

We sincerely thank the reviewer for revising our manuscript carefully. We are especially grateful for the constructive comments and suggestions, which helped improving our research. Below, we have tried to respond to each comment. Reviewer's original comments are listed (in bold) followed by our response (in italics).

Major Comments

-The overall effect of democracy on growth (which is the aim of the paper), including that mediated by FDI and PCE, remains unidentified. It would have been interesting to see this general relationship and some type of clearly defined mediation analysis for the channels under study.

RESPONSE: Structural equation modeling provides a suitable framework for mediation analyses. Please note, however, that the concept of structural equation modeling, often used in assessing unobservable 'latent' factors, should not be confused with the related concept of simultaneous equations models, typically used in economics.

Unfortunately, there is no technology yet for dealing with mediation analysis in the context of dynamic panel simultaneous equation using the Arellano and Bond estimator. The simultaneous equation model as such is able to disentangle the direct and indirect relationship between democracy and growth without resorting to mediation analysis.

Despite this, to address this comment, we performed the bootstrapped mediation test of Preacher and Hayes (2004). This method is commonly accepted in literature. The obtained results provide some evidence that the effect of democracy on growth is mediated by fdi and govsp. However, this test must be interpreted with caution as it is not relevant for the case of several mediators. Furthermore, to the best of our knowledge, there is no available mediation method that takes into account the endogeneity of mediators.

-As noted above, there are at least major questions on the correct specification of the model. The authors claim to apply a simultaneous equation model, but do not comment on the methods used, such that I got the impression that each equation is simply estimated on its own. Within each equation, the authors apply an Arellano-Bond estimator. For this, however, the equations given beforehand seem misspecified.

RESPONSE: Indeed, we estimated the equations one by one. We will explain later the reasons for this choice. Obviously, estimation techniques¹ do not change the nature of the model (simultaneous equations).

The main econometric problem that may rise when estimating a dynamic panel simultaneous equations model is that of endogeneity associated to reverse causality / simultaneity bias.

¹ System estimation or equation-by-equation estimation

Democracy may be thought to have an effect on growth, but at the same time, economic growth may influence the path of democracy. Statistically, endogeneity implies a violation of the non-correlation assumption between the error term and the explanatory variables, which introduces a bias in the traditional panel model estimators (OLS, Fixed Effect).

The problem of endogeneity also arises from the presence of the lagged value of the endogenous variable among the explanatory variables (dynamic specification). In the presence of such a problem, estimating our model by traditional econometric methods, such as the Ordinary Least Squares (OLS) estimator or the Within (Fixed Effect) estimator, gives biased estimates.

Widely used approaches to treat endogeneity usually start with searching for variables (instruments) that are highly correlated with potentially endogenous variables and uncorrelated with the error term. Traditional estimators of simultaneous equation model, such as the (2sls) estimator or (3sls)² estimator, use all the strictly exogenous variables of the model as instruments, whereas only model-dependent variables are treated as endogenous. For example, if we take our model, the traditional estimators (2sls, 3sls ...)³ consider that only the variables (growth, fdi, democracy, govsp) are endogenous, but all the others are strictly exogenous (uncorrelated with the term of error) and used as instruments. In this context, these traditional estimators do not account for the endogeneity of trade in the growth equation.

To fill this gap, we apply the Generalized Moment Method (GMM) that enables a richer set of instruments compared to standard approaches, thereby generating instruments from the lags of endogenous variables. This mitigates the limits of traditional estimators, which generally suffer from weak instruments bias, because it is not easy to find theoretical variables (strictly exogenous explanatory variables of the model) that are correlated with the endogenous variable and uncorrelated with the error term.

In fact, there are several approaches for testing weak instruments. Firstly, we tested the relevance of instruments by examining the fit of the first stage regression⁴. If the explanatory power of instruments in the first stage regression is insignificant, the bias of the instrumental estimator is the same as that of traditional estimators (OLS, Fixed effect) (Hahn and Hausman 2002). Based on the partial R^2 statistic proposed by Shea (1997), we can conclude that the strictly exogenous variables of the model are irrelevant instruments.

Secondly, we run the formal test of weak instruments proposed by Stock and Yogo (2005), which yields the same results confirming the weak instruments problem. The estimation bias

² This full-information estimation method takes into account the correlation between the residuals of the different equations and makes it possible to estimate all the equations simultaneously.

³ One has to decide whether to estimate the system in an equation-by-equation (two-stage least squares, 2SLS) or simultaneous manner (three-stage least squares, 3SLS).

⁴ the first stage regression are reduced form regression of the endogenous regressors on the full set of instruments

of the traditional estimators resulting from the use of weak instruments can be very important, exceeding sometimes the bias of OLS.

In view of the above, we definitely opt to use GMM estimator as an alternative to traditional estimators of simultaneous equation models (2SLS, 3SLS...).

The GMM estimator can correct the potential endogeneity of all the right hand side variables. In this way, this method makes it possible to go beyond the limit of the traditional techniques of the instrumental variables that correct only the endogeneity of the dependent variables introduced in the model as explanatory variables.

Concerning the question of the specification of the model, it should be noted here that the F-stat, Hansen and AR (2) tests indicate that the model is globally well specified for all equations.

Also, it should be noted that the econometric literature concerning the performance of estimators in the context of a dynamic panel simultaneous equations is very limited⁵. To the best of our knowledge, Mitze (2012), is the only author who has made a comparison of the properties of different dynamic simultaneous equations estimators⁶ through Monte Carlo simulation.

Mitze (2012), concludes that, in the presence of a high persistence in the autoregressive parameter of the endogenous variables as well as a small N and T settings, dynamic GMM estimator performs best. This estimator generally also ranks best in terms of efficiency (measured by means of the root mean square error). It may thus be seen as a good choice for empirical applications, when right hand side endogeneity and simultaneity matter.

In the case of dynamic panel data estimators, instrumentation is a serious problem. Finding suitable instruments for the lagged regressors of the set of endogenous variables is not an easy task as well as the dynamic term is correlated with the error term. Given this additional estimation problem, the application of dynamic simultaneous equations estimators greatly benefits from recent advances in the single equation dynamic panel data estimation techniques.

-Equations 2-4 contain the lagged variables of the dependent variable, while the central equation 1 does not. In order to trust the results, it would be indispensable to see the equations which are finally estimated, and to learn about how the simultaneous equation structure is exploited. Without this, the interpretation of the results cannot be evaluated.

⁵ Theoretical and empirical contributions to static Simultaneous equations estimation with panel data and full information estimators include, for instance, Baltagi (1980, 1981), and Baltagi and Chang (2000),

⁶ Including different full and limited information estimators.

***RESPONSE:** The estimating equation that will be used is based on a standard neoclassical growth model that relates real growth of per capita GDP to the initial level of income per capita, investment-to-GDP ratio (a proxy for physical capital in a standard neoclassical production function) and population growth.*

*In **dynamic** framework, the growth equation can be written as follow:*

$$y_{it} = \alpha + \beta y_{it-1} + \delta X_{it} + \eta_i + \varepsilon_{it} \quad (1)$$

Where y_{it} is the logarithm of per capita GDP of country i at time t , X_{it} is a set of control variables including investment-to-GDP ratio and population growth, η_i captures the effects of the country i that are time invariant, ε_{it} is the error term.

The equation (1) is equivalent to:

$$\Delta y = y_{it} - y_{it-1} = \alpha + (\beta - 1)y_{it-1} + \delta X_{it} + \eta_i + \varepsilon_{it}$$

Δy is the GDP growth rate calculated as log difference, y_{it-1} is the log of lagged income, that should capture the conditional convergence of income across countries.

The main idea regarding the income convergence effect is based on the neoclassical growth model developed by Solow (1956) who predicts that both poor and rich countries will converge to the same levels of per capita income in the steady state but poor countries with lower initial GDP will grow relatively faster than the rich countries. If country heterogeneity is allowed in variables such as the investment ratio, population, or other policy variables, then this type of convergence is said to be ‘conditional β convergence’. This convergence effect holds if the coefficient of the initial per capita income is negatively related with the growth rate. $(\beta - 1)$ is the rate of convergence⁷ in the augmented Solow Model.

Minor Comments

- In line with the comment on the mediated effects, it would have been nice to have the economic significance of the effects of at least democracy on FDI/PCE on growth discussed.

***RESPONSE:** Please see the answers provided in major comments.*

⁷ For a survey on the “convergence literature,” see Barro and Sala-i-Martin (1992), Mankiw et al. (1992), and Quah (1996).

- In the discussion of the literature, some findings mentioned are contrary to each other (e.g. on the effect of democracy on physical capital accumulation, p. 3). A short discussion where these differences might come from would help to put the findings in perspective. This equally holds for the discussion of the own results where they do not coincide with previous findings.

RESPONSE: In the literature review, we have exposed the different findings that have been reported by several previous studies. Researchers have shown that the ambiguous effect of democracy on economic growth (the non-significative relationship between democracy and economic growth) could be explained by the fact that democracy may affect economic growth through different channels, some of these channels have a positive impact on economic growth, while others show a negative influence.

For the physical capital accumulation channel (not only this channel but also for the other channels), we should notice that contrary findings have been pointed out. Some studies have advocated that democracy may affect negatively physical capital accumulation as it is associated with relatively low savings rate. This is mainly due to the increasing popular demands for more equal distribution of income and wealth, which may induce higher public spending and taxation (Acemoglu and Robinson, 2000, 2006; Boix, 2003; Acemoglu et al., 2013). In other words, to satisfy redistribution demands, the government penalizes the richest by raising taxes on their incomes in order to benefit the poorest of social transfers. As a result, the savings of the richest would be reduced in favor of an increase in the incomes of the poorest, which may therefore slow investment in physical capital and increase public and private consumption.

However, some other studies have shown that democracy may enhance physical capital accumulation as it fosters economic freedom, insures a better protection of property rights and a better control of corruption and, thereby provides a more attractive institutional environment for investment in general and FDI in particular (Harms and Ursprung, 2002; Jakobsen, 2006; Busse and Hefeker, 2007).

PS. To address this comment, we revised the literature review.

- Some formulations put forward facts or interpretations that are likely to not be uncontested, such as the interpretation of the background of the Arab Spring in Footnote 1 or the claim that the US invasion in Iraq was motivated by the desire to establish democracy in the Middle East. These should either be substantiated by literature or formulated more cautiously.

RESPONSE: In response to this comment, we provided a graph that captures the evolution of democracy in the Arab world to show how the democracy index has evolved during the last decades. The graph shows that the democracy index has improved during the period 2001-2005 (after the events of 11 September 2001). Some references are added as well.

- Abbreviations, such as GCC (Gulf Cooperation Council), should be introduced.

RESPONSE: Provided as requested.

- It would be better to stick to one language, even if lines in tables are also understood in French (“Nombre de Pays”)

RESPONSE: We apologize for the mistakes. We have improved the language of the paper.

- It would have been interesting to see descriptive statistics along different dimensions, rather than only the summary statistics of the pooled sample, most notably the *within* variation in the democracy variable (or a graph with the development of the democracy variable by country), or how far average growth rates differ between the countries in the period under study. This also relates to that while the paper is motivated by wanting to analyze the economic effect of the Arab Spring, the Arab Spring can be dated back only to 2010 the earliest, so that the sample, ending in 2013, could capture only very short-term effects of the alleged democratization movements.

RESPONSE: We agree about the fact that identifying the effect of the Arab spring only two or three years after its emergence is insufficient, but it is important to mention that the Arab countries have known some changes in their democracy index namely after the events of 11 September 2001. As mentioned above, we provided a graph that captures the evolution of the democracy index in the Arab countries during the period 1990-2013.

- Since the robustness tests section consists of replacing one measure of democracy by another, where most qualitative results stay the same, a footnote with reference to the appendix, replacing the entire section, would be sufficient.

RESPONSE: Provided as requested.

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