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The Third Demographic Dividend: Measuring the "Demographic Tax" in the Arab Countries in Transition

Gilles Dufrénot

Highlights

- Among the priority areas that the international community recognized as key priorities to support the political transition to democracy in the Arab countries in transition, job creation is considered as one of the most significant challenges facing these countries.
- The paper draws the attention to the fact that, currently, the demographic changes in the ACT leads to a demographic tax rather than to a demographic dividend, because some factors appear to exercise a negative influence on the countries capacities to raise the working-age people's productivity: vulnerable unemployment, the share of rural population and the density out of total population.
- The demographic tax is illustrated by the existence of a gap between the GDP per-capita that a country obtains, given its demographic characteristics, and the highest level it could reach if the effects of the demographic factors were fully efficient. This gap remains unclosed over time. We provide empirical estimates based on stochastic frontier analysis (SFA) and quantile regression (QR).
- We document the existence of a dividend gap for the ACT with unchanging inefficiency scores over time between 56% and 79% in Yemen, 35% on average in Egypt, between 22%, between 4% and 23% in Tunisia, between 7% and 30% in Libya, between 6% and 21% in Jordan. Morocco in the only country showing a demographic dividend with an average 30% inefficiency score that decreases over time. The variables that are sources of these inefficiencies are the gender gap (with a significant influence of female labor market participation), insufficient secured jobs (this variable carry a positive sign with GDP per-capita and has the largest size among of the coefficients in the regression), own-account employment (which can be considered as a proxy of the importance of the informal sector) and a low public spending in health.

Abstract

This paper proposes a new approach to quantify the demographic dividend and shows evidence of a demographic tax in the Arab countries in Transition (ACT). Our question is whether a shift in the age structure (a larger share of working-age population) is translated into less (more) efficient labor supply and demand and whether these in turn reduce (increase) per-capita GDP. We propose estimates based on stochastic frontier analysis and quantile regressions. We find several interesting results. First, we document the existence of a dividend gap for the ACT with unchanging inefficiency scores over time between 56% and 79% in Yemen, 35% on average in Egypt, between 4% and 23% in Tunisia, between 7% and 30% in Libya, between 6% and 21% in Jordan. Morocco in the only country showing a demographic dividend with an average 30% inefficiency score that decreases over time. Secondly, the variables that are sources of these inefficiencies are the gender gap (with a significant influence of female labor market participation), insufficient secured jobs (this variable carry a positive sign with GDP per-capita and has the largest size among of the coefficients in the regression), own-account employment (which can be considered as a proxy of the importance of the informal sector) and a low public spending in health.

Keywords

Demographic Tax, Efficiency Score, Arab Countries, Stochastic Frontier, Quantile.

JEL

C31, J11, P51.

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The Third Demographic Dividend: Measuring the "Demographic Tax" in the Arab Countries in Transition

Gilles Dufrénot*

1. Introduction

The factors that were behind the protests of people during the Arab Springs are still hotly debated in the literature (for a review, see Campante and Chor 2012, Holder 2018 and Yom 2015). Political factors are prominent and are related to the legitimacy of people's political rights (endorsed by the army in some countries like Tunisia and Egypt), or to the disintegration and collapses of ancient political regimes (like in Libya and Yemen). However, beyond the political factors youth unemployment is probably a key factor of the uprisings in the Arab countries. Many of them are experiencing a strong population explosion of the young generations. The latter are frustrated for their inability to find well paid jobs (though the education indicators have ranked among the highest in the developing and emerging countries during the 1990s). People's dissatisfaction also come from the difficulties faced by their governments to transform the demographic boom into an economic dividend in a context of economic transition to private-sector jobs (see Devarajan and Ianchovichina 2017). This situation leads to putting the issue of the demographic dividend at the core of the economic policy agenda in the Arab countries, as a major factor of political and social stability in the forthcoming decade.

Traditionally, there are two views about the impact of a rapid population growth on the economic development. On the one hand, in the tradition of Malthus, a high fertility rate is thought of as inhibiting growth because it imposes a rising youth dependency ratio on the working-age population, thereby reducing the ability to accumulate productive capital. This negative effect can be exacerbated if a country experiences a demographic transition with a decline in the mortality rate implying higher survivals among the youth and retired people. On the other hand, an expanding population means a larger number of workers that mechanically increase labor input into production. Further, a growing population can be a source of increased human capital and furnish expanding markets which is good for consumption and production. The positive impact of demographics on economic development and growth has been popularized in the literature since a paper by Bloom et al. (2002) in which the authors analyze the experience of countries that have passed through a successful demographic transition by improving their living standards (through greater savings and investment, better health, more shared technology and changes in aggregate productivity).

Despite much interest in the economic consequence of demographic transition, the issue of the existence of a "demographic tax" remains under-explored. This paper proposes to quantify it in the Arab countries in Transition (ACT). We use this expression to mean that changes in the working-age population can have a negative contribution to the living standards through various channels. The demographic tax is referred to as the inverse of a demographic dividend which we interpret here as the extent to which the demographic

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factors' impact on labor market conditions are conducive to higher GDP per-capita (or equivalently how changes in these factors are transmitted to economic growth). Unlike the bulk of papers written so far, we propose a new interpretation of the demographic dividend based on an *efficiency* approach. Our issue is whether the implications of a shift in the age structure (a larger share of working-age population) is translated into less (more) *efficient* labor supply and demand and whether these in turn decrease (increase) per-capita GDP. We consider some basic variables reflecting the labor market implications of demographic changes and analyze their effect on GDP per-capita: the dependency ratio, female workforce participation, own-account employment, wage and paid-employment and public spending in health and education. Our idea is the following. A demographic transition – a situation that many Arab countries are experiencing today – has two effects. One is a volume effect, reflected by an increase in the share of working-age population (people aged between 15 and 64) in total population. The second is a qualitative effect which operates through the structural changes of demographics on the labor market conditions. We attempt to see whether the latter have been progressively more important or not in enhancing the efficiency of GDP per-capita. We therefore interpret the demographic dividend as a phenomenon of higher efficiency in producing income and wealth, besides the usual effects on growth of a larger labor supply and of the shift in the intergenerational asset allocations. It is not enough to explain how a demographic transition can raise economic growth (a typical approach of the literature). What matters is whether the additional growth can support the job growth required to absorb the larger working-age population induced by the demographic changes in the age structure of population. This is an issue of efficiency.

We focus on the ACT. This group consists of six countries: Egypt, Jordan, Libya, Morocco, Tunisia and Yemen. They are considered by the international community to undergo transitional political reforms to democracy and are supposed to receive financial support (through a Marshall plan designed during the "Deauville partnership" in 2011). Among the areas that the governments recognize as key priorities to support the political transition, job creation is considered as one of the most significant challenges facing these countries (see Kitromilides 2016).

The paper draws the attention to the fact that the demographic changes in the Arab countries in transition has led to a demographic tax rather than to a demographic dividend, probably because the favorable factors needed for labor market conditions to be translated into higher growth and GDP per-capita were outweighed by unfavorable factors that inhibited the efficiency of production. The following factors appear to exercise a negative influence on the countries capacities to raise the working-age people's productivity: vulnerable unemployment, the share of rural population and the density out of total population. Conversely, foreign direct investment (FDI), the enrollment rate and adults' literacy rate help to gain from demographic changes by pushing up production efficiency. Unlike the usual papers in the literature that examine the demographic dividend/growth link by relying on regressions relating GDP growth, or savings/investment, or consumption to indicators of cohorts of different aged population (to capture the role of the life cycle), we adopt an interpretation in terms of GDP per-capita efficiency. Specifically, we examine the effect that the structural changes implied by the demographics in the labor market conditions has on the efficient level of GDP per-capita a country can reach. The demographic tax is illustrated by a non-closing gap between the GDP per-capita that a country obtains given its demographic characteristics and the highest level it could reach if the effects of the demographic factors were fully efficient. To address this issue, we provide empirical estimates based on two parametric approaches. One is the stochastic frontier analysis (SFA). The second is quantile regression (QR). To the best of our knowledge, this is the first-time efficiency-based techniques are applied to analyze the economic outcome of demographics.

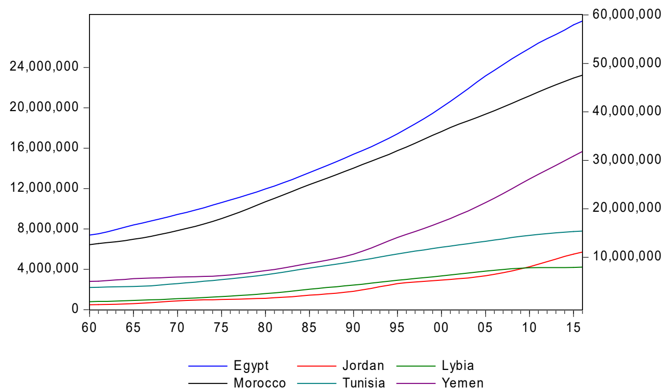
We find several interesting results. First, we document the existence of a demographic gap for the ACT with inefficiency scores between 56% and 79% in Yemen, 35% on average in Egypt, between 4% and 23% in Tunisia, between 7% and 30% in Libya and between 6% and 21% in Jordan. Only Morocco succeeded in benefiting from a demographic dividend by reducing its inefficiency score that was between 22% and 33%. Secondly, the variables that are sources of these inefficiencies are the gender gap (with a significant influence of female labor market participation), insufficient secured jobs (the estimated coefficient of this variable carries a positive sign and has the largest size among of the coefficients in the regression), own-account employment (which can be considered as a proxy of the importance of the informal sector) and a low public spending in health.

The remainder of the paper is organized as follows. Section 2 provides some stylized facts on the demographic transition and on the general trends of labor productivity in the ACT. In Section 3, we attempt to quantify the demographic tax through some econometric regressions. Finally, Section 4 concludes.

2. Some stylized facts on demographics and labor productivity in the ACT

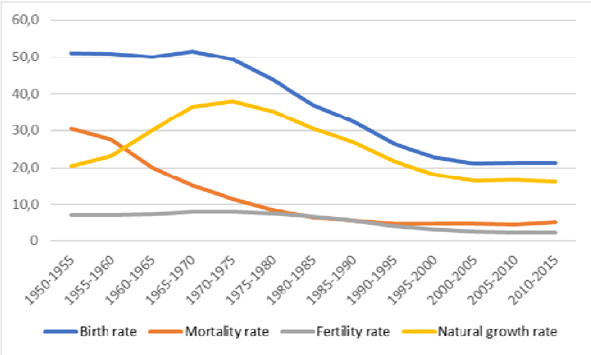
Over the last decade, the population growth has been historically low in Tunisia and Libya. It has grown at a constant rate in Morocco. In Jordan, the population has started to increase since 2010. In Yemen and Egypt, it has grown strongly. In the latter country, there has even been a slight acceleration in population growth since 2010 (Figure 1). The ACT are at different stages of their demographic transition (Figure 2). In Morocco and Tunisia, the gap between birth and mortality rates became narrower over time compared with the other countries. As a result, their dependency ratio decreased, reflecting the fact that the working-age population has grown faster than total population. Egypt is in a radically different situation. As a consequence of high fertility rates, the curves of the natural growth rate and of the dependency ratio have become flat since the mid-2000s and the slopes have been positive since 2010. The situation of Jordan is close to that of Egypt. Libya is in a situation similar to the Maghreb countries. Yemen in an in-between situation.

Figure 1 – Population in the ACT

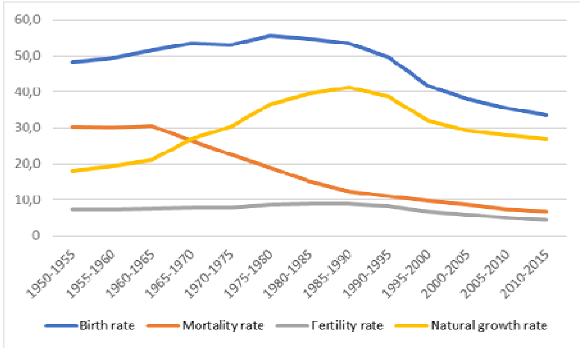


Source: World Population Prospect 2017, UN- Rigth scale: Egypt; left scale: the other countries

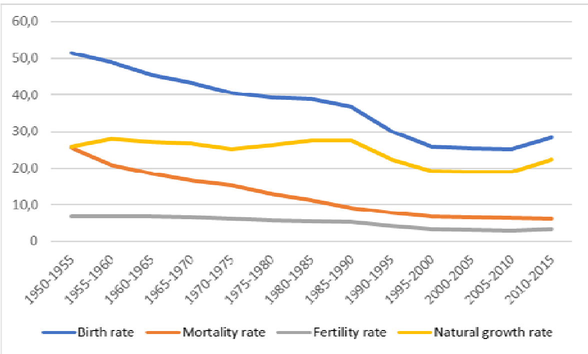
Figure 2 – Demographic transition



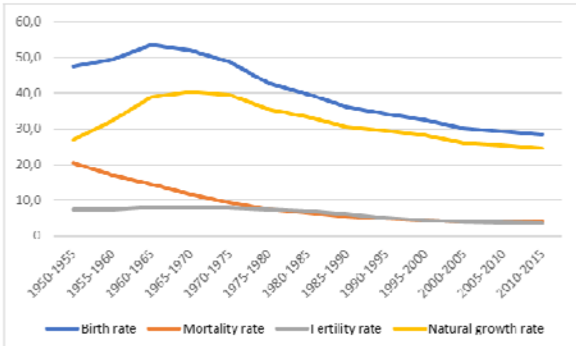
Libya



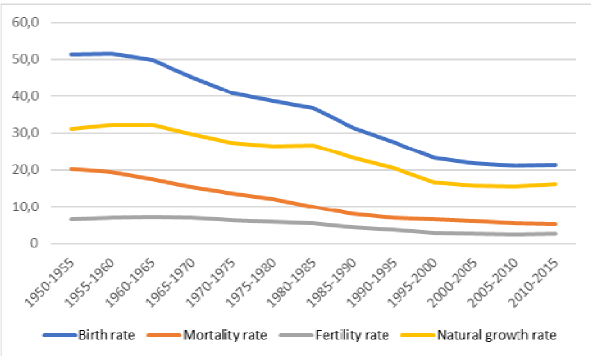
Yemen



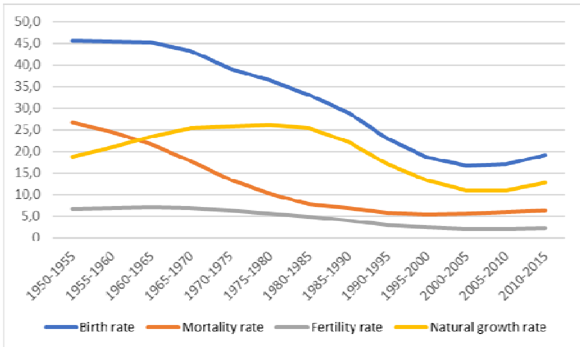
Egypt



Jordan



Morocco



Tunisia

Source: World Population Prospect 2017, UN.

Birth rates (births per 1000 population), Mortality rate (deaths per 1000 population)

Fertility rate (live births per woman, Natural growth rate (per 1000 population)

Theoretically, Egypt and Yemen should be better off to benefit from the demographic dividend. Indeed, their high fertility rates lead to an increase in a young working-age population, while the Maghreb countries are entering the second phase of their demographic transition marked by the ageing of their population. Table 1 shows the evolution of the annual growth rate of GDP per-worker, as a proxy of labor productivity since 1995. In all the countries, it slowed down after 2010 (more in the Maghreb countries than in Egypt). In those countries facing political or migration crises, it collapsed. Where does the stall come from?

Table 1 – Ouput per-worker (constant 2011, US dollars, PPP), annual growth

	1995-2000	2000-2005	2005-2010	2010-2017
Egypt	2.33	1.41	2.61	2.47
Jordan	-0.28	3.91	0.95	-1.09
Libya	-3.35	1.47	2.38	-8.86
Morocco	-1.18	1.78	2.82	1.94
Tunisia	2.68	2.00	2.23	0.72
Yemen	1.68	3.18	2.20	-10.65

Source: International Labor Organization and author's calculation.

A factor still not studied, but likely to explain the decline in labor productivity in ACT, is the rapid deskilling of the labor force, or equivalently the rapid obsolescence of skills. The governments in these countries still provide too few statistics on indicators like time-related and unemployment related underemployment, on the share of youth not in employment, education or training, or on discouraged job seekers. Such indicators are very important, however, to account for the degree of under-utilization of the labor force. For the few statistics available, we learn for example that in Jordan the proportion of young people between the ages of 20 and 24 leaving the labor market is 24% in rural areas and 14% in urban areas. In Egypt, the proportion of youth that are is neither registered in the participation rate, nor in education or training lies above 25% (according to ILO statistics[1], 27.6% in 2017). In Morocco, despite the low population growth rate, the rate of underemployment of the labor force has increased from 11% on average over the period 2000-2005 to 17.5% over the period 2005-2010. One factor that accelerates the obsolescence of human capital stems from the difficulties faced by the governments to promote the mobility of the labor force from the informal sector to the formal sector. Indeed, labor productivity increases with capital-labor ratio. Jobs in the informal sector require mainly labor and the contribution of the informal sector to GDP (excluding agriculture) in the ACT is important. For example, it is 17% in Egypt and twice this percentage in Tunisia. Informal employment as a share of the labor force remains high: 45% in Egypt, 62% in Jordan, 31.5% in Libya, 76.2% in Morocco and 34% in Tunisia.

Another factor, also rarely studied, is likely to slow the rise of labor productivity: increasing inequalities related to gender, income and capital.

[1] International Labor Statistics.

Gender inequality affects potential growth in three ways: *(i)* the unequal access to education of female deteriorates the average human capital of women; *(ii)* it results in an inefficient allocation of resources when women participation rate in the labor market is low; and *(iii)* it causes losses in potential GDP levels when the marginal return on girls' education is higher than that of boys'. In the MENA region the remainder gender gap was 40% in 2016, the highest in the world[2]. In Egypt, the global gender gap index is 0.61 which indicates a remainder gap for parity of 39%. The gender gap related to economic participation and opportunity is even worse (0.44). In both Jordan and Morocco, the statistics are 0.60 for the global index gap and 0.38 for the indicator of economic participation. In Tunisia these numbers are higher (0.64 and 0.44) and in Yemen 0.51 and 0.35. A striking feature is that these figures have hardly changed over the last ten years.

The governments in the ACT countries seek to transform their economies from resource-intensive to more diversified economies. This should result in a rise of the share of industry and innovation sectors in total GDP. Mechanically, this will result into more income inequalities. The reasons are twofold: *i)* industrialization and high-tech require more capital accumulation thereby implying a higher inequality between wages and profits; *ii)* the needed higher returns to capital are usually obtained through an increase in private capital; but since the latter is usually concentrated in few sectors, the result is capital inequality. What matters during the transition phase of industrialization and innovation is not pro-poor growth per se, but that the entire distribution of income moves to the right (though inequalities increase, the income becomes superior for all the people). For this to happen high productivity gains are needed during the structural transformation of the economy. These can be obtained in several ways: foreign direct investment of a capital-intensive nature, revolution in innovation or substantial public spending allocated to education. What do we observe in the ACT countries?

First, FDI dropped by an average 45% between 2008 and 2013 and even by 70% if 2010 is taken as the reference year (MENA-OECD, 2014). Among the countries, Morocco is an exception and has seen a greater stability in FDI inflows, especially in infrastructure and renewable energy. FDI inflows as share of GDP was only 2.25% in Tunisia in 2013, and 2.04% in Egypt. Secondly, the countries rank poorly in the global competitiveness index 2017-2018, defined as the set of institutions, policies and factors that determine the level of productivity. On a scale ranging from 1 (weak) to 7 (strong), Yemen has a score of 2.87, Tunisia and Egypt of 3.97 (with a deteriorating trend), Morocco of 4.24, Jordan of 4.30. Thirdly, there exists a big mismatch between the university curricula and market needs due to several factors, for instance weak industry-university linkages, insufficient government support to higher education and improvement of entrepreneurial skills, R&D expenditure stand at low levels, or little business R&D (UNESCO Science Report, 2015). In a context of demographic boom, these elements weight on inequalities by increasing the polarization of income, which destroys human capital and prevents potential growth from recovering.

An additional factor can explain why the ACT's demographic transition does not result into higher potential growth rates. Prolonged periods of unemployment lead to a worsening of deprivation indicators and this can in turn lead to low labor productivity growth. The index combines twelve indicators shared into three dimensions of deprivation in households' life: education (years of schooling and child enrollment), health (nutrition and child mortality

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[2] See the World Economic Forum (http://reports.weforum.org/global-gender-gap-report-2016/rankings/).

indicators) and the living standards (electricity, sanitation cooking fuels, floor, real assets). For the Arab countries some additional indicators are usually added for an acute analysis of the reciprocal relationship between poverty and weak labor efficiency: the proportion of people with disability, overcrowding and early pregnancy and the prevalence of female genital mutilation (see United Nations 2017). For purpose of illustration, Table 2 shows that low education, health and living standards have strong contributions to poverty in the ACT. In addition, we report some statistics related to some social-cultural factors that account for violence towards women that can be dissuasive for their participation to the labor markets and/or reduce their productivity.

Table 2 – Contribution of education and health to poverty and socio-cultural factors as source of labor discrimination (%)

	MPI	**Education**	**Health**	**Living standards**	**Female genital mutilation / cutting (prevalence women, %)**
Egypt	27,21	54	21.2	16.3	91
Jordan	11,7	65.7	15.7	19.9	-
Morocco	36,6	61.3	13.8	38.4	-
Tunisia	17,8	70.3	15.6	31.8	-
Yemen	69	44	19.7	42.5	17
	Justification of wife beating (Female)	Adolescents currently married/Union (Female)	Adolescent birth rates		
Egypt	39.3	13.1	49.5		
Jordan	90	6.6	32.3		
Morocco	63.9	0.6	18		
Tunisia	30.3	1.2	6		
Yemen	-	1.3	80		

Source: Abu-Ismaid and Sarangi (2015) and UNICEF. MPI is the multidimensional poverty index computed using a cut-off of 33%. The numbers in the MPI column correspond the percentage of households that are considered poor. Data on social norms are based on averages over 2002-2012.

3. Quantifying the demographic tax

3.1. Econometric methodologies

In this section, we attempt to quantify the demographic tax in the ACT. To that end we adopt an efficiency-based approach. More specifically, we perform a stochastic frontier analysis (SFA) and quantile regressions (QR) to assess the degree of under-performance of the components of the demographic dividend. To our knowledge there are not so far, any applications of these techniques in the field of the demographics/growth links. More frequent methodologies rely on non-parametric techniques like the Data Envelopment Analysis (DEA) or the Free Disposable Hull (FDH). We choose the SFA and QR because they are robust to outliers.

A first issue that arises is how to measure the demographic dividend and how to assess its outcome. Since the seminal paper by Bloom and Williamson (1998), the demographic dividend is usually considered as measuring the positive effect of the age structure on economic growth. Specifically, when the share of non-working age dependents diminishes compared to the working age people, income per-capita increases. This can be seen formally by decomposing GDP per-capita as follows:

$$\frac{Y_t}{N_t} = \frac{W_t}{N_t} \times \frac{Y_t}{W_t} = \frac{Y_t}{W_t} / \frac{N_t}{W_t}, \ \frac{N_t}{W_t} = \frac{young_t + old_t + W_t}{W_t} = 1 + dependency\ ratio, \quad (1a)$$

where Y_t is GDP, N_t is total population, W_t is the working aged population (people aged 15-64). $\frac{Y_t}{W_t}$ is the productivity of the working-age population. $\frac{young_t}{W_t}$ and $\frac{old_t}{W_t}$ are the youth (people aged 0-14) and old (people aged 65 and over) dependency ratios. During a demographic boom, when the working-age population grows faster than total population, lower dependency ratios promote higher GDP per-capita. The literature usually interprets as a "demographic dividend" the positive impact of the age structure (of which $\frac{W_t}{N_t}$ is a proxy) on in $\frac{Y_t}{N_t}$ or growth. $\frac{W_t}{N_t}$ captures the quantitative component of the age structure. There is also a qualitative component measured by the productivity of the working-age people $\frac{Y_t}{W_t}$. The growth impact of the "quality" of working- age people is frequently examined in the literature through education and human capital effects.

To study the economic impact of both the quantitative and qualitative components of the demographic dividend, a first common approach is to incorporate the quantitative and qualitative components of the working-age population in growth regressions, or in regressions relating these components to consumption, saving, investment or productivity. The literature is abundant. The reader can refer to the seminal papers by Bloom and Caning (2004), Bloom et al. (2000, 2002), and for more recent illustrations to Oosthuizen (2015), Prskawetz and Sambt (2014), Aiyar and Mody (2016). Another strand of the literature uses national transfers account models. These are based on microeconomic surveys and allow to calculate the effect on aggregate wealth of inter-generational resource reallocations. The measurement of the demographic dividend is related to lifecycle consumption. Youth and the elderly often need transfers to finance their consumption. These are provided by the working-age population through various forms of transfers (asset reallocations by dis-saving, capital reallocation, transfers by public systems). Examples of contributions in this area are Lee and Mason (2010, 2011), Mason et al. (2016).

The above two strands of the literature provide two measures of the demographic transition. The so-called “first demographic dividend” refers to the influence of the age structure on economic outcome (GDP, growth, consumption, investment, saving). In this approach the dependency ratio (alternatively called the support ratio) plays a central role. The literature also investigates the “second demographic dividend” which is designed to capture the growth effects of higher human and investment capital through intergenerational transfers.

In this paper we take a different perspective than the approaches mentioned above and propose to compute a “third demographic dividend”. Specifically, we propose to track the effects of the quantitative and qualitative changes in the age distribution of the population in terms of efficiency achievement. The logic behind this approach is simple. Suppose that there exists a maximum level of outcome (for instance GDP per-capita) that a country could reach with both the quantitative and qualitative components of its working-age population. This level is unobserved, and needs be estimated. The efficiency approach amounts to measuring how far from this maximum level the country is and whether changes in the working-age population allow it to reduce the gap between its current outcome and the frontier outcome. A demographic tax reflects a situation in which the distance from the frontier outcome does not diminish over time. A reason why the efficiency approach is interesting lies in the fact that reforms designed to benefit from the demographic transition involve the assignment of resources to different activities (structural reforms to modernize the functioning of the labor markets, public spending in health and education to boost human capital, institutional reforms that modify socio-cultural behavior to reduce gender inequality, etc). To guide resource allocation, it is interesting to quantify the ability of demographic changes to lead the highest performance in terms of economic outcome.

Our measure of demographic dividend is thus dictated by a frontier analysis and this issue is treated in a very similar way as in efficiency approaches based on stochastic production frontier models[3]. Suppose that, instead of Equation (1a) which is an identity, we consider a “behavioral” equation where GDP per-capita is the outcome of two factors of production related to demographics, the share of working-age population out of total population, and the productivity of the working-age population. Assuming a simple log-linear form, we write

$$ln\frac{Y_t}{N_t} = a_0 + a_1 ln\frac{W_t}{N_t} + a_2 ln\frac{Y_t}{W_t} + V_t - TE_t,\ V_t \sim iid(0, \sigma_V^2) \qquad (1b)$$

This formulation is based on the usual Debreu-Farell measure of technical inefficiency (here $-TEF_t$) in a stochastic framework. One imposes the restriction $0 \leq TEF_t \leq 1$. If, the working-age components are fully efficient in raising per-capita GDP, then $TEF_t = 0$ and on average GDP per-capita reaches its highest (or efficient) level since $E(V_t) = 0$. $TEF_t > 0$ indicates a gap to the frontier which is referred to a situation of inefficiency.

Rather than choosing $\frac{W_t}{N_t}$ and $\frac{Y_t}{W_t}$ as the explanatory variables, it is better to consider some variables to which they are correlated. The reasons are threefold. Firstly, this avoids problems in the estimations related to the endogeneity of these variables. Secondly, we reduce biases due to measurement errors, specifically for the variable of productivity. Thirdly,

[3] For a recent survey, see Kumbhakar et al. (2017).

our issue here is not to measure the direct effects of these variables on GDP, but their effects through demographic dividend channels. We need some variables that capture the opportunity that larger cohorts of young working-aged adults will translate into higher GDP per-capita.

Within a stochastic frontier framework, our empirical model is the following:

$$Y_{it} = f(\boldsymbol{X}_{it},; \boldsymbol{\beta})\exp{(u_{it})}TEF_{it}, \;\; 0 \leq TEF_{it} \leq 1. \tag{2}$$

Y_{it} is per-capita GDP in country *i* during the year t, i=1,…, N and t = 1,…,T, $\boldsymbol{X}_{it}$ is a vector of variables that condition the positive or negative impact of the working-age population on per-capita GDP. We consider the following variables: the total dependency ratio, the share of own-account employers in total employment, the share of wage and salaried workers in total employment, female labor force participation rate, government health and education expenditure as percentage of GDP.

These are some basic determinants that capture the links between the population age structure and GDP through the demographic behaviors and through their impact on the labor markets. A boom in GDP per-capita can only be obtained through declining dependency ratios. Changes in these ratios are mainly driven by fertility behaviors. A decline in fertility rates increases aggregate saving rate and thereby leads to higher investment and output. In addition to this, the issue is whether younger cohorts of individuals can be employed in productive activities. For the ACT countries, given the recent socio-political events, we choose variables for which the positive impacts on income per-capita are channeled by stronger social and political stability. Among the factors that have led to the Arab revolution was the frustration of massive young people entering the labor market but not finding a job. What triggered the contests was the fact that many could neither be fully employed in productive activities, nor could earn satisfactory income. Our two variables of own-account employers and the percentage of salaried people capture characteristics of the labor markets. They are a proxy of a political stability channel of the demographics/GDP link.

We further consider the female labor force participation in the labor markets as a proxy of the gender gap and the outcome of several cultural and sociological traits of societies. For instance, a higher participation rate of women to the labor markets frequently comes as a substitute for early marriages or pregnancy and as a complement of higher education achievement for girls, of the provision of family planning, of the adoption of contraception. Finally, the potential benefits of demographic dividend also stem from public policies to improve human capital. Here, we consider the role of policies targeting higher education and improved health by looking at how much governments spend per student in primary school and how much they spend in health activities as percentage of GDP.

In Equation (2), we focus on the case of a “pure” demographic effect. We therefore omit capital as an input in the production function, which can be motivated for instance by the very low growth of the capital/labor ratios in the countries over the last two decades. Capital is considered as a fixed factor (a time-invariant fixed effect).

TEF_{it} is a GDP per-capita efficiency term measuring the ratio of observed per-capita output over the maximum per-capita output achievable in a country which benefits from the demographic dividend.

$$y_{it} = \boldsymbol{x}'_{it}\, \boldsymbol{\beta} + u_{it} - v_{it}, \tag{3}$$

under the following assumptions:

i) $u_{it} \sim iidN(0, \sigma_u^2)$ and $v_{it} \sim iidN^+(\mu_{it}, \sigma_v^2)$ (i.e. a truncated-Normal distribution from below zero);

ii) $\varepsilon_{it} = u_{it} - v_{it}$ is uncorrelated with the explanatory variables;

iii) u_{it} and v_{it} are independent from one another.

Usual interpretations of the demographic dividend attempt to explain the effects of demographic *changes* on economic *growth*. Taking the first-difference of the terms on both sides on the equation and denoting Δ the first-difference operator, we write

$$\Delta y_{it} = \Delta \boldsymbol{x}'_{it} \boldsymbol{\beta} + \Delta u_{it} - \Delta v_{it}. \quad (4)$$

To assess the demographic dividend, two things are thus needed. First, the estimated coefficients $\boldsymbol{\beta}$ must carry the right signs. Secondly, we expect production inefficiency Δv_{it} to decrease over time (or equivalently efficiency to increase over time). In practice, Equation (3) is estimated and a plot of the efficiency scores over time -the inverse of inefficiency- is drawn.

A second issue concerns the choice of "proneness" variables to outcome. The idea is that for the demographic dividend to occur, some conditions must be in place. Gains or losses of the demographic dividend can be more or less important depending upon the socio-economic and political environment. In our case, this implies to specify a list of "inefficiency variables". Equation (3) must be estimated under the assumption that the time varying mean of $\mu_{it} = E[v_{it}]$ is described by an additional equation

$$\mu_{it} = E[\boldsymbol{Z}'_{it}\boldsymbol{\delta} + W_{it}],\ W_{it} \sim iidN(0, \sigma_W^2), \quad (5)$$

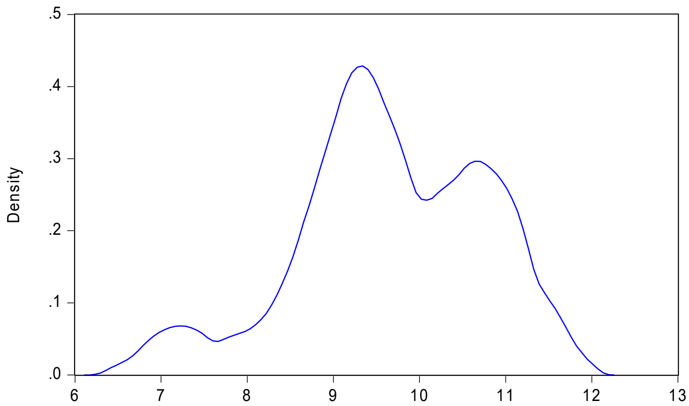
where **Z** is a vector of inefficiency variables, including an intercept. We consider the following variables: vulnerable employment, enrollment in secondary school, adults' literacy rate, population density, the percentage of rural population and foreign investment net inflows in percentage of GDP.

Lower vulnerable employment indicates an improvement in the quality of jobs proposed in the labor markets and is an indicator of higher secured works proposed to employees. School enrollment in secondary school is a proxy of human capital (a social revendication in the MENA countries). Adults' literacy rate accounts for the impact of parents' education of their future children's education and health. This is also an indirect measure of the impact of education on social norms. We further consider population density as a potential hindrance to reach the enrollment rate targeted by governments. Moreover, our motivation for considering the percentage of people living in rural areas is a way to capture the distance to schools which are usually further away than in urban areas where transportation systems are more developed. Further, living in a rural area does not necessarily ease access to jobs. In the other hand, a higher rural population reduces the congestion side-effects of strong urbanization (urban poverty is a hindrance for labor productivity). Foreign direct investment is a proxy to governments' willingness to import best practices and new ideas in business from abroad (labor productivity is potentially boosted through higher FDI)

Equations (3) is estimated by the maximum likelihood estimator and individual efficiency scores are computed for each couple of time and countries.

Though very useful, the SFA suffers from some caveats. The first one is that the methodology assumes common coefficients for the countries, thereby implying that the demographic dividend or demographic tax materialize in a similar manner across the countries. This assumption is restrictive if there are strong heterogeneities in the sample. Figure 3 shows the distribution of GDP per-capita in the MENA countries over the period 2000-2017. The distribution is estimated using an Epachenikov Kernel. It shows a strong heterogeneity reflected by the multimodality of the distribution and the high dispersion of the observations. To accommodate heterogeneity, we wish to explore the entire conditional distribution in the response of per-capita GDP to the demographic variables.

Figure 3 – Distribution of GDP per-capita in the Middle East and North Africa countries (2000-2017)



x-axis: log of GDP per capita, PPP (constant 2011 international $, Source World bank

In the context of panel data, we can adopt the generalized quantile regression estimator proposed by Powell (2017)[4]. In a context of strong heterogeneity across countries and time, measuring the distributional impact of demography on per-capita GDP through mean estimates does not allow a full characterization of the links between demography and GDP.

Define $\theta \epsilon (0,1)$ the θ^{th} quantile of per-capita GDP distribution as shown in Figure 3. We are interested in measuring the effects of the demographic variables in the vector $\boldsymbol{x}$ in Equation (3) at a given quantile. We are therefore not interested by a unique vector estimate $\widehat{\boldsymbol{\beta}}$, but by a set of estimates $\widehat{\boldsymbol{\beta}}(\theta)$. Standard quantile regression amounts to finding $\widehat{\boldsymbol{\beta}}(\theta)$ that is solution to the minimization problem

$$\min_{\boldsymbol{\beta}} \sum_{i=1}^{N} \sum_{t=1}^{T} \rho_\theta (y_{it} - \boldsymbol{x}_{it}' \, \boldsymbol{\beta}(\theta)), \tag{6a}$$

where $\rho_\theta(u) = u\theta I(u \geq 0) + u(1-\theta)I(u < 0)$ is the quantile function. $I\big(u \gtreqless 0\big)$ is the indicator function. The conditional quantile function is minimized using a simplex algorithm.

[4] For an overview of the methods based on quantile regressions, the reader can refer to Koenker et al. (2017).

We calculate bootstrap standard errors using an adaptive Monte Carlo Markov Chain (MCMC) estimator with 5000 draws.

As we said before, the influence of $\boldsymbol{x}$ on per-capita GDP depends upon some characteristics of the countries described by the vector $\boldsymbol{Z}$ in Equation (5) (the variables that help improving the efficiency of GDP per-capita). The bulk of the literature that uses QR for frontier analysis imposes that both variables in $\boldsymbol{x}$ and $\boldsymbol{Z}$ enter the quantile function. This means that in (6a), we have an additional term $\boldsymbol{Z}'_{it}\,\boldsymbol{\gamma}(\theta)$:

$$\min_{\boldsymbol{\beta}} \sum_{i=1}^{N} \sum_{t=1}^{T} \rho_\theta (y_{it} - \boldsymbol{x}'_{it}\,\boldsymbol{\beta}(\theta) - \boldsymbol{Z}'_{it}\,\boldsymbol{\gamma}(\theta)). \tag{6b}$$

They enter as control (or conditioning) variables in the sense that they are added as supplemental explanatory variables. However, the standard conditional quantile estimator raises some difficulties of interpretation particularly in terms of identification. This approach does not fully answer the central question: what is the impact of $\boldsymbol{x}$ on per-capita GDP, for some given characteristics of the countries (that is for given values of $\boldsymbol{Z} = \boldsymbol{z}$)?

To answer this question, one needs considering that the set of variables in $\boldsymbol{Z}$ affects the conditional distribution of per-capita GDP without necessarily entering the quantile function. Suppose for instance that a country with a high adult's literacy rate is more likely to have its GDP per-capita values in the upper quantiles of the distribution of per-capita GDP. Then, the conditional distribution of per-capita GDP is likely to be different when conditioning upon high literacy rate than on low literacy rate. Powel (2017) proposes a trick by combining quantile and distribution regressions (what he calls a generalized quantile estimator).

If we would apply a distribution regression to the $\boldsymbol{x}$ and $\boldsymbol{Z}$ variables taken jointly, we would search to estimate a cumulative distribution function $F(\theta) = Pr\{y_{it} \leq \theta\}$ where the dependent variable is $I(y_{it} \leq \theta)$. The function would be estimated by a binary choice model. For instance, with a logistic model, we have

$$F(\theta) = \Lambda\big(\boldsymbol{x}'_{it}\,\boldsymbol{\beta}(\theta) + \boldsymbol{Z}'_{it}\,\boldsymbol{\gamma}(\theta)\big) = \frac{exp\{\boldsymbol{x}'_{it}\,\boldsymbol{\beta}(\theta)+\boldsymbol{Z}'_{it}\,\boldsymbol{\gamma}(\theta)\}}{1+exp\{\boldsymbol{x}'_{it}\,\boldsymbol{\beta}(\theta)+\boldsymbol{Z}'_{it}\,\boldsymbol{\gamma}(\theta)\}} \tag{7}$$

and $$\hat{F}(\theta) = \Lambda\left(\boldsymbol{x}'_{it}\,\widehat{\boldsymbol{\beta}}(\theta) + \boldsymbol{Z}'_{it}\,\widehat{\boldsymbol{\gamma}}(\theta)\right)$$

Here, instead of treating $\boldsymbol{x}$ and $\boldsymbol{Z}$ in the same manner (both are explanatory variables of GDP per-capita), only $\boldsymbol{Z}$ is introduced in the distribution regression function and $\boldsymbol{x}$ in the quantile function to avoid altering the basic structural model.

The QR estimator $\widehat{\boldsymbol{\beta}}(\theta)$ when only $\boldsymbol{x}$ enters the quantile regression can be shown to satisfy the following moment condition:

$$E\left[\rho_\theta\left(y_{it} - \boldsymbol{x}'_{it}\,\widehat{\boldsymbol{\beta}}(\theta)\right)\right] = 0, \;\; \rho_\theta\big(y_{it} - \boldsymbol{x}'_{it}\,\boldsymbol{\beta}(\theta)\big) = \boldsymbol{x}_{it}\big[\theta - I(y_{it} - \boldsymbol{x}'_{it}\,\widehat{\boldsymbol{\beta}}(\theta))\big]. \tag{8}$$

Now, when $\boldsymbol{Z}$ enters the distribution regression function, we have an additional moment condition:

$$E\left[\rho_\theta\left(y_{it} - \boldsymbol{x}'_{it}\,\widehat{\boldsymbol{\beta}}(\theta)\right) - \Lambda\big(\boldsymbol{Z}'_{it}\,\widehat{\boldsymbol{\gamma}}(\theta)\big)\right] = 0. \tag{9}$$

One thus estimates the vectors of coefficients $\boldsymbol{\beta}(\theta)$ and $\boldsymbol{\gamma}(\theta)$ in a less restrictive way than is generally considered in the literature.

In the quantile regression context, the frontier to which the other observations are compared is defined by the estimates obtained for the observations positioned at the highest quantiles of the conditional distribution (here $\theta = \tilde{\theta} = 0.8$). Efficiency scores are computed by the ratio of the predicted per-capita GDP based on the benchmark quantile (this corresponds to Bahrain in our sample and is denoted $\tilde{y}(\tilde{\theta})$) and the estimate corresponding to a given quantile where a country is located in the conditional distribution (say $\hat{y}(\hat{\theta})$).

3.2. Data

Our sample consists of the following MENA (Middle East and North Africa) countries: Algeria, Bahrain, Iraq, Iran Islamic Republic, Egypt Arab Republic, Libya, Lebanon, Kuwait, Jordan, Israel, Oman, Saudi Arabia, Syrian Arab Republic, United Arab Emirates, Morocco, Tunisia, Yemen Republic. The time period (2000-2017) is dictated by the availability of data to keep a balanced panel. Data are annual. Though our interest is the ACT, using a panel with the MENA countries increases the dimensionality of data and avoids bias and imprecisions in the estimations. The results in the next section are a selection of the estimates obtained for the whole sample and focus on the ACT countries. Table 3 presents the data (definitions and transformation of the variables).

Table 3 – Data definitions and sources

Variables	Definitions and sources	Transformation
Endogenous		
GDP per-capita	GDP per capita, PPP (constant 2011 international $), WDI	log
Explanatory variables	*Vector x*	
Dependency ratio	Age dependency ratio, old (% of working-age population) Age dependency ratio, young (% of working-age population) Working age population refers to individuals aged 15-64, WDI	We take the sum of both variables and then the log.
Own-account employers	Employers, total (% of total employment) (modeled ILO estimate)	log
Female participation rate	Labor force participation rate, female (% of female population ages 15-64) (modeled ILO estimate)	log
Wage and paid work	Wage and salaried workers, total (% of total employment) (modeled ILO estimate)	log
Public spending (Education)	Government expenditure per student, primary (% of GDP per capita). Iraq, source: UNICEF, 2014, The cost and benefit of ed strategies to maximize the benefits of education Algeria: Government expenditure per secondary student (% GDP per capita), UN data, UNESCO Institute for Statis Libya: tradingeconomics.com/libya/ Public spending on education (% GDP), traidingeconomics Lebanon: expenditure per student tertiary (% GDP per-cap Tradingeconomics.com	log Egypt = mean (Kuwait, Morocco, Saudi Arabia, Israel)
Public spending (Health)	Domestic general government health expenditure (% of GDP), WDI	log
Conditioning variables	*Vector Z*	
Vulnerable work	Vulnerable employment, total (% of total employment) (modeled ILO estimate)	log
Enrollment rate	School enrollment, secondary (% gross), WDI	log
Literacy rate	Literacy rate, adult total (% of people ages 15 and above), WDI	log
Density, FDI	Population density (people per sq. km of land area), Foreign direct investment, net inflows (% of GDP), WDI	log
Rural population	Rural population (% of total population), WDI	log

3.3. Results

We report the results for the ACT. Table 4 contains the average efficiency scores obtained by applying SFA and QR methodologies. In Figure 4, we plot the efficiency scores over the period 2000-2017. They reach their minimum values for Yemen for which they are considerably lower than the ones registered for the other countries. The scores are even decreasing since 2011. Egypt has a record of the lowest performance amongst the remainder ACT with an average efficiency of only 0.6. The graphs suggest that, in this country, the benefits of demographics do not translate into higher GDP per-capita (for instance the scores based on SFA show a downward trend since 2008). A similar deterioration of the efficiency scores is observed for Jordan since 2011, in spite of the fact that this country shows the best performances in terms of the level of the scores among the ACT. Morocco is the exception in the sample with upward trending efficiency scores, while in Libya and Tunisia the scores stay stable with no improvement over time. For purpose of comparison and for illustration, we also show, in Table 5, the average efficiency scores obtained for the other MENA countries based on the SFA. The general picture is that the ACT countries perform the worst (except Libya) among the MENA countries, thereby suggesting that they have been less capable than the others of turning the demographic factors into a positive dividend for the GDP per-capita.

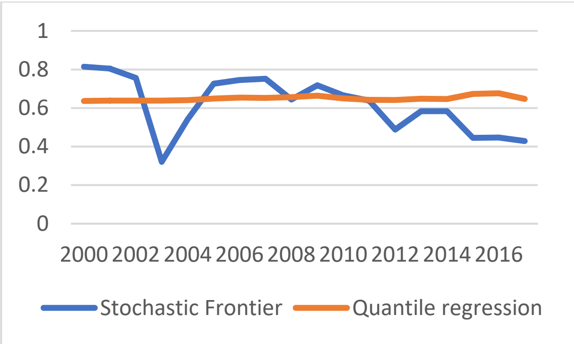
Table 4 – Efficiency scores. Arab Countries in Transition – 2000-2007 (average)

Country	Quantile regression	Stochastic frontier
Egypt	0.66	0.62
Jordan	0.78	0.84
Morocco	0.78	0.57
Tunisia	0.77	0.96
Yemen	0.44	0.21
Libya	0.70	0.93

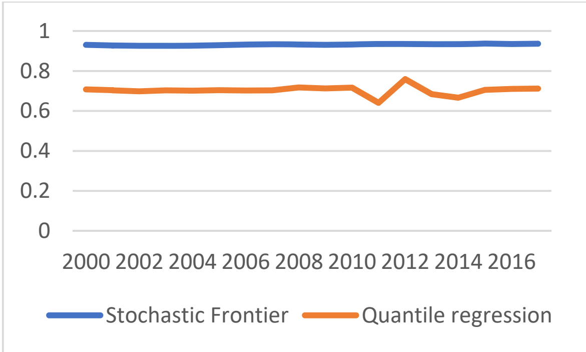
Table 5 – Efficiency scores. Middle East and North African countries – 2000-2007 (average) SFA estimates

Algeria	0.89	Lebanon	0.86	Syria	0.96
Bahrain	0.83	Kuwait	0.97	UAE	0.08
Iraq	0.46	Jordan	0.84	Morocco	0.57
Iran	0.86	Israel	0.96	Tunisia	0.96
Egypt	0.62	Oman	0.26	Yemen	0.21
Libya	0.93	Saudi Arabia	0.95		

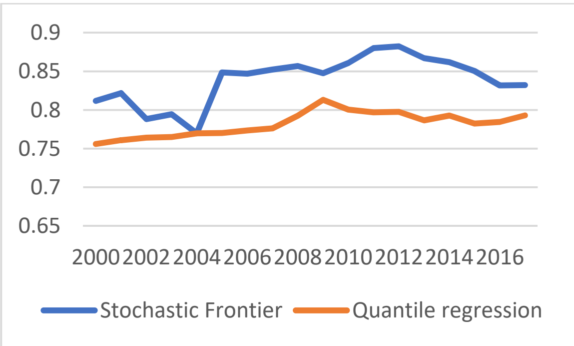
Figure 4 – Efficiency scores estimates



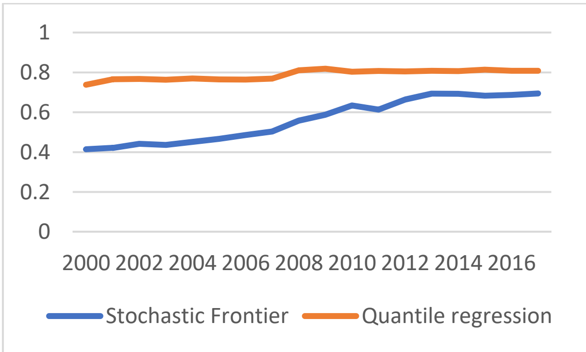
Egypt



Libya

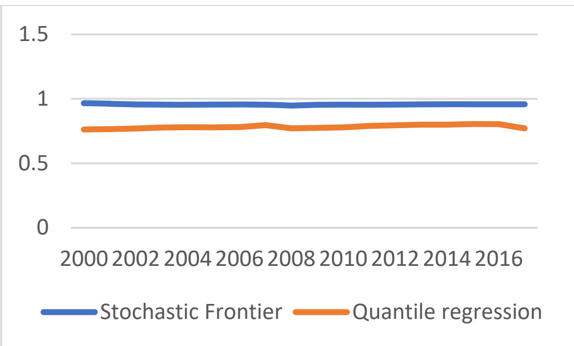


Jordan

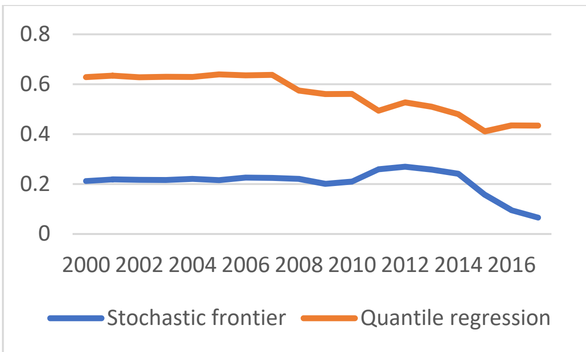


Morocco

Figure 4 (next) – Efficiency scores estimates



Tunisia



Yemen

Table 6 reports the estimates derived at the different quantiles. They reveal several interesting things.

First, the coefficients of the age dependency ratio appear to be negative. This variable is measured by the sum of age-dependency of the young (people aged 15 or younger) and old (people aged 65 or older) in percentage of the working-age population. The negative sign indicates that an increasing rate of survival of the elderly population (due to a longer life expectancy) or of the youngest people (due to high fertility rates) exercises a negative impact on income per-capita. This could be explained by the standard arguments of negative savings, accumulation and wealth effects. Typically, if one divides the life cycles in three periods of respectively childhood, adulthood and retirement, a negative demographic dividend comes from the fact that the young's and old's life cycle deficits (difference between consumption and labor incomes) are higher than the resources of the working-age people. Over-consumption, or equivalently insufficient saving, weights on capital accumulation and has a negative impact on GDP per-capita. The interesting feature here is that the strength of this negative effect materializes differently across quantiles: the higher the GDP per-capita, the stronger the negative impact. For instance, Yemen (with a GDP per-capita located between the 5th and 10th percentile) is likely to suffer more from the negative effect of the dependency ratio than Egypt, Jordan and Tunisia (with a GDP per-capita located around the 30^{th} percentiles). In a country like Bahrain (high GDP per-capita near the 80^{th} quantile) the coefficient is not significant at all, meaning that the negative effect is probably compensated by positive reallocations of resources between the generations. For instance, in countries with the highest GDP per-capita, the life-cycle deficits of the youngest and oldest are more easily financed through private transfers (parents' saving finance their young and old dependent's consumption through asset reallocation) or through public funds (by social welfare transfers like unemployment benefits or pension).

Secondly, a growing share of wage and salaried people improved GDP per-capita considerably as shown by the large estimated coefficients at the different quantiles. We see that the positive effect increases with the level of GDP per-capita. The channel behind this is a positive relationship between the salaried work and labor productivity. When people are well paid, their productivity increases. In turn, it becomes profitable for firms to hire additional workers. This pushes up labor demand and contributes to pull up wages.

Thirdly, own-account employment exerts a negative impact on GDP per-capita and the detrimental effect increases as countries are located at the lowest quantiles in the distribution (compare the estimated coefficients in Table 6). Like the variable of salaried work, own-account-employment can be considered as a proxy variable for countries' economic development. Indeed, the size of own-account employers tends to be larger in countries with a higher proportion of informal activities and larger agricultural sector. In countries with a high share of self-employment, labor productivity tends to be lower than in the paid employment sectors. The results therefore suggest that, compared with Morocco, countries like Egypt, Jordan and Tunisia may face difficulties to improve their efficiency scores over time (what we see in Figure 4) in terms of benefiting from their demographic dividend because these economies have a higher share of informal activities, or because they have a lower degree of economic diversification (this was reflected in a larger increase in own-account workers over the last two decades).

Table 6 – Quantile regression results. Arab Countries in Transition: 2000-2007

$\theta = 0.3$			$\theta = 0.1$ (Yemen)		
Dependency ratio	-0.08	-0.57	Dependency ratio	-1.13***	-4.52
Own-account employment	-0.04	-0.55	Own-account employment	-0.73***	-12,83
Wage and paid work	2.48***	9.11	Wage and paid work	0.77***	3.07
Female participation	0.21***	3.53	Female participation	0.64***	7.20
Public spending (education)	-0.53***	-5.24	Public spending (education)	-0.53***	-10.02
Public spending (health)	-0.56***	-3.77	Public spending (health)	0.98***	6.21
Intercept	1.33	1.24	Intercept	9.34***	4.77
$\theta = 0.3$ (Egypt, Jordan, Tunisia)			$\theta = 0.18$ (Morocco)		
Dependency ratio	-0.63***	-4.05	Dependency ratio	-0.20	-1.36
Own-account employment	-0.47***	-16.31	Own-account employment	-0.66***	-7.49
Wage and paid work	2.02***	6.07	Wage and paid work	0.95***	2.54
Female participation	0.78***	13.58	Female participation	0.78***	5.28
Public spending (education)	-0.95***	-7.46	Public spending (education)	-1.13***	-7.01
Public spending (health)	0.74***	4.82	Public spending (health)	0.81***	3.68
Intercept	3.06***	2.50	Intercept	6.47***	4.59
$\theta = 0.65$ (Libya)					
Dependency ratio	-0.32*	-1.83			
Own-account employment	-0.16***	-3.11			
Wage and paid work	2.57***	11.97			
Female participation	0.29***	3.68			
Public spending (education)	-0.49***	-5.07			
Public spending (health)	-0.23***	-2.50			
Intercept	1.05	0.75			

Note: The number in the second and fifth columns are the estimated coefficients. The numbers in the third and sixth columns are the Z-ratios computed as the ratio of the estimated coefficients over the bootstrapped standard errors. ***, * indicate that the coefficients are statistically significant respectively at 1% and 10% levels of significance.

Fourthly, we find a significant positive effect of female labor force participation on GDP per-capita, which could be explained by various channels. A first channel is related to the effect of fertility reduction on GDP per-capita. Indeed, an increase in the participation of women to the labor market makes small births cohort in the economy, thereby reducing youth dependency ratio. This in turn increases output per-capita. A second channel is referred to as “gender dividend”. A greater participation of women in the labor markets increases the households’ total income. A third channel works through the gender gap. For instance, policy measures or an environment that facilitate the access of girls to education improves women’s employment conditions and promote higher income. Our estimates in Table 6 show that the effect of female labor force participation is stronger in Egypt, Jordan, Morocco and Tunisia than in Libya and Yemen.

Fifthly, regarding the policy variables, we find the following results. Increasing government health expenditure results in a higher GDP per-capita in the ACT, except in Libya where the impact turns to a negative effect. The coefficient of government expenditure per student (education) is systematically negative, thereby indicating that for the bulk of the ACT the human capital policies operates in two different ways. The intuition for the negative sign of the education fiscal variable is the following. Our variable measures the budgetary allotment to primary schools (which is the basis for education). Rising public spending in primary education creates opportunities for people to enroll for schools, thereby implying a lower labor force participation. A decrease in the workforce participation reduces production. Such a negative effect of public rising public spending in primary and/or secondary education has also been found in the literature for other emerging countries (see for instance, Kumar and Saibal 2016 for India). Conversely, public spending in the health sector engenders a rise in human capital and increases the productivity of the working-age population.

Table 7 contains the results based on SFA. A difference with quantile-based regression is that they reflect the situation of all the MENA countries, since we obtained our estimates by considering the whole sample (just as we did for the quantile regressions but without the possibility of considering changing slopes across countries according to their location in the distribution of GDP per-capita). Nonetheless, the results are interesting as they show that the ACT behave like the other MENA countries. Indeed, the coefficients carries the same signs as in the quantile regressions. SFA provide some additional information as to the influence of the conditions that need to be in place for the demographic factors analyzed above to have favorable effects on GDP. As we indicated, these conditions refer to some key variables that engenders production efficiency or inefficiency: vulnerable employment, enrollment rate, etc (all the variables in the vector $\boldsymbol{Z}$ in Equation (5)).

Table 7 – Stochastic frontier regression results.
Middle East and North African countries – 2000-2007

Explanatory variables	Coefficient	Z-ratio
Dependency ratio	-0.28***	-3.75
Own-account employment	-0.31***	-8.53
Wage and paid work	0.80***	5.74
Female participation	0.43***	9.32
Public spending (education)	-0.08	-1.42
Public spending (health)	-0.60***	-8.05
Intercept	7.71***	11.01
Determinants of μ_{it}		
Vulnerable employment	0.94***	2.16
Enrollment rate	-1.37***	-3.93
Adults' literacy	1.02***	2.84
Population density	1.55***	5.41
Rural population	3.18***	7.21
Foreign direct investment	-0.02	-0.64
Intercept	-19.76***	-4.38

Source: *** indicates that the coefficients are statistically significant at 1% level of significance.

The interpretation of the signs of the estimated coefficients are done keeping in mind that μ is the expectation of production inefficiency. The estimations suggest that a larger share of vulnerable employment, a higher population density and a higher portion of rural population increase production inefficiency. Our finding about the role of vulnerable employment is in line with our comment on paid employment and own-account employment. Our results mean that vulnerable employment is conducive to a demographic tax because it induces loss in production efficiency, while at the same time inhibiting GDP growth (because of inadequate earning, low productivity or difficult conditions or work). Since most of the rural population works in the agricultural sector, our results also suggest that the MENA countries - among which the ACT- could be more efficient in rising their GDP per-capita by reducing the share of the agriculture sector in the economies. This means that when a large agricultural sector dominates over industry and services – less diversified economies – there may be an efficiency gap in the economy and this can reduce the success that the demographic variables may have on GDP per-capita.

We see that the coefficients of enrollment rate in secondary schools and FDI carry a negative sign, thereby indicating that they reduce production inefficiency. We are not surprised as higher enrollment rates lead to higher labor and total productivity. Furthermore, it is known that countries that are in a demographic transition can shift their GDP upward if the demographics is supported by external factors such as international trade or capital inflows (see World Bank 2016).

As a whole, the above results indicate that the ACT (except Morocco) have suffered from a demographic tax since they have failed to close the gap between the current GDP per-capita and its efficient level. Our results can also be interpreted in terms of inefficiency. Since the beginning 2000s, the ACT have had unchanged inefficiency scores between 56% and 79% in Yemen, 35% on average in Egypt, between 4% and 23% in Tunisia, between 7% and 30% in Libya, between 6% and 21% in Jordan. Morocco is the exception, with an average 30% inefficiency score that decreases over time. The variables that lock the potential to improve these scores are the gender gap (with a significant influence of insufficient female labor market participation), non-secured jobs (this variable carry a positive sign with GDP per-capita and has the largest size among of the coefficients in the regression), and own-account employment (an indication of the preeminence of the informal sector) and a low public spending in health.

4. Conclusion

This paper has attempted to go beyond the usual interpretation of demographic dividend and to propose an approach in terms of increasing or reducing inefficiencies in economic outcomes of changes in the variables linked to the age structure of population. The main policy implication of our results is that they need reforms to enhance the functioning of their labor markets. Combining the stylized facts and the econometric results, this paper suggests that the difficulties in transforming the current demographic transition into a window of opportunity for higher living standards could be explained by increasing inequalities of opportunity in terms of the access to secured and well-paid jobs discrimination against women and a segmentation of the labor market with a predominance of vulnerable jobs. The benefits of reaching a higher performance in terms of GDP per-capita are likely to be curtailed by a high population density and by the still dominant share of rural population.

There are several potential extensions to this paper. First, it could be interesting to perform a similar analysis from a comparative perspective, by classifying the Arab countries in four groups: i) the Arab Least Developed countries (Djibouti, Mauritania, Somalia, Sudan, Yemen), ii) the Gulf Cooperation Council countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates), Mashreq countries (Egypt, Iraq, Jordan, Lebanon, Palestine, Syrian Arab Republic) and Maghreb countries (Algeria, Libya, Morocco, Tunisia). The reason is that these subgroups, though experiencing a demographic transition, still experience specific demographic changes: different labor migration profiles, mid-age earners have different income level, different amount of remittances results into differences in the support ratios, etc.

Secondly, besides the poor quality of jobs as a factor potentially gripping the capability of countries to reach their efficient GDP per-capita level, variables providing a more complete overview of the way in which degraded labor markets pave the way to a demographic tax are needed in the analysis: the share of underemployed people, the share of working poor persons, the individuals leaving the labor markets and no longer looking for jobs, the disenfranchised (a proxy of social unrest).

Thirdly, comparative analyses could be useful to see whether for instance the Asian countries have benefited from a third demographic dividend, in addition to the first and second dividends as pointed by the literature.

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