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Macroeconomic Implications of Remittances In MENA And Mediterranean Countries

Claude Berthomieu
University of Nice Sophia-Antipolis

Anna Tykhonenko
University of Nice Sophia-Antipolis

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Claude BERTHOMIEU[1]; Anna TYKHONENKO[2]

Abstract : The aim of this paper is to examine the macroeconomic implications of remittances in MENA and Mediterranean countries. After a brief review of theoretical and empirical literature devoted to macroeconomic performance of remittances, we select the arguments that can be applied to this region and try to identify a significant relationship between remittances and per capita growth in these countries. The Iterative Bayesian procedure allows us to calculate the rates of convergence for each MENA country (without taking into account the remittances flows). Our results show that only 6 countries out of 13 appear to have a positive impact of remittances on growth.

Classification JEL : N15, O40, J61, F43, C23, C11, F32

Key words : remittances, MENA, speed of convergence, panel data, Bayesian shrinkage estimator, endogenous growth.

INTRODUCTION.

In the global economy, nowadays, remittances represent one of the largest international flows of financial resources. Notably, remittance flows can exceed, sometimes, foreign direct investment, portfolio flows from financial markets and official development assistance or international aid. It is the case in many MENA Region or Mediterranean countries, where they should be expected to have significant macroeconomic effects on these economies.

A lot of recent studies has been published on these questions, particularly in the case of some emerging countries from Latin America or Eastern and South-Eastern Asia, but concerning the MENA Region or Mediterranean countries, "exporting" yet a lot of migrant workers, there is a very weak interest in the literacy for studying, on one hand, the importance of this phenomenon and, on the other hand, its relationship with economic growth in these labour-exporting economies receiving these remittances[3]. The aim of this paper is then to briefly review the theoretical as well empirical literature devoted to remittances, in order, first, to select the arguments that can be applied to this region and, second, to identify empirically if there are significant relationships between remittances and growth in these countries.

Then, the paper will be organized into the following three Sections. **Section 1** will be devoted to a summing up on the theoretical analysis as well some empirical findings on the impact of remittances on long-term economic growth because, from a theoretical point of view, there are different kinds of mechanisms through which some positive as well negative effects can be brought about by remittances. This survey will also show that the MENA and Mediterranean region are rather poor in terms of investigations on remittances, even if there are many migrant workers from these countries in Western Europe as well in many other industrialized or emerging countries.

Section 2 overviews the empirical studies that have tested the beta-convergence hypothesis. We also present the limits of some cross-section approaches of growth model in comparison with panel data studies. Moreover, a strong heterogeneity in the MENA and Mediterranean region leads us to select the Bayesian iterative method for the panel data in order to estimate the catching-up rates in

[1] Université de Nice-Sophia-Antipolis, CEMAFI, [berthomi@unice.fr]
[2] Université de Nice-Sophia-Antipolis, CEMAFI, [tikhonen@unice.fr]
[3] Except SETTIMO (2006) and AGENOR and alii, (2007).

the Remittance-Growth (or development) relationship(s). Finally, the data, the models to estimate and some empirical results are presented in **Section 3**. In this section, the countries of the MENA and Mediterranean region were selected in function of their size of remittances flows (sufficiently important relative to the size of their economies and of the other flows of above mentioned financial resources). This section also concludes on the effects of remittances, in the MENA and Mediterranean region, on the growth and the speed of the catching up process of the selected countries.

Section 1. The Macroeconomic Impacts of Remittances on the Home Countries of the Emigrated Workers: a brief survey on some theoretical and empirical studies.

In a recent paper of the IMF, Chami and alii (2008) analyse, from a theoretical point of view and also while referring to a great number of empirical work, the macroeconomic consequences of the remittances; it comes out from this very complete study that the effects in the macro-economic plan of these surges of capital in the countries in the process of development from where migrant worker comecome, are far from being always positive and systematically carrying economic growth. It is necessary, indeed, to distinguish the positive aspects and the negative aspects from the consequences of these transfers.

1.1. The positive effects of remittances in terms of economic growth and development.

The transmission channels via which the funds of remittances of the emigrated workers can have positive effects on the growth of their home country, are at least of three types:

1.1.1. The transmitted funds can feed the productive investment, and that in two manners: first, if these funds are deposited in banks or in local institutions of savings, by increasing the financial resources of these institutions for granting the credit to the companies or for short or long term loans granted by non banking financial institutions to companies or households; second when the families of the emigrated workers encounter difficulties of credit rationing, the remittances enable them to circumvent these difficulties and are able to finance their needs for consumption or their capital expenditures. Of course, in order this effect takes place, it is necessary that the families which receive these funds, be incited to do that.

Let us briefly develop these different arguments:

(i) At the macroeconomic level, in particular, the increase in the total capacity of financing of the investments that brings this saving coming from abroad, plays a pro-cyclic role if the migrant workers abroad trust the local economic situation and if the financial system of the country encourages them to invest. But one could also observe that remittances, for certain countries and in certain circumstances, play a counter-cyclic role: it is the case if, when the country of origin of the migrant workers is a poor country which knows a period of economic crisis, these workers send more remittances to help their families to overcome these difficulties more easily. Studies like Bobeva's (2005) or Chami et alii's (2003) ones analyse different aspects of this question to turn remittances into investment or to verify if remittance flows are an actual source of physical capital improvement. And the answer to this question is not always positive (cf. Chami et alii, 2003).

(ii) The remittances can then have a sometimes pro-cyclic effect, sometimes counter-cyclic. It is what a recent study of Sayan (2006) shows, which wonders about the way in which the migrant workers answer the cyclic movements of the GDP in their home country. For this author, who develops an at the same time theoretical and empirical analysis on the evolution of flows of remittances in twelve developing countries (among which only two are located in the area which interests us in this paper) [4] over the period 1976-2003, and on their business cycle characteristics, the remittances receipts follow a complex temporal dynamics, either pro-cyclic, or counter-cyclic, which must encourage with prudence in the analysis of their implications according to the considered country's economic

[4] Morocco and Turkey.

situation. Vargas-Silva, in his PhD thesis (2006), studies also empirically, among a lot of other questions, the business cycle characteristics of remittances and he concludes that, if remittances are counter-cyclical, then the receiving countries can use them to offset negative cyclical fluctuations in output and, on the other hand, that, if remittances are procyclical, then they cannot offset these cyclical fluctuations. However, he concludes finally that his results suggest that remittances are globally countercyclical.

(iii) If there are difficulties for the poor families of obtaining bank credit, the receipts of remittances can resolve these difficulties as shown in the study related to the remittances entering to Bangladesh of Azad (2005), who found that these funds are a source of financing for micro-enterprises; and in countries where informal (or "grid") finance is very significant, these financial resources can play a significant role on a macro-economic point of view. This remark leads us to the following considerations concerning the financial system of the home countries of the migrant workers.

1.1.2. The remittances can also contribute to develop the financing capacities of the financial system, in the home economy, in particular in its banking component; and we know, as it has been shown in numerous endogenous growth models, that the enhancing of the financial system in developing or emerging countries is an important factor of growth. Thus, between the US and Mexico, the importance of flows of remittances encourages the banks to intervene in the routing of these flows, which is also desirable from the point of view of the State, as the study of Taparia (2005) shows; it is also known that, in the case of several countries like Morocco, the surge of the remittances involves a surliquidity of the banks, a characteristic which can be regarded as favourable if the banks use these funds to lend more easily credits to small and medium-sized enterprises; however, it is not always the case, banks preferring to buy Treasury bonds in spite of financing small private companies.

This effect is thus more or less pronounced according to the degree of financial development already reached in the country. In particular, Bugamelli and Paterno (2006) underline that remittances can have a beneficial effect if they reduce the probability that foreign investors suddenly flee out of emerging markets or developing economies; they consider that there is a threshold effect of remittances: if remittances are over three percent of GDP, they can be considered as cheap inflows of foreign currencies which gives guarantees to the foreign investors present in the country[5].

1.1.3. Another important role of remittances is their contribution to fight positively against poverty as many studies show, like Adams' (2005) or Ekens' (2005) ones, and they are also favourable to the economic development when part of these funds contributes, in the families of the emigrated workers, to support the building of "human capital" while allowing to pay expenditure for education and training for the young people living in these families. Thus, one could note, in certain countries, that remittances can actually contribute to the accumulation of human capital, and then to the growth of total factor productivity of the local economy (Chami and alii, 2008).

However, besides these positive aspects of the links between remittances and growth, one can find, in the appropriate literature, a rather great number of theoretical analysis and empirical studies which describe the negative aspects of the remittances for the home countries of the migrant workers as we shall explain it now.

1.2. The negative impacts of remittances on growth.

In the literacy on remittances, one finds a number of theoretical as well empirical papers in which the impacts of the remittances on the macroeconomic performance of the recipient countries are estimated to be rather negative. Among the empirical studies above mentioned, the majority of them concerns migrants' countries located outside of MENA or Mediterranean region, but the same negative impacts should certainly be observed in this area also.

[5] but this threshold of 3% seems rather high!

These negative effects can be gathered and analysed around three analytical topics: first, the mechanical monetary consequences of the entry of foreign currencies in a low developed country open to the movements of capital (through their effects on the exchange rate of the local currency and on the domestic price level); second, the uses of these incomes either within the family of the migrant worker (ostentatious consumption expenditure), or by the worker himself who chooses to spend his savings through land acquisitions or real estate investment; finally, the effect of the remittances can be also negative in terms of incentives to not-work (or to less work) among the members of the family remained in home country or to encourage them (and also some neighbours) for a new wave of emigration. Let us look further into the analysis of these three types of risks to specify why these consequences are considered as unfavourable from a macro-economic point of view.

1.2.1. The natural consequences of the remittances flows on the exchange rate of the local currency and on the domestic price level is a rise of both, the exchange rate being defined as the price in terms of the local currency, of the foreign currencies of the countries where live the migrant workers (for each entry of foreign currencies rises normally the central bank reserves, rise which obliges the bank to issue new local hot money entailing mechanically inflation). Therefore, the real exchange rate (ReR), defined by the expression $\{ReR = \boldsymbol{e}.\ (\mathbf{P_n}/\mathbf{P_f})\}$ (in which $\boldsymbol{e}$ is the nominal exchange rate, above defined, and $\mathbf{P_n}$ and $\mathbf{P_f}$ indicate respectively the local and the foreign level of prices)[6], increases and then the commercial competition capacity of the country drops.

Many authors consider that this increase of the real exchange rate produce a so-called "*Dutch Disease Effect"* in the local country : in the case of Mexico, see the PhD thesis from Vargas-Silva (2006) and for Cape Verde, see Bourdet and Falck (2006). However to conclude in favour of a "*Dutch Disease Effect"*, it is necessary to remind that such an effect is only possible if the country receiving remittances (and suffering a rise of its real exchange rate) is a country already industrialised at a certain level and exporting some manufactured commodities (the negative effect of the resources movements analysed, three decade ago, by Corden and Neary (1982), and observed on that time, in United Kingdom or in Netherlands matters only if the initial situation of the productive system of the country is of this type, that is already enough industrialised). Otherwise, the country has to be a country exporting some commodities or services whose cost of production and selling prices will increase due to the entry of remittances.

Besides these negative effects on growth observed from the point of view of the *global demand side*, some authors, working *on the supply side* possibilities for remittances to boost local investment, have shown that these financial transfers play not the same role in economic development or growth as foreign investment or other capital flows; thus, Chami, Fullenkamp and Jahjah (2005), testing the correlation between remittances and GDP growth with a model using a panel data set on remittances, find a robust negative correlation between both variables: "This indicates, say the authors, that remittances may not be intended to serve as a source of capital for economic development"[7]. In a neighbourly way, Schiopu and Siegfried (2006), studying the determinants of workers' remittances from the European neighbouring region[8], show that the interest rates in the migrants countries are insignificant for explaining remittances, evidence suggesting a weak investment motive among immigrated. We would like also to mention a result attributed to Glytsos (2005) who shows, through a dynamic approach and an empirical analysis, that economies are weakly sheltered against the damaging impact of falling remittances (a negative effect from the point of view of the demand side) but that remittances could be reshuffled towards imports of investment goods (which would have a positive effect, as far as the supply side is concern).

The above arguments on the negative effects of remittances rest on the usual macroeconomic keynesian or neoclassical approaches, taking remittances as a factor affecting growth mechanically through their action on the demand or supply side. However, some other studies show that the remittance behaviour of migrants, considered from a microeconomic point of view, can also be responsive to negative effects on macroeconomics variables.

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[6] Definition similar to S. Edwards'(1989) or El Badawi's (1994) ones.

[7] Abstract from authors.

[8] using a panel data set of bilateral flows from 21 Western European to 7 EU neighbouring countries

1.2.2. The remittances, in some recipient countries or families, can incite members of the family who profit from these incomes, living in the country of migrants' origin, to be satisfied to live with this "manna falling from heaven" (in fact "from abroad") without working or by withdrawing from the local labour market; one observes also scenarios in which these recipients use remittances while launching themselves in ostentatious consumptions or of luxury goods (often imported from abroad); also, certain expenditure in projects not very relevant or in badly studied investments can lead to the wasting of these funds.

The impact of workers' remittances may have also a negative impact on the local income distribution inequality as shown in Adams' and Richard's (1989) paper and these inequalities among families with or without emigrate members abroad, lead to two types of further inequalities and negative incentives. An historical study, entitled "Southern Cross", {The Economist (2005)}, describes how the flow to Italy of remittances from Italian emigrants in the late 19th and early 20th centuries "removes some of the brightest and more energetic workers and does nothing to create a dynamic economy at home". Nowadays the same story happens: Van Dalen, Groenewald and Fokkema (2005) in an empirical study for Egypt, Turkey and Morocco, show also that the receipt of remittances in the home country of emigrants has an attractive effect on emigration intentions of household members living home; this trigger-effect is a truly negative effect in terms of labour force disposal for economic development in the home country. This contribution of the receipt of remittances to new flows of migration seems to be particularly high in Morocco.

1.2.3. Land and housing property being, in many developing countries, the privilege of a nascent "*petite bourgeoisie"* compared to the destitute masses, in many countries migrants' remittances go up to this kind of unproductive uses, which fetch huge prices in these specific spheres; and, from a macroeconomic point of view, this kind of expenses act for another set of negative effects of remittances because these funds coming from abroad are sterilized in unproductive uses leading only to price inflation and, possibly, to possible speculative bubbles. This kind of unproductive investment is obviously the case in Tunisia as well in Morocco, but the amounts of money spent through these speculative uses are hard to be known, due to fact that an important part of remittances utilized in that way, are transferred from abroad to the migrants' home countries through non official money circuits.

The different positive or negative effects of remittances on macroeconomic performance analyzed above showed that these specific financial funds, contrary to FDI and portfolio inflows, do not insure economic growth. In the following sections (2 and 3), we shall study the contribution (of remittances) to the global process of convergence among a set of MENA and Mediterranean countries, for which, till now, no such a global study has been done.

Section 2. Empirical Studies of Growth.

The concept of beta-convergence is issued from the neo-classical growth models (Solow R., 1956 ; Swan T., 1956 ; Cass D., 1965 ; Koopmans T., 1965). According to the conclusions of these models, in the long run, the economies will grow at the same per capita income exogenous rate, equal to the rate of technical progress. But, in the short run, there is a catching-up process: the initially poor economies have a tendency to grow faster than the rich ones in terms of per capita variables. The idea of the catching-up suggested by the neo-classical authors is the subject of analysis for many empirical studies as well in "cross-section" as in panel data.

2.1 Cross-section approach.

According to the β - absolute convergence hypothesis, the initially poor economies tend to grow faster than the rich ones. In "cross-section" approach, this hypothesis is generally accepted for one period [0 ; T], if, by regressing the average growth rate of a group of countries $i=1,\ldots,N$ on the logarithmic expression of the initial value of the GDP per capita, the coefficient on the initial GDP per capita is significantly negative :

$$\log(y_{iT}/y_{i0})=a-(1-e^{-\beta T})\log(y_{i0})+u_t \qquad (1)$$

If the parameter β (translating the rate of convergence) is positive[9], then, whatever the per capita income gap between the economies, in the long run, all the economies will converge towards the same level of per capita income. Generally, the empirical studies show that, for rather wide samples of countries, the coefficient on the initial GDP per capita is not significantly negative. Thus, the absolute β - convergence is not checked on a worldwide scale. This result led many authors to focus on a more flexible form of convergence, the conditional one. According to the β - conditional convergence hypothesis, it's checked if, after introducing the "control variables" for the heterogeneity in the long term growth trajectories, the per capita growth rate is negatively and significantly correlated with initial level of GDP per capita. These "control variables" represent the criteria having to be filled for emergence of the catching-up process. The conditional convergence hypothesis is thus less restrictive than the absolute one, since the economies will not converge between them if the determinants of their long-term behavior differ.

According to the authors, the "control variables" were searched among the indicators of the initial level of the investment (De Long J.B. and Summers L., 1991 ; Levine R. and Renelt D., 1992 ; Mankiw N. and *alii*, 1992), of the human capital (Barro R., 1991; Barro R.J. and Lee J.-W., 1993 ; Benhabib J. and Spiegel M., 1994 ; Berthélemy J.-C. and Varoudakis A., 1995, 1997), of the financial development (King R.G. and Levine R., 1993, Berthélemy J.-C. and Varoudakis A., 1994, 1995, 1998), etc. The objective of the empirical studies on conditional convergence is to evaluate the effect of these variables on economic growth and to determine how they let to control the heterogeneity of the long term paths of growth.

However, the "cross-section" approach of real convergence represents at least two disadvantages. The first one is related to an insufficient exploitation of information : the GDP per capita data taken into account are those relating to the initial period, *0*, and the final period, *T*. The statistics relating to transitory catching-up period during which the per capita income tends to the steady state, are ignored. The second disadvantage is to ignore the considered countries' heterogeneity. Indeed, the "cross-section" regressions provide information only on the average behavior in the sample. The implicit assumption being their homogeneity, the parameters estimated are constrained to be identical to all the countries. This constraint appears abusive because, wrongly imposed, it seems to bias the estimates of the rates of convergence to the steady state.

2.2 Panel Data Econometrics Contribution.

Consequently, more recent empirical studies of real convergence focus on the methods modeling the cross-countries' heterogeneity. In particular, panel data approaches let one estimate the heterogeneity in growth dynamics. Firstly, thanks to the time series, the β - convergence regression can be transformed into a dynamic model of the following type:

$$\log(y_{it}/y_{it-1})=a-(1-e^{-\beta})\log(y_{it-1})+\gamma x_{it-1}+\varepsilon_{it} \qquad (2)$$

where x_{it-1} are explanatory variables for countries' heterogeneity. Secondly, if, in cross-section, the estimated parameters are assumed to be equal for all the countries, in panel data, this constraint can be slackened. The empirical panel studies can be classified according to the degree of heterogeneity introduced into the β - convergence model's specification. Firstly, the fixed-effects models of convergence will be presented; secondly, those which introduce cross-sectional heterogeneity in the AR(1) term and, finally, in all parameters.

2.2.1 Fixed Effects Models.

These models are not radically different from the cross-section models: the growth model's specification is the same. In the analysis of panel data, this model is estimated with or without specific

[9] Barro R. and Salt-I-Martin X [1996] show that, for any positive beta, the coefficient on the initial GDP per capita has to be negative, which implies that the growth rate drops with the increase in the per capita income.

individual and/or time effects. The slope coefficients are assumed to be equal for all the countries: the rate of convergence is thus identically estimated for all the countries. The empirical studies of Knight, Loayza and Villanueva (1993), Islam (1995, 2000), Caselli, Esquivel and Lefort,(1996) or Berthélemy and Varoudakis (1998) are representative of this type of real convergence analysis. However, the homogeneity of the slope coefficients is often an unreasonable assumption, and one can allow for cross-sectional heterogeneity. The econometric issues related to the fixed effects models often used in the panel data studies have been discussed in Nerlove (1999), who shows that the use of fixed effects models biases the empirical results towards rapid convergence.

It is the more important insufficiency of this approach because, according to the theory of convergence, the parameter β (the rate of convergence of current per capita income $\tilde{y}$ towards its steady state level $\tilde{\tilde{y}}$) can take different values according to the distance for each economy from its *steady state*. Therefore, the value of β will tend to decrease when the economy will approach its *steady state* ($\tilde{y}/\tilde{\tilde{y}}=1$). Thus, the rate of convergence slows down with increasing per capita income (Barro and Sala-I-Martin, 1995). If the value of β is known, it is possible to calculate the catching-up period. Commonly called the half-life of the convergence process, this is the time period necessary to shrink half of the gap between the current state and the *steady state* position: $t=\frac{\log(2)}{\beta}$.

Consequently, the higher the value of β is, the more rapidly the economy will catch-up to its *steady state* position. When the speed of convergence slows down, the per capita income increases and the half-life is lengthened with time. If parameter β takes different values according to the distance from the *steady state* position, it is necessary to impose some structure on the slope coefficients. This is the purpose of the empirical studies presented below.

2.2.2 Models with variable AR(1) structure.

The first originality of these models is to introduce a complementary source of heterogeneity into the growth model's specification: the AR(1) parameters are not assumed to be equal across the countries. The estimated rates of convergence can thus vary from country to country. The second originality is to use the unit root tests either on the series of gaps between the per capita incomes of the pairs of countries (Quah, 1993 ; Greasley and Oxley, 1995 ; Bernard and Jones, 1996), or on the series of the gaps between the per capita incomes and its individual average in panel (Evans and Karras, 1996 ; Gaulier, Hurlin and Jean-Pierre, 1999). Im, Pesaran and Shin (1995, 1997, 2002) developed some unit root tests for the random-coefficient model. If the unit root hypothesis is accepted, the authors conclude on a real divergence either between the countries or compared to its average in the panel. On the other hand, if the unit root hypothesis is rejected, one can conclude there is a real convergence. However, Maddala (1999) stressed about the results' interpretation of the unit root tests in panel data. It is not because the unit root hypothesis is rejected for the whole of the countries that they are all converging towards the same *steady state*. Indeed, it is sufficient that some of them converge, and others not (the series contains a unit root), to reject the divergence hypothesis and to accept the convergence hypothesis. Sometimes, introducing of one atypical country in the sample with converging countries is sufficient to lead the analysis to reject the convergence hypothesis for the whole of the countries. In panel data, the unit root tests would thus be inappropriate to analyze the real convergence.

2.3 Towards more heterogeneity in model's specification?

Even if the unit root tests allow for more important cross-sectional heterogeneity, they don't take into account heterogeneity in the parameters of explanatory variables. Lee, Pesaran and Smith (1995, 1997) give some arguments for introducing more heterogeneity in the model's specification. They consider a dynamic growth model and propose to estimate it, firstly, by pooling and, secondly, separately for each country. Lee, Pesaran and Smith (1997) show that the rate of convergence estimator decreases when the sample is limited to economically rich countries. These empirical results

are conform to the theory which predicts the deceleration of the speed of convergence for the countries with increasing per capita income.

In the framework of this type of analysis, some authors focus on the specificities of heterogeneous panel estimations for dynamic models. Maddala, Li, Trost and Joutz (1997) argued that the Bayesian approach lets one reconcile the homogeneity of the slope coefficients and their complete heterogeneity. Note that the empirical study of Lee *et alii* (1997) is based successively on these two extreme assumptions: the model is initially estimated by pooling and then it is estimated separately for each country. The results issued from the first estimation method are valid only under the assumption of homogeneity in the slope coefficients. At the other extreme is the case of complete heterogeneity and separate estimation of cross-section coefficients.

As Maddala *et alii* (1997) stressed, the problem with the two usual estimation methods of either pooling the data, or obtaining separate estimates for each cross-section is that both are based on extreme assumptions. If the data are pooled, it is assumed that the parameters are all the same. Consequently, the parameters that characterize the catching-up process (per capita income value in a *steady state*, the technological trend and the rate of convergence) will be the same for all the countries in the sample. On the other hand, if separate estimates are obtained for each cross-section, it is assumed that the parameters are all different in each cross-section. They will be excessively dispersed and will, probably, posses the theoretically wrong signs. The implicit assumption is that the catching-up dynamics are completely different. This assumption does not seem to be reasonable.

According to Maddala *et alii* (1997), the truth probably lies somewhere in between. The parameters are not exactly the same, but there is some similarity between them. One way of allowing for the similarity is to assume that all the parameters come from a joint distribution with a common mean and a nonzero covariance matrix. The authors argued that the resulting parameter estimates will be a weighted average of the overall pooled estimate and the separate time series estimates based on each cross-section. Thus, each cross-section estimate is "shrunk" toward the overall pooled estimate (i.e. "shrinkage estimator"). According to Maddala *et alii* (1997), this estimator should to be preferred if the model contains lagged endogenous variables (as it is the case in the dynamic models) because it gives gave much more reasonable parameter values than the heterogeneous estimators.

Consequently, we propose to employ the Bayesian iterative procedure (presented in appendix) to estimate the rates of convergence (without and with the remittances effects on growth) for each country in the MENA and Mediterranean region.

Section 3. Panel Analysis.

The panel data analysis focuses on the sample of 13 MENA (Middle East & North Africa) and Mediterranean countries : Algeria (DZA), Egypt (EGY), Iran (IRN), Israel (ISR), Jordan (JOR), Lebanon (LBN), Malta (MLT), Morocco (MAR), Oman (OMN), Syrian Arab Republic (SYR), Tunisia (TUN), Turkey (TUR), Yemen (YEM). Four variables are observed over the period from 1990 to 2007 (source: World Development Indicators, The World Bank Group, 2007):

1) GDP per capita, PPP (constant 2005 international $) : GDP per capita based on purchasing power parity (PPP). PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates ;
2) Workers' remittances and compensation of employees, received (% of GDP) : they comprise current transfers by migrant workers and wages and salaries earned by non resident workers. Workers' remittances are classified as current private transfers from migrant workers who are residents;
3) Population growth (annual %): annual population growth rate. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship - except for refugees not permanently settled in the country of asylum.

3.1 Absolute Convergence Testing.

The test of absolute or unconditional convergence consists in identifying the correlation between the growth rate ($\log(y_{i,t}/y_{i,t-1})$) and the initial income per capita. Barro R. and Sala-I-Martin X. [1996] specified the model of absolute convergence (rewritten in dynamics for panel data) :

$$\log(y_{it}/y_{it-1}) = a - (1-e^{-\beta})\log y_{it-1} + \varepsilon_{it} \qquad (3)$$

with a indicating the constant term and $-(1-e^{-\beta})$ the slope coefficient. Note that if β has a positive value, the annual growth rate $\log(y_{i,t}/y_{i,t-1})$ is negatively correlated with $\log(y_{i,t-1})$. In this case, the poor economies tend to grow faster than the rich ones, which implies the absolute convergence. Table 1 contains the results of estimates: empirical iterative Bayes' estimators for rates of convergence and associated "half-life". The Bayesian shrinkage estimators for the model of absolute convergence (state by state) are given in the Table 2.

Table 1. Empirical Iterative Bayes' Estimators of the Rates of Convergence ($\hat{\beta}_i$).
Hypothesis : Absolute Convergence.

Beta-shrinkage country by country : Number of iterations 10				
Country	Half-life	Beta	StdErrors	T-Stat
DZA	19.4	**0.01555**	0.0047065	3.3053437
EGY	19.2	**0.01570**	0.0048499	3.2384173
IRN	22.3	**0.01349**	0.0046057	2.9289793
ISR	22.3	**0.01349**	0.0041199	3.2750552
JOR	18.8	**0.01599**	0.0050788	3.1503111
LBN	22.0	**0.01367**	0.0048643	2.8103119
MLT	22.6	**0.01329**	0.0041556	3.1985514
MAR	18.3	**0.01641**	0.0052627	3.1194634
OMN	22.1	**0.01360**	0.0041957	3.2417475
SYR	18.3	**0.01643**	0.0050105	3.2791737
TUN	20.6	**0.01461**	0.0046993	3.1104420
TUR	21.4	**0.01406**	0.0046611	3.0169917
YEM	16.5	**0.01824**	0.0053618	3.4036518

Hence, according to Bayesian shrinkage estimations, Yemen has the highest rate of convergence of the sample (1,8 % per year) and Malta the lowest one (1,33 % per year). According to the predictions of the convergence theory, the "half-life" is shorter for the initially poorer countries. Thus, according to these results, Malta, Israel, Iran and Oman would need more than 22 years to catch-up half of the distance which separates their economies from the path of steady state growth. On the other hand, the "latecomers" of the sample, Yemen, Morocco and Syrian Arab Republic (SYR), need 16-18 years.

Figure 1 presents the distribution of the rates of convergence country by country. Thus, Malta, Israel, Iran and Oman are in the first section (from left to the right): these two countries have the slowest rates of convergence (respectively, 1,33 %, 1,35 % and 1,36 % per year). The countries' distribution according to their rates of convergence seems to be consistent with the indicators of economic growth performance: "poor" countries having rates of convergence systematically higher than their "rich" neighbors of the sample. However, the dynamic convergence model is limited to only one explanatory variable, $\log y_{it-1}$. The growth model augmented by the population growth rate and the workers' remittances and compensation of employees, received (% of GDP) allows us to test the conditional convergence assumption. The theoretically expected sign is negative for demographic growth rate.

Table 2. The Shrinkage Estimation of the Model : $\log(y_{it}/y_{it-1}) = a_i - (1-e^{-\beta_i})\log y_{it-1} + \varepsilon_{it}$

Method : Iterative Bayesian procedure.

Shrinkage Estimators state by state : 1990-2007 number of iterations 10				
Country		Parameters	StdErrors	T-Stat
DZA	Const	0.1486910	0.0398728	3.7291364
	Log(gdp_1)	-0.0159284	0.0046315	-3.4391457
EGY	Const	0.1374924	0.0393913	3.4904237
	Log(gdp_1)	-0.0136125	0.0047839	-2.8454741
IRN	Const	0.1492608	0.0398635	3.7442990
	Log(gdp_1)	-0.0133994	0.0045440	-2.9488280
ISR	Const	0.1524374	0.0399318	3.8174440
	Log(gdp_1)	-0.0134023	0.0040647	-3.2972554
JOR	Const	0.1498475	0.0398009	3.7649303
	Log(gdp_1)	-0.0158725	0.0049982	-3.1756750
LBN	Const	0.1561316	0.0399336	3.9097829
	Log(gdp_1)	-0.0135772	0.0047982	-2.8296394
MLT	Const	0.1581907	0.0397832	3.9763199
	Log(gdp_1)	-0.0132040	0.0041007	-3.2199066
MAR	Const	0.1503443	0.0397649	3.7808338
	Log(gdp_1)	-0.0162828	0.0051770	-3.1451970
OMN	Const	0.1526557	0.0398757	3.8282904
	Log(gdp_1)	-0.0135093	0.0041390	-3.2638866
SYR	Const	0.1554689	0.0397854	3.9076837
	Log(gdp_1)	-0.0162960	0.0049288	-3.3062826
TUN	Const	0.1404766	0.0393704	3.5680717
	Log(gdp_1)	-0.0125376	0.0046404	-2.7018740
TUR	Const	0.1507631	0.0399325	3.7754511
	Log(gdp_1)	-0.0139641	0.0045960	-3.0382767
YEM	Const	0.1499499	0.0395478	3.7916152
	Log(gdp_1)	-0.0180842	0.0052649	-3.4348733

3.2 Conditional Convergence Testing.

Islam N. [2000][10] proposes to test the following specification for the model of conditional convergence in panel data:

$$\log(y_{it}/y_{it-1}) = a - (1-e^{-\beta})\log(y_{it-1}) + \gamma x_{it-1} + \varepsilon_{it} \qquad (4)$$

The specification introduces in the convergence model some explanatory variables of the process of growth over the period considered. Our model of conditional convergence contains thus three explanatory variables: initial GDP per capita $\log(y_{it-1})$, the share of the the workers' remittances and compensation of employees (received) in the GDP and the sum of demographic growth rates (n_{it-1}), growth of technical progress (m) and the rate of the physical capital depreciation (δ). The sum of the last two parameters is approximated by an arbitrary value of 0.05 (see Mankiw N.G., Romer D. and Weil D., 1992).

Table 3 contains the Bayesian shrinkage estimators for the rates of convergence for 13 MENA (Middle East & North Africa) and Mediterranean countries over the period 1990-2007. The column on the left of the table includes the speeds of convergence estimated for the dynamic

[10] Islam N. [1995, 2000] (for the last reference, see p. 323 in Baltagi B.H. [2000]).

model whose three explanatory variables are the initial per capita income, the share of the remittances and compensation of employees (received) in the GDP and, finally, the variable $\log(n_{it-1}+m+\delta)$. The sign of the last variable is theoretically expected: demographic growth has a negative impact on per capita growth. The values of the rates of conditional convergence estimated over the considered period vary from 8,32 % (for Israel) to 11,4 % per year (for Yemen). The general sample average of the rates of convergence is about 9,8 % per year, which implies a "half-life" of more than four years.

Table 3. Empirical Iterative Bayes' Estimators for the Rates of Convergence ($\hat{\beta}_i$). Hypothesis : Conditional Convergence.

Estimated Model : $\log(y_{it}/y_{it-1}) = a_i - (1-e^{-\beta_i})\log(y_{it-1}) + \gamma x_{it-1} + \varepsilon_{it}$

with $x_{it-1} = \log(Remit_{it-1}/Y_{it-1}) - \log(n_{it-1}+m+\delta)$

Beta-shrinkage country by country : Number of iterations 15				
Country	Half-life	Beta	StdErrors	T-Stat
DZA	3.2	**0.0948115**	0.0058083	16.3234509
EGY	2.9	**0.1039681**	0.0065557	15.8591912
IRN	3.6	**0.0832142**	0.0051473	16.1665728
ISR	5.4	**0.0555816**	0.0043247	12.8521285
JOR	3.2	**0.0954007**	0.0063792	14.9549630
LBN	3.3	**0.0898639**	0.0058010	15.4911050
MLT	3,7	**0.0803817**	0.0049139	16.3580252
MAR	2.7	**0.1112162**	0.0073031	15.2286289
OMN	3.9	**0.0766061**	0.0044080	17.3788793
SYR	2.8	**0.1081592**	0.0068004	15.9048291
TUN	3.1	**0.0974978**	0.0059325	16.4345217
TUR	4.8	**0.0626123**	0.0046678	13.4136638
YEM	2.6	**0.1168523**	0.0074057	15.7786975

The results of conditional convergence model's estimation are significantly different from the preceding results (Table 4). The rates of conditional convergence for all the countries begun higher (about 9 % per year), which implies a "half-life" of 3 years only. As expected, the impact of the initial income and population growth on per capita growth is negative. The impact of the share of the remittances and compensation of employees (received) in the GDP is positive but not always significantly different from zero. We can conclude on the significantly positive impact of remittances on per capita income growth only for six countries of our sample: Jordan, Lebanon, Morocco, Syrian Arab Republic, Turkey and Yemen.

Table 4. The Shrinkage Estimation of the Remittances-Growth Model :

$$\log(y_{it}/y_{it-1}) = a_i - (1-e^{-\beta_i})\log(y_{it-1}) + \gamma x_{it-1} + \varepsilon_{it}$$

Shrinkage Estimators state by state : 1990-2007 number of iterations 15				
Country		Parameters	StdErrors	T-Stat
DZA	Const	0.6549045	0.0133426	49.083721
	$\log(y_{it-1})$	-0.0904556	0.0107433	-8.4197220
	$\log(remit_{it-1})$	0.0083803	0.0098398	0.8516663
	$\log n_{it-1}$	-0.0186043	0.0134149	-1.9868417
EGY	Const	0.6734166	0.0133802	50.329352

	$\log(y_{it-1})$	-0.0987459	0.0095613	-10.327664
	$\log(remit_{it-1})$	0.0064156	0.0097756	0.6562852
	$\log n_{it-1}$	-0.0490363	0.0133486	-3.6735097
IRN	Const	0.6607316	0.0129057	51.196845
	$\log(y_{it-1})$	-0.0798459	0.0047363	-16.858286
	$\log(remit_{it-1})$	0.0015545	0.0083924	0.1852261
	$\log n_{it-1}$	-0.0303329	0.0126430	-2.3991835
ISR	Const	0.6556808	0.0129432	50.658376
	$\log(y_{it-1})$	-0.0540651	0.0061720	-8.7597375
	$\log(remit_{it-1})$	0.0078286	0.0097531	0.8026801
	$\log n_{it-1}$	-0.0200345	0.0125190	-1.6003268
JOR	Const	0.6645358	0.0132644	50.099162
	$\log(y_{it-1})$	-0.0909913	0.0067078	-13.564998
	$\log(remit_{it-1})$	***0.0051029***	***0.015607***	***3.2696226***
	$\log n_{it-1}$	-0.0336052	0.0126808	-2.6500904
LBN	Const	0.6673850	0.0131585	50.719096
	$\log(y_{it-1})$	-0.0859444	0.0062165	-13.825207
	$\log(remit_{it-1})$	***0.0452901***	***0.0119531***	***3.7889836***
	$\log n_{it-1}$	-0.0360849	0.0127675	-2.8263135
MLT	Const	0.6621349	0.0128762	51.423003
	$\log(y_{it-1})$	-0.0772359	0.0045343	-17.033698
	$\log(remit_{it-1})$	0.0075940	0.0091455	0.8303503
	$\log n_{it-1}$	-0.0305320	0.0125449	-2.4338182
MAR	Const	0.6676644	0.0133120	50.155143
	$\log(y_{it-1})$	-0.1052547	0.0066001	-15.947440
	$\log(remit_{it-1})$	***0.0481197***	***0.0117364***	***4.1000391***
	$\log n_{it-1}$	-0.0395040	0.0131122	-3.0127813
OMN	Const	0.6611285	0.0128036	51.636283
	$\log(y_{it-1})$	-0.0737453	0.0040829	-18.061990
	$\log(remit_{it-1})$	0.0041232	0.0087266	0.4724829
	$\log n_{it-1}$	-0.0315211	0.0120728	-2.6109229
SYR	Const	0.6667970	0.0129983	51.298612
	$\log(y_{it-1})$	-0.1025152	0.0050869	-20.152784
	$\log(remit_{it-1})$	***0.0390496***	***0.0077480***	***5.0399586***
	$\log n_{it-1}$	-0.0370862	0.0127637	-2.9056070
TUN	Const	0.6665451	0.0131929	50.523028
	$\log(y_{it-1})$	-0.0928956	0.0058349	-15.920684
	$\log(remit_{it-1})$	0.0074606	0.0098484	0.7575454
	$\log n_{it-1}$	-0.0377970	0.0129019	-2.9295755
TUR	Const	0.6823886	0.0137343	49.685025
	$\log(y_{it-1})$	-0.0606924	0.0167186	-3.6302321
	$\log(remit_{it-1})$	***0.0481015***	***0.0117868***	***4.0809634***
	$\log n_{it-1}$	-0.0630263	0.0145137	-4.3425286
YEM	Const	0.6680421	0.0132529	50.407289
	$\log(y_{it-1})$	-0.1102834	0.0066552	-16.571012
	$\log(remit_{it-1})$	***0.0324250***	***0.0080774***	***4.0142867***
	$\log n_{it-1}$	-0.0423879	0.0130312	-3.2527985

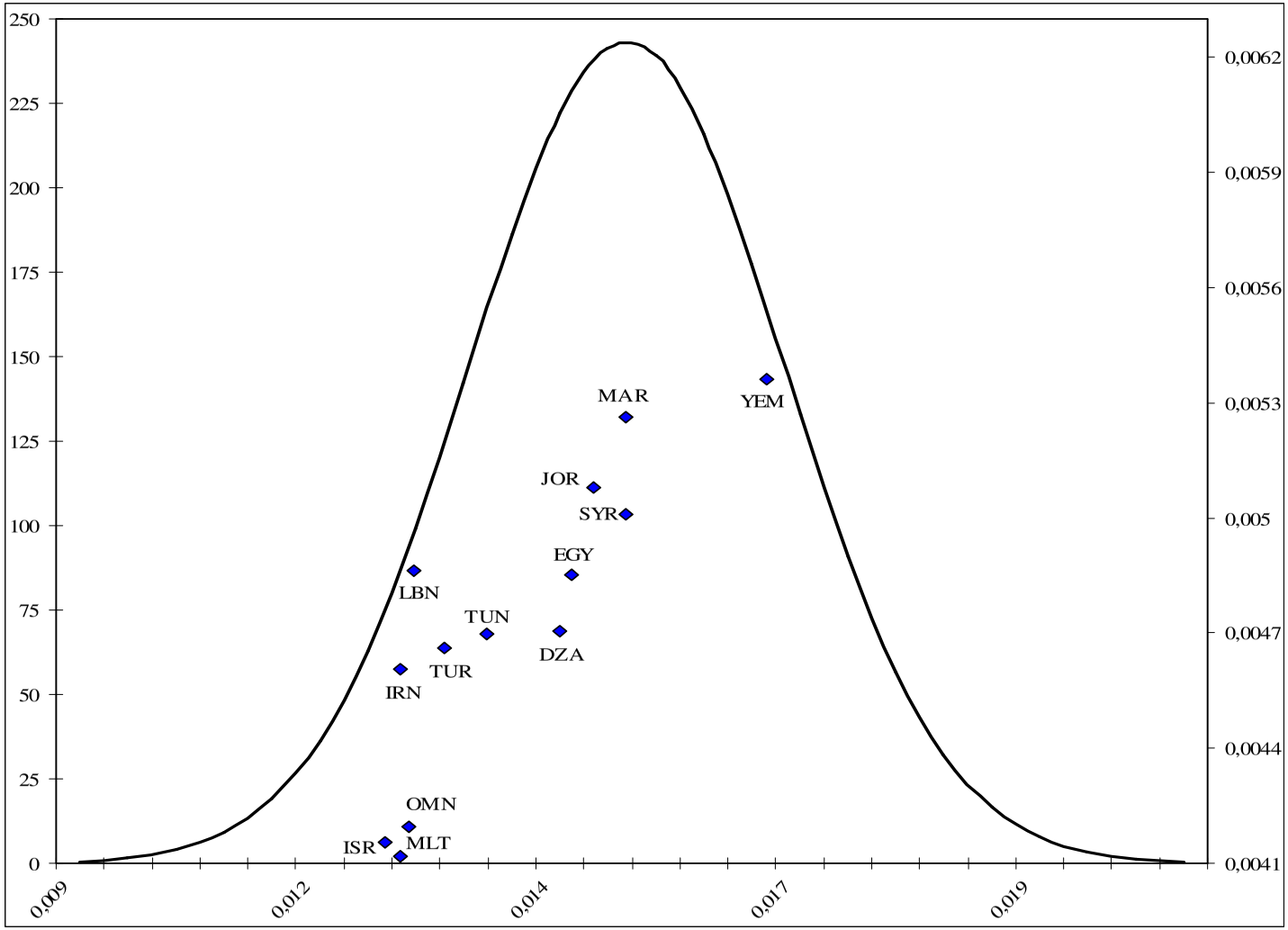
Figure 2 represents the distribution of the rates of conditional convergence estimated for the Remittances-growth dynamic model. Their distribution in term of convergence dynamics leads us to stress the diversity of the growth trajectories borrowed over the considered period. Indeed, the introduction in the initial growth model the share of remittances and compensation of employees (received) and population growth rate in the relation of conditional convergence lets to obtain higher rates of convergence. Thus, the sample average rate of convergence becomes close to 9 %, which implies that, on average, the MENA countries need three years only to catch-up half of the distance which separates them from the steady state growth path.

CONCLUSION.

The used Iterative Bayesian procedure allowed us to calculate the rates of convergence for each MENA country. Contrary to the usually accepted idea of a common speed of convergence, the countries do not converge at the same rate. The distributions of convergence rates showed the similarity of growth dynamics for some countries of the sample and their diversity for the others. Their economies could be classified according to their catching-up dynamics.

The main results obtained to characterize the specific influence of remittances on per capita growth show that for Algeria, Egypt, Iran, Israel, Malta, Oman and Tunisia, the flows of remittances have not a significant effect on growth. However, for Jordan, Lebanon, Morocco, Syrian Arab Republic, Turkey and Yemen, the remittances play an important role on their growth and catching-up process.

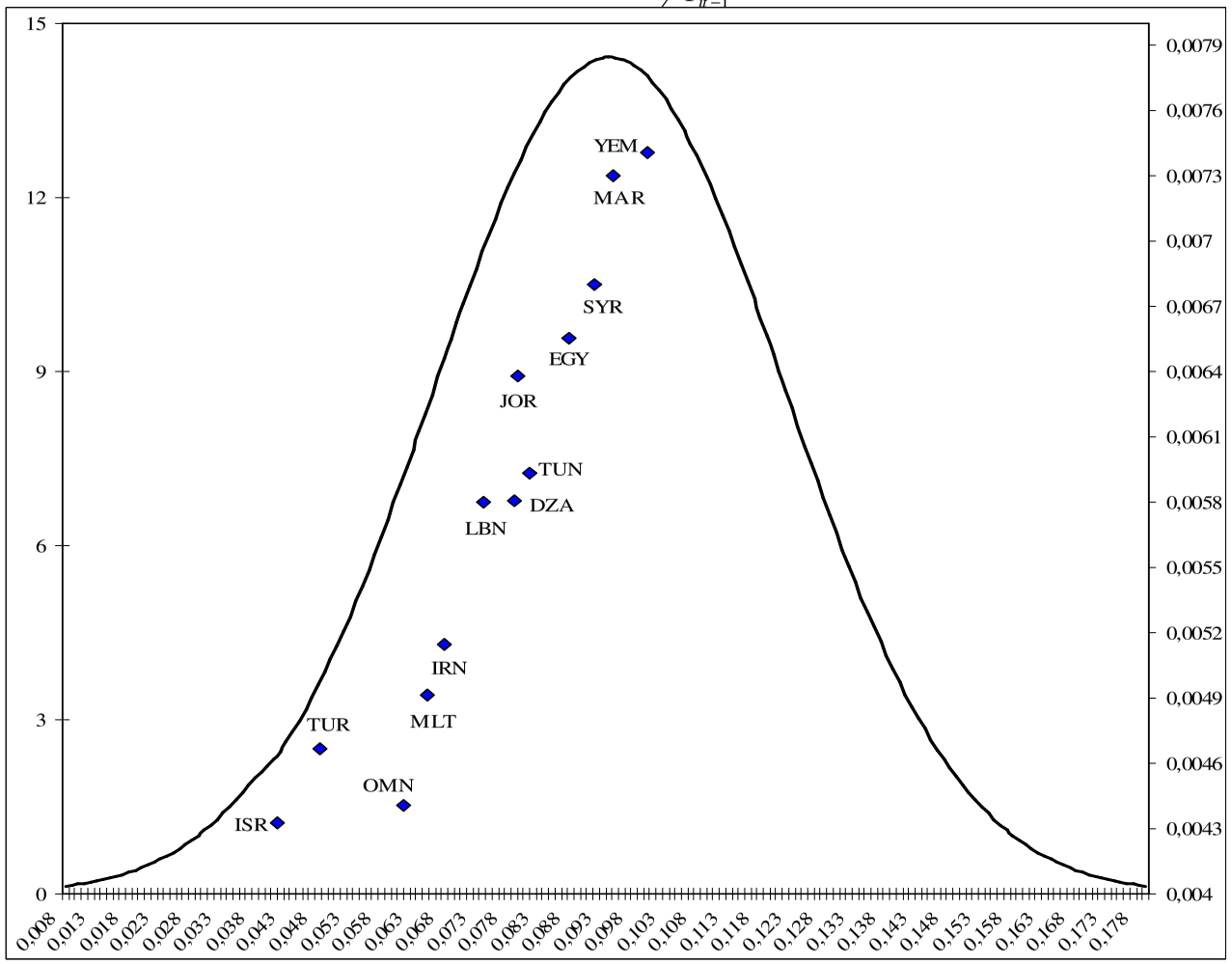
Figure 1. Distribution of Convergence Rates for 12 MENA countries (+ Turkey) over the period 1990-2007. Hypothesis : Absolute Convergence.



$\hat{\beta}$ (Bayesian Shrinkage Iterative Estimator for the Rates of Convergence)

Figure 2. Distribution of Convergence Rates for 12 MENA countries (+ Turkey) over the period 1990-2007. Hypothesis : Conditional Convergence.

« Control » variable : $x_{it-1} = \log(Remit_{it-1} / Y_{it-1}) - \log(n_{it-1} + m + \delta)$



References:

Adams R.H Jr, Page J., (2005), "The Impact of International Migration and Remittances on Poverty", in *Remittances: Development Impact and Future Prospects,* pp.277-306, Washington D.C., World Bank.

Adams R.H Jr, Richard H., (1989), "Workers remittances and inequality in Rural Egypt", *Economic Development and Cultural Change*, Vol. 38, Iss.1, pp. 47-72.

Agénor P-R., Nabli M.K., Youssef T., Jensen H. T.,(2007), "Labor Market Reforms, Growth and Unemployment in Labor-Exporting Countries in the Middle east and North Afrika", *Journal of Policy Modeling*, March-April, Vol. 29, Iss. 2. pp.277-309.

Azad A.K, (2005), "Migrant Workers' Remittances: A Source of Finance for Micro enterprise Development in Bangladesh?", in *Remittances: Development Impact and Future Prospects,* pp.119-132, Washington D.C., World Bank.

Barro, R. J., (1991), "Economic Growth in a Cross-Section of Countries", *Quarterly Journal of Economics*, 106(2), pp. 407-443.

Barro, R. J., Lee, J.-W., (1993), "International Comparisons of Educational Attainment", *Journal of Monetary Economics*, 32 (3), pp. 363-394.

Barro, R. J., Sala-I-Martin, X. (1992), "Convergence", *Journal of Political Economy*, Vol. 100(2), 223-251.

Barro, R. J., Sala-I-Martin X., (1995), "Economic Growth", McGraw Hill, New York.

Bernard, A. B., Jones, C. I. (1996), "Productivity Across Industries and Countries : Times Series Theory and Evidence", *The Review of Economics and Statistics*, pp. 135-146.

Bobeva D.,(2005), " Turning Remittances into Investments", in *Remittances and Development,* pp.297-313, Development Dimension Series, Paris-Washington D.C.

Bourdet Y., Falck H., (2006), "Emigrants Remittances and Dutch Disease in Cape Verde", *International Economic Journal*' Vol. 30. Iss. 3. pp. 267-284.

Bugamelli M., Paterno F., (2006), "Do Workers' Remittances Reduce the Probability of Current Account Reversals?", *C.E.P. Discussion Paper*, L.S.E.

Chami R., Fullenkamp C., Jahjah S.,(2003), "Are Immigrant Remittance Flows a Source of Capital Development", *IMF Working Paper 03/189*, IMF Washington D.C.

Chami R., Barajas A., Cosimano T., Fullenkamp C., Gapen M., Montiel P., (2008), "Macroeconomic Consequences of Remittances", *Occasional Paper 259,* IMF Washington D.C.

Corden W.M., Neary J.P., (1982), "Booming Sector and De-industrialistion in a Small Open Economy", *The Economic Journal*, Vol. 92, N° 368, pp. 825-846.

The Economist, (2005), "Southern Cross", article in Vol. 377, Iss. 8454, Special Section pp.13-15 (from *11-26-2005).*

Edwards s., (1989), "Real Exchange Rate in Developing Countries: Concepts and Measurement", *NBER Working Paper 2950.*

Eken S., (2005), "Macroeconomic Impact of Remittances", in *Migration, Remittances and Development,*pp.193-196, Development Dimension Series, Paris-Washington D.C.

Elbadawi I. A., (1994), " Estimating Long Run Equilibrium real Exchange Rates", pp. 93-132, *in Estimating Equilibrium Exchange Rates,(1994),* Williamson J., editor, Institute for International Economics, Washington D.C.

Evans, P., (1998), "Using Panel Data to Evaluate Growth Theories", *International Economic Review* 39, No. 2, pp. 295-305.

Evans, P. and Karras, G., (1996), "Convergence Revisited", *Journal of Monetary Economics*, 37, pp. 249-265.

Faini R., (1994), "Workers' Remittances and the Real Exchange Rate: A Quantitative Framework", *Journal of Population Economics*, Vol.7, iss. 2, pp.235-245.

Federal Reserve Board, (2005), "Remittance business grows, banks' share of it still small", *North-Western Financial Review*, Vol.190, iss. 18, p.30.

Gaulier, G., Hurlin, C., Jean-Pierre, P. (1999), « Testing Convergence: A Panel Data Approach", *Annales d'économie et de statistique,* 55-56, pp. 411-427.

Glytsos N.P., (2005), "The Contribution of Remittances to Growth: A Dynamic Approach and Empirical Analysis", *Journal of Economic Studies*, Vol. 32, iss. 5-6, pp.468-496.

Greasley, D., Oxley, L., (1995), "A Time-Series Perspective on Convergence: Australia, UK and USA since 1870", *Economic Record*, 71, pp. 259-270.

Hamdouch B., (2005), "The remittances of Moroccan Emigrants", in *Migration, Remittances and Development,* pp.69-79, Development Dimension Series, Paris-Washington D.C.

Hsiao, C., Pesaran, H. M., Tahmiscioglu, K. A. (1999), "Bayes estimation of short-run coefficients in dynamic panel data models", in: Hsiao, Cheng, Lahiri, Kajal, Lee, Lung-Fei, Pesaran, Hashem M. (Eds), *Analysis of Panels and Limited Dependent Variable Models*, Cambridge University Press, pp. 268-296.

Icduygu A., (2005), "Migration, Remittances and their Impact on Economic Development in Turkey", in *Migration, Remittances and Development,*pp.89-95, Development Dimension Series, Paris-Washington D.C.

Im K. S., Pesaran H. M., Shin Y., (1997), "Testing for Unit Roots in Dynamic Heterogeneous Panels", University of Cambridge, DAE, Working Papers Amalgamated Series No. 9526, revised version 1995, September.
Available at : www.ecom.cam.ac.uk/faculty/pesaran.

Im K. S., Pesaran H. M., Shin Y., (2003), "Testing for Unit Roots in Heterogeneous Panels", *Journal of Econometrics*, 115(1), pp. 53-74.

Islam, N., (1995), "Growth Empirics : A Panel Data Approach", *Quarterly Journal of Economics*, 110, November, 1127-1170.

Islam, N., (2000), "Small Sample Performance of Dynamic Panel Data Estimators in Estimating the Growth-Convergence Equation: A Monte-Carlo Study", *Advances in Econometrics* 15, pp. 317-339.

King R. G. and Levine R. (1993), "Finance and Growth : Schumpeter Might Be Right", *Quarterly Journal of Economics* 108, pp. 717-737.

Koopmans, T. C. (1965), "On the Concept of Optimal Economic Growth. The Econometric Approach to Development Planning", Amsterdam: North-Holland.

Lee K., Pesaran H. M., Smith R., (1995), "Growth and Convergence: a Multi-Country Empirical Analysis of the Solow Growth Model" Working Paper available at www.ecom.cam.ac.uk/faculty/pesaran, University of Cambridge.

Lee K., Pesaran H. M., Smith R., (1997), "Growth and Convergence in a Multi-country Empirical Stochastic Solow Model", *Journal of Applied Econometrics* 12, pp. 357-392.

Levine R., Renelt D., (1992), "A Sensitivity Analysis of Cross-Country Growth Regressions", *American Economic Review* 82(4), pp. 942-963.

Maddala G.S., (1999), "On the Use of Panel Data Methods with Cross-Country Data", *Annales d'économie et de statistique* 55-56, pp. 429-448.

Maddala G.S., Li H., Trost R. P., Joutz F., (1997), "Estimation of Short-run and Long-run Elasticities of Energy Demand From Panel Data Using Shrinkage Estimators", *Journal of Business and Economic Statistics* 15, pp. 90 - 100.

Maddala G.S., Hu W. (1996), "The Pooling Problem", in: Mátyás, László, Sevestre, Patrick (Eds.), The Econometrics of Panel Data: a Handbook of Theory with Applications, Kluwer Academic Publishers, 2nd Ed. Boston, pp. 307-322.

Mankiw G. N., Romer D., Weil D. N. (1992), "A Contribution to the Empirics of Economic Growth", *Quarterly Journal of Economics* 107, pp. 407-437.

Nerlove M., (1999), "Likelihood Inference for Dynamic Panel Models", *Annales d'économie et de statistique* 55-56, pp. 369-410.

Quah D. T., (1993), "Empirical Cross-Section Dynamics in Economic Growth", *European Economic Review* 37, pp. 426-434.

Sayan S., (2006), "Business Cycles and Workers' Remittances: How Do Migrant Workers Respond to Cyclical Movements of GDP at Home", IMF WP/06/52, 19 p.

Settimo R., (2005), " Workers' Remittances to Mediterranean Countries: A Potentially Important Tool for Economic development", *Economia Internazionale / International Economics*, feb., Vol. 58, Iss. 1, pp.51-77.

Schiopa I., Sigfried N., (2006), " Determinants of Workers' Remittances: Evidence from the European Neighboring Region", *W.P. Series: 688*, European Central Bank.

Smith, A.F.M. (1973), "A General Bayesian Linear Model", *Journal of the Royal Statistical Society*, Ser. B, 35, pp. 67-75.
Solow R. M. (1956), "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics* 70, n°1, February, 65-94.
Taparia V., (2005), "Banking Across Borders", *Texas Business Review*, feb., pp.1-6.
Van Dalen H.P., Groenewald G., Fokkema T., (2005), "Remittances and their Effects on Emigration Intention in Egypt, Morocco and Turkey", *Tinbergen Institute Discussion Paper 05-030/1*, Tinbergen Institute.
Vargas-Silva C. I., (2006), *Determinants and Consequences of Workers' Remittances*, PhD Thesis, Western Michigan University.
Wahba J., (2005), "What is the Macroeconomic Impact of International Remittances on the Home Country?", in *Migration, Remittances and Development*, pp.185-19, Development Dimension Series, Paris-Washington D.C.

Appendix.

The empirical iterative Bayes' estimators belong to the family of the shrinkage estimators. In the framework of the random-coefficients model, a single equation model, in its matrix notation for the i^{th} individual, can be written as:

$$y_i = X_i \gamma_i + u_i \quad \text{with} \quad i=1.....N$$

where y_i is a vector $(T.1)$. X_i is a matrix with $(T.k)$ observations and γ_i is a vector of $(k.1)$ parameters.

The model is assumed to be dynamic: X_i contains lagged values of y_i. If all the parameters are treated as fixed and different for cross-sectional units and time periods, there are *NTk* parameters to estimate with only *NT* observations. Obviously, we cannot obtain any meaningful estimates of vector γ_i. Alternatively, each regression coefficient can be viewed as a random variable with a probability distribution. The random-coefficients specification substantially reduces the number of parameters to be estimated, while still allowing the coefficients to differ from unit to unit and/or from time to time.

In the Bayesian framework, the *prior* distribution of γ_i is given by : $\gamma_i \sim N(\mu,\Sigma)$. Since the parameters μ (average of γ_i), Σ (variance of γ_i allowed as a measurement of heterogeneity) and σ_i^2 (residual variance) are unknown, we must make some assumptions on the *prior* specification of these parameters. Then, we can obtain the *posterior* distribution of γ_i. If μ, Σ and σ_i^2 were known, then the *posterior* distribution of γ_i will be given by :

$$\gamma_i^* = \left[\frac{1}{\sigma_i^{*2}} X_i' X_i + \Sigma^{*-1}\right]^{-1} \left[\frac{1}{\sigma_i^{*2}} X_i' X_i \hat{\gamma}_i + \Sigma^{*-1}\mu^*\right] \quad (1)$$

where $\hat{\gamma}_i$ is the OLS estimator of γ_i^*. The *posterior* distribution mean of γ_i and its variance are defined by:

$$\mu^* = \frac{1}{N}\sum_{i=1}^{N} \gamma_i^* \quad (2)$$

$$V[\gamma_i^*] = \left[\frac{1}{\sigma_i^{*2}} X_i' X_i + \Sigma^{*-1}\right]^{-1} \quad (3)$$

But, in general, Σ and σ_i^2 are unknown parameters, so we have to make some *prior* assumptions about them. Smith [1973] proposed for Σ^{*-1} the conjugate Wishart distribution and independent inverse χ^2 distributions for σ_i^2 (Lindley and Smith. 1972). The author used the mode of the joint *posterior* distribution:

$$\sigma_i^{*2} = \frac{1}{T+\varsigma_i+2}\left[\varsigma_i \lambda_i + (y_i - X_i\gamma_i^*)' (y_i - X_i \gamma_i^*)\right] \quad (4)$$

and $\Sigma^{*}=\frac{1}{T-k-2+\delta}\left[R+\sum_{i=1}^{N}(\gamma_i^{*}-\mu^{*})(\gamma_i^{*}-\mu^{*})'\right]$ (5)

where ς_i , λ_i , δ and R are parameters arising in the *prior* distributions. Smith (1973) proposed to approximate these parameters by using $\varsigma_i=0$, $\delta=1$ and R is a diagonal matrix with small positive entries (for example, equal to 0.001).

The estimators are:

$$\sigma_i^{*2}=\frac{1}{T+2}\left[(y_i-X_i\gamma_i^{*})'(y_i-X_i\gamma_i^{*})\right] \quad (6)$$

$$\Sigma^{*}=\frac{1}{T-k-1}\left[R+\sum_{i=1}^{N}(\gamma_i^{*}-\mu^{*})(\gamma_i^{*}-\mu^{*})'\right] \quad (7)$$

$$\gamma_i^{*}=\left[\frac{1}{\sigma_i^{*2}}X_i'X_i+\Sigma^{*-1}\right]^{-1}\left[\frac{1}{\sigma_i^{*2}}X_i'X_i\hat{\gamma}_i+\Sigma^{*-1}\mu^{*}\right] \quad (8)$$

and $$\mu^{*}=\frac{1}{N}\sum_{i=1}^{N}\gamma_i^{*} \quad (9)$$

The equations (6) to (9) have to be estimated by iterative procedure. The initial iteration uses the OLS estimates of $\hat{\gamma}_i$ to calculate μ^{*}, Σ^{*} and σ_i^2. The second iteration is based on the empirical iterative Bayes' estimator γ_i^{*}. The third iteration and the following ones are identical to the second.

The empirical Bayes' estimator has been proposed by Maddala G.S. and *alii* (1996). The only difference with Smith's estimator is the computation of the parameters σ_i^2 and Σ^{*}:

$$\sigma_i^{*2}=\frac{1}{T-k}(y_i-X_i\gamma_i^{*})'(y_i-X_i\gamma_i^{*}) \quad (10)$$

$$\Sigma^{*}=\frac{1}{N-1}\left[R+\sum_{i=1}^{N}(\gamma_i^{*}-\mu^{*})(\gamma_i^{*}-\mu^{*})'\right] \quad (11)$$

Maddala G. S. and Hu W. (1994) have shown by Monte Carlo study, that iterative processes for estimating Σ^{*} and μ^{*} tend to more efficient estimates for dynamic models than the two-step procedures. Hsiao C., Pesaran M. H. and Tahmiscioglu A. K. (1999) have also confirmed that, in the case of dynamic panel data model with coefficient heterogeneity, the Bayesian approach performs fairly well even if the time dimension is small.