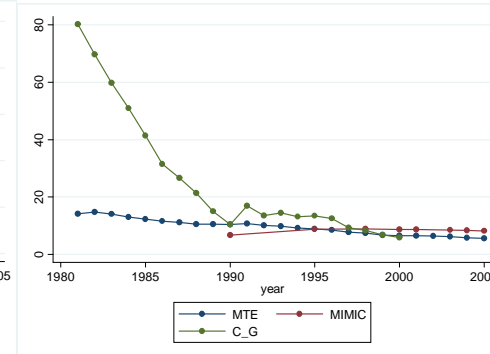
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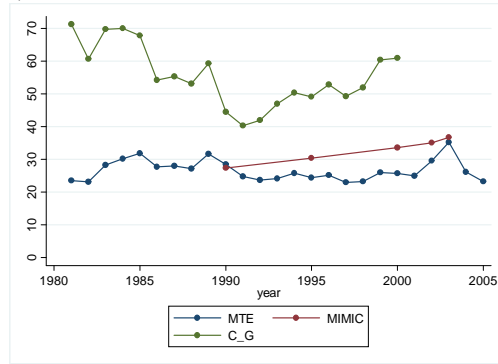
United Kingdom



USA



Venezuela



Source: MTE=own calculations; MIMIC= Schneider (2004, 2005); C-G= Chong and Gradstein (2007)

8 Appendix IV- Interpreting dynamics of the shadow economy: some anecdotal evidence

Growth-enhancing reforms in developing countries

In *Botswana* the decrease in the share of unobserved economy during the 1980s may be related to the phase of impressive economic growth started after independence from Britain in 1966. Botswana's economic performance has been built on a foundation of diamond mining, prudent fiscal policies, international financial and technical assistance, and a cautious foreign policy. In particular, it has been noted that good economic policies were chosen in Botswana because good institutions were in place (Acemoglu, Johnson and Robinson, 2002). Analogously, the *Egyptian* unrecorded income strongly decreased during the 1980s. Also this reduction may be related to a phase of particularly high economic growth, following the implementation of a policy regime (*Open Door Policy*) which allowed for a greater role of the private sector and for partial liberalization of the trade sector and of the exchange rate regime. (Dobronogov and Iqbal, 2005). In *Malaysia*, the decade 1985-1995 was characterized by a significant reduction of the unobserved economy and, at the same time, by a rapid economic growth. The Malaysian economic performance was strongly influenced by a series of policies directed to revive economic growth through investment. The reforms from the mid-1980s also involved a process of economic stabilization, privatization, restructuring of state-owned enterprises and, in the area of labor market, the creation of new jobs was emphasized. In particular, these policies focused on trade and financial liberalization, market opening, promotion of small and medium enterprises, antitrust legislation, greater opening to foreign investment, and structural changes toward the development of more technology based industries (Smith, 2000; Harvie-Pahlavani, 2006).

Transition countries

The unobserved economic activity has surged immediately after the collapse of communism in 1989. The unrecorded income has then begun to decrease mainly thanks to market-oriented reforms, based on privatization and price- and trade-liberalization measures, that were undertaken during the 1990s (Havrylyshyn and Wolf, 1999). In particular, in Poland, the reduction in the relative size of unobserved economy may be related to the reforms that removed price controls, eliminated most industry subsidies, opened markets to international competition. Similarly, in Hungary the reduction in the relative size of unobserved sector may be associated to the positive effects of price and trade liberalization, tax- and banking-system reforms, introduced by the government in 1990. In Romania, the recovery was stimulated by government policies based on privatization and trade liberalization. Moreover, Romania signed an association agreement with the EU in 1992 and a free trade agreement with the European Free Trade Association (EFTA) in 1993, codifying its access to European markets and creating the basic framework for further economic integration. In the Czech and Slovak Republics the decrease in the relative size of unobserved sector may be explained by the economic reform process- based on privatization,

price liberalization and trade openness- that begun immediately after the Velvet Revolution in 1989. Finally, in Bulgaria, reforms were introduced in 1997.

OECD economies

Finally, among the highly industrialized OECD countries, the unrecorded income has rapidly decreased in Ireland in the second half of the 1980s. This reduction may be related to a series of national economic programmes (*Tallaght Strategy*)- started by the government in 1987- designed to contain inflation, ease tax burdens, reduce government spending, increase labour force skills, and reward foreign investment. This strategy transformed the Irish economy, that began the so called *Celtic Tiger* phase, characterized by an unprecedented economic growth (Powell, 2003). Also in Spain, the unobserved income started to decrease in the second half of 1980s. This reduction may be attributed to social and economic policies- introduced in 1985- directed to reduce labor market rigidities and increase employment. Other two labor market reforms were introduced in 1994 and 1997, respectively. These reforms are considered the main causes of the significant increase in the Spanish employment level during the last two decades (Ferreiro and Serrano, 2001; Gil Martin, 2002).