The Nexus between Components of Population Change and Its Impact on Timing of Opening and Duration of Reaping Demographic Dividend: Can This Period of Economic Miracle Be Augmented[1]?
Empirical Evidence from the Arab Countries

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Abstract

The genesis of the present paper is **a serendipitous** demographic phenomenon. Whilst analyzing the ageing phenomenon of League of 22 Arab States, the author observed that some States demonstrated multiple openings of "demographic window"- a phenomenon not documented in demographic literature. This observation is incompatible with the statement given by Lee and Mason (2006) that 'demographic dividend is onetime opportunity during a complete cycle of demographic transition'. The statement is unconditional being true only if the country is closed for international migration. Further analysis revealed that the reason behind the multiple openings of demographic window might be international migration. The present paper attempts to study the effects of fertility projected under high and low fertility variant assumptions, international migration (age-selective emigration and immigration), and mortality decline on the timings of opening and duration of demographic window. Based upon the results, the paper gives a schematic framework portraying the relationship between the selected variables on the timings and duration of demographic window of economic opportunity. Finally, the paper discusses how through demographic and social engineering (the newly coined terms, explained in the text) the timings of opening and duration of demographic window could be planned to reap maximum economic benefits at appropriate time and for desired duration.

Introduction

Prior to the publication of the research article by Bloom and Williamson (1998), entitled "Demographic Transitions and Economic Miracles in Emerging Asia", *World Bank Economic Review*, 12: 419-56, little was known to the Economist about the role of the period of demographic dividend in boosting country's economy. In several countries of the West this favourable period passed away unnoticed during their demographic transition. None of these countries could take benefit of the period of demographic dividends. Since the existing demographic literature says that the period of demographic dividend is onetime opportunity and lasts for a short period, these statements suggest that once this period passes away, the country loses the chance of getting economic benefits for ever [see Lee and Mason, 2006]. An obvious question is that **"can't the favourable situation of reaping demographic dividends be restored back?"** The answer to this question is "probably yes!". The present paper focuses on this issue and suggests the ways to reap the demographic dividends at opportune time and desired duration.

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While analyzing the ageing phenomenon of 22 Arab countries, the author accidentally found that a few Arab countries experienced multiple openings of demographic window during complete cycle of demographic transition. This phenomenon gave a clue to break this demographic impasse. So, we first thought to find the effects of fertility, mortality and international migration (age-selective emigration and immigration) on the timings of opening, closure of demographic window and its duration. Knowledge of these factors and the mechanism through which they affect the timing of initiation of demographic window and its duration may perhaps be helpful in exercising control to reap demographic dividends at appropriate time and desired duration. The specific objectives have been formulated as under:

Objectives

- To find the effects of the fertility projected under high[3] and low[4] variantassumptions on the timings of opening, closure and duration of demographic window of economic opportunity;

- To discuss the effects of mortality change, age-selective emigration and immigration on the timing of opening of demographic window and its duration; and

- To discuss the feasibility of extending the period of demographic window and/or reaping the economic benefits at preferred time and desired duration, through demographic and social engineering (the words coined by the author are explained in the paper elsewhere).

Data and Methods

Effects of the High and Low Fertility Variants

To accomplish the above objectives and for illustrative purpose we use the data from the revised version of the *World Population Prospects 2012* - the official United Nations population estimates and projections released in 2013. For finding the effects of the high and low fertility variants on the timings of opening and closure of demographic window, the population projections made by the UN under both high and low variant assumptions of fertility decline have been used for 150 years period from 1950 to 2100.In case of mortality, only one variant was used in the UN population projections. It has been observed that in a majority of countries level of mortality has either been stabilized or may be approaching to its lowest level during next 50 years. However, this is not the situation in case of fertility. Level of fertility is still high in some developing countries. Thus, in this paper, we have used the UN population projections made underthe high and low variant assumptions of fertility decline with one course of mortality. It may be mentioned that under the high variant the fertility was higher by one child per woman at the end of projection period than that of projections made under low variant (U.N. 2012).

Effect of Age-Selective Migration

Since the data on international migration by age is not available, we attempt to assess the effect of age-selective emigration and immigration on the timing of opening and duration of demographic window through its patterns in the Arab states. To find the patterns of net migration by

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[3]**High - Fertility Assumption**:

Under the high variant, fertility is projected to remain 0.5 children above the fertility in the medium variant over most of the projection period by 2045-2050, fertility in the high variant is therefore half a child higher than that of the medium variant. That is, countries reaching a total fertility of 1.85 children per woman in the medium variant have a total fertility of 2.35 children per woman in the high variant at the end of the protection period. (UN 2012).

[4]**Low - Fertility Assumption**:

Under the low variant, fertility is projected to remain 0.5 children below the fertility in the medium variant over most of the projection period. By 2045-2050, fertility in the low variant is therefore half a child lower than that of the medium variant. That is, countries reaching a total fertility of 1.85 children per woman in the medium variant have a total fertility of 1.35 children woman in the low variant at the end of the projection period. (UN 2012).

economic development, the 22 Arab countries have been classified in four groups[5] mainly on the basis of their geographical proximity and economic and social characteristics. The four groups with the names of their constituent countries are given in the footnote. The net immigration rate has been taken as a proxy to ascertain the level of economic development of the country. To find the trends and patterns of international migration in 22 Arab States, medium variant of the revised population projections prepared by the United Nations in 2012 and released in 2013 have been used.Usually labour exporting countries are economically less developed as they cannot provide employment and/or better wages to their unskilled/semiskilled/skilled populations. A negative sign of Net Migration Rate (NMR) shows out migrating countries and its magnitude may be assumed as a substitute for the measure of the level of economic development. Non-availability of the magnitude of net migration even by broad age-groups (0-19; 20-64; and 65+) has disabled the researcher to find quantitatively the effects of the emigration of the population in working age-groups and of the immigration of return migrants in 65+ ages, on the timings of opening and closure of demographic window.

Potential Support Ratio

To find the size and timing of first demographic dividend, we use Potential Support Ratio (PSR) which is the reciprocal of the modified demographic dependency ratio suggested by Miller (2008). The author showed that the modified demographic dependency ratio exactly fits (age-averaged) economic dependency. He demonstrated near equivalence between demographic and economic dependency and preferred the latter over the former. The PSR is defined as:

$$PSR = \frac{W_{25-64}}{0.9*D_{0-24} + D_{65+}}$$

Where, W_{25-64} is the working population in the age group 25-64, D_{0-24} and D_{65+} are dependent persons in age group (0-24) and (65+), respectively.

Empirical Results

Trajectories of Potential Support Ratios of Arab Countries, 1950-2100

Using the above formula, the PSRs have been computed for 22 Arab countries from the UN population projections obtained under the high variant and the low variant fertility assumptions with only one mortality assumption. **A numerical value of PSR greater than one implies that production exceeds the consumption and the surplus available can be used for economic growth and development of the state.** The point at which the trajectory of PSR crosses the line PSR=1, is the time (year) at which the demographic window opens. The trajectory first continues to go up and later takes downward turn, comes down and cuts again the axis PSR=1. The point at which the trajectory cuts the axis again is the year at which the demographic window closes. The time elapsed between the opening and closure of the window is called the period of demographic dividend. Figure 1 below presents the trajectories of potential support ratios for 22 Arab countries from 1950 to 2100 classified under four groups of countries, namely, *Mashreq* countries; *Maghrib* countries; Gulf Cooperation Council Countries; and Least Developed Countries.

Timings of Opening and Closure of Demographic Window

Based on the trajectories of potential support ratios for 22 Arab countries presented in Figure 1,the expected years of opening and closing of demographic window of economic opportunity and its duration computed under high and low fertility variant assumptions have been ascertained and

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[5]The four groups constituted are named as A.*"Mashereq* Countries"; B.*"Maghreb* Countries"; C."Gulf Cooperation Council (GCC) Countries"; and D."Least Developed Countries. Group A contains six countries, namely, Egypt, Iraq, Jordan, Lebanon; Palestine; and Syria. Group B consists of four countries - Algeria; Libya; Morocco, and Tunisia. The group C includes six countries, namely, Bahrain; Kuwait; Oman; Qatar; Saudi Arabia; and UAE; whereas the Group D. is comprised of six countries, namely, Comoros, Djibouti, Mauritania, Somalia; Sudan; and Yemen, designated as the "Least Developed Countries" (See Saxena, 2013).

presented in Table 1. The table gives some interesting results. Among six *Mashreq* countries Lebanon is the only Arab state where the demographic window opened first time as early as in 2010 under both fast and slow variants of fertility assumptions. Egypt and Jordan are expected to open their window of economic opportunity in 2020 and 2025, respectively (UNESCWA, 2013). In rest of the countries in this group, the demographic window is expected to open either late or may not open during the projection period.

Among four *Maghreb* countries, namely Algeria, Libya, Morocco, and Tunisia, all are expected to open their demographic window circa 2015. Out of six Gulf Cooperation Council (GCC) Countries, United Arab Emirates (UAE) was the first in whole of the Arab countries to have the opening of its demographic window of economic opportunity as early as in 1970. Later, Bahrain and Qatar witnessed openings of their demographic window in 1985. In GCC countries, leaving Oman, in rest of the five countries the fertility (TFR) has been near or below replacement level (see Table 1).

As expected, all the six least developed countries will have a PSR value less than one for a very long time (see Figure 1). Leaving Djibouti which may be the first in this group of countries to have opening of the demographic window in 2025; none of the remaining five countries of this group is expected to have the opening of their demographic window earlier than 2035. In these countries the demographic window is expected to open at much later date and may also close quite earlier, thus leaving a short duration during which the economic benefits could be harvested. All these six countries of this group had high fertility; Total Fertility Rate (TFR) circa 2012 ranged from a minimum of 3.5 for Djibouti to 6.7 for Somalia (see Table 1).

Due to high fertility, the 'Young age dependency ratio[6] is high which drags the PSRs trajectory downwards to check it going upwards and in turn delays the time of opening of demographic window. On the other hand, the increase in 'Old age dependency ratio[7]' due to the influx of return migrants of ages 65+ and improvement of life expectancy may forcibly pull-down the PSR trajectory and close the demographic window early.

Multiple Openings of Demographic Window

While looking at the trajectories of the Potential Support Ratios (PSRs) for 22 Arab countries, it is found that the trajectories for three Arab states, namely, Algeria, Morocco, and UAE cut the axis PSR=1 three times implying that the window of economic opportunity opened thrice. This phenomenon of multiple openings of demographic window though for short durations, but leaves the question that "under what conditions would it happen?" This phenomenon has not been reported in demographic literature and its reason needs to be explained. It is empirically observed that the phenomenon of multiple openings of demographic window may be observed in countries having relatively small populations with comparatively large international migration (age-selective emigration and immigration).
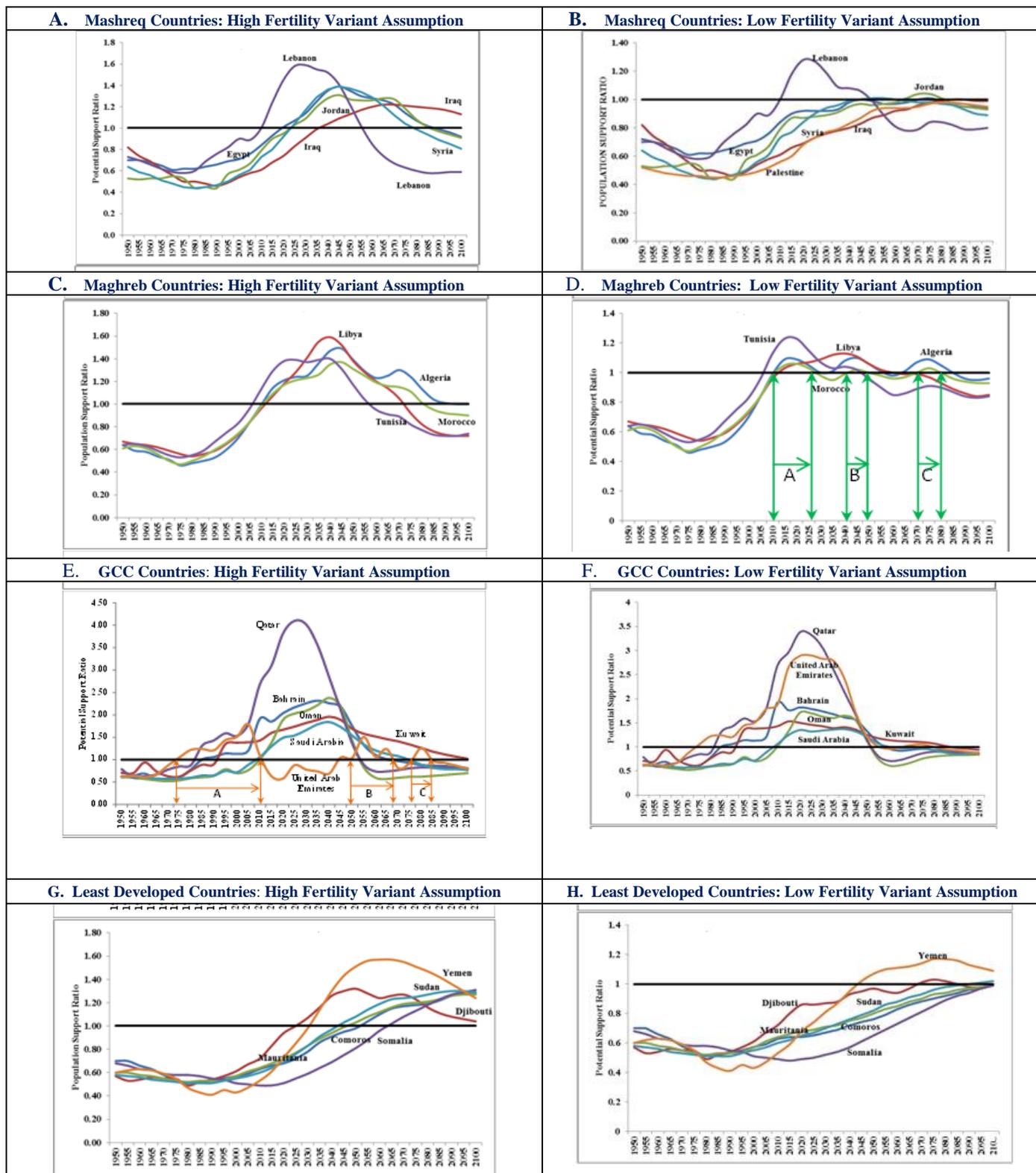
In such countries large emigration from working age-groups in search of employment or for better career prospects and heavy immigration of expatriates in old age-groups (65+) after retirement may severely affect the 'young age' and 'old age' dependency ratios, respectively, which in turn pull the trajectory of PSR downwards. Both the dependency ratios are quite sensitive for the change in emigration and immigration, respectively.

Increase in young age dependency ratio drags the PSR trajectory downwards and thus delays the opening of demographic window; whereas, increase in old-age dependency ratio pulls down the PSR trajectory to meet the PSR=1 axis early and thus shortens the duration of demographic window of economic opportunity. The total duration of demographic window is determined by the net effect of both the dependency ratios (see Fig. 3).

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[6]Young age dependency ratio is defined as: $\dfrac{0.9*D_{0\text{-}24}}{W_{25\text{-}64}}$

[7] Old age dependency ratio is defined as: $\dfrac{D_{65+}}{W_{25\text{-}64}}$

**Figure 1: Trajectories of Potential Support Ratios for Arab Countries Under
High&Low Fertility VariantAssumptions, 1950-2100.**

A. Mashreq Countries: High Fertility Variant Assumption	B. Mashreq Countries: Low Fertility Variant Assumption
C. Maghreb Countries: High Fertility Variant Assumption	D. Maghreb Countries: Low Fertility Variant Assumption
E. GCC Countries: High Fertility Variant Assumption	F. GCC Countries: Low Fertility Variant Assumption
G. Least Developed Countries: High Fertility Variant Assumption	H. Least Developed Countries: Low Fertility Variant Assumption

Source: Computed from United Nations, 2012 (http://www.esa.un.org/unpp)

Table 1: Timings of Opening and Closure of Demographic Window for Arab Countries Under High & Low Variant Fertility Assumptions, 1950 - 2100.

Country	Timings of Opening and Closure of Demographic Window under						Difference in Durations of Demog. Window (Years)	TFR* (2012)
	High-Fertility Variant Assumption			Low-Fertility Variant Assumption				
	Year of Opening	Year of Closure	Duration of Demog. Window (Years)	Year of Opening	Year of Closure	Duration of Demog. Window (Years)		
Mashreq Countries								
Egypt	2020	2090	70	2045	2070	25	45	2.8
Iraq	2035	After 2100	-	Not Opened	---	---	-	4.1
Jordan	2025	2085	60	2065	2080	15	35	3.3
Lebanon	2010	2055	45	2010	2050	40	5	1.5
Syria	2025	2080	55	2040	2065	25	30	3.0
Palestine	---	---	---	Not Opened	---	---	---	---
Maghreb Countries								
Algeria**	2010	2095	85	2010	Multiple Openings	A + B + C =35	50	2.8
Libya	2015	2070	55	2015	2060	45	10	2.4
Morocco	2015	2080	65	2015	Multiple Openings	A + B + C =35	30	2.7
Tunisia	2010	2055	45	2010	2045	35	10	2.2
Gulf Cooperation Council Countries								
Bahrain	1985	2065	80	1985	2055	70	10	2.1
Kuwait	1995	2100	105	1995	2085	90	15	2.6
Oman	2010	2050	40	2010	2050	40	00	2.9
Qatar	1985	2050	65	1985	2050	65	00	2.0
Saudi Arabia	2010	2075	65	2010	2060	50	15	2.7
U.A.E.**	1970	Multiple Openings	A+B+C= 75	1975	2050	75	0	1.8
Least Developed Countries								
Comoros	2050	After 2100	-	Not Opened	-	-	-	4.8
Djibouti	2025	2100	75	2070	2085	15	60	3.5
Mauritania	2045	After 2100	-	Not Opened	-	-	-	4.7
Somalia	2065	After 2100	-	Not Opened	-	-	-	6.7
Sudan	2045	After 2100	-	2090	After 2100	-	-	4.5
Yemen	2035	After 2100	-	2045	After 2100	--	---	4.2
*Source of TFR: The World Bank [http://data.worldbank.org/indicator]								

** **Multiple Openings** –
Algeria - Duration of Demographic Window Under High- Fertility Variant Assumption = **85 Yrs**
Algeria –Duration of Demographic Window Under Low-Fertility Variant Assumption = [A + B + C] = **35 Yrs**.

Morocco - Duration of Demographic Window Under High- Fertility Variant Assumption = **65 Years**
Morocco - Duration of Demographic Window Under Low-Fertility Variant Assumption = [A+ B + C] = **35 Yrs.**

UAE – Duration of Demographic Window Under High- Fertility Variant Assumption [A + B + C] = **75 Yrs**.
UAE -- Duration of Demographic Window Under Low-Fertility Variant Assumption =**75 Yrs**.

Net Migration Rate[8]: Direction, Magnitude and Economic Development

As mentioned earlier, for the purpose of analysis, the 22 Arab states have been classified in four groups mainly on the basis of their geographical proximity and economic and social characteristics. The four groups with the names of their constituent states are given in footnote 5 above (also see Fig.2). The net migration rate can be taken as a proxy to ascertain the level of economic development of the country. Usually labour exporting countries are economically less developed as they cannot provide employment and/or better wages to their unskilled/semi-skilled/skilled populations.

A negative sign of NMR shows out-migrating countries and its magnitude may be assumed as a substitute for the measure of the level of economic development. Figures 2(A, B, C and D) present trends and patterns of NMR during 1950-2100, of countries classified under four groups, namely, *'Mashreq'*, *'Maghreb'* 'Gulf Cooperation Council (GCC)' and 'Least Developed' countries, respectively. Figure 2A shows trends of NMR of six Arab states, namely, Egypt, Iraq, Jordan, Lebanon, Palestine and Syria.

As can be seen from the figure, net outmigration was high and fluctuated between 139 per 1000 population to 189 per 1000 population during 1980-2000. Later, however, it showed a downward trend. The emigration rate in Egypt is likely to drop to 53 persons per 1000 in 2020-2025. It appears that the economy of Egypt is on the path of recovery. Iraq was also labour exporting country till 2010 but is expected to take its expatriates back during 2010-2025. Lebanon had an emigration rate of 44 per 1000 population during 1980-90. However, the trend of migration witnessed a reversal of trend during 1995-2005. The pattern of net migration is consistent with the political situation of the country. Lebanon witnessed civil war from 1975-1990 and the post-war period covering 1990-2005 was the period of reconstruction of the country. During this period the return of a section of population took place who had emigrated earlier during the civil war in the country.

Jordan had been a population receiving country during 1980-1995 but in 1995-2000 it had net outmigration rate of 38 per 1000 population. Among *Mashreq* countries, excluding Iraq, the rest of the five Arab states are expected to witness net out migration. Syria may have a net outmigration rate of 35 persons per 1000 population per year, of the country.

All the four *Maghreb* countries (barring Algeria and Libya during 1980-1985) had negative NMR and are likely to witness a net outmigration rate throughout the study period. Among the four countries of this group, the net outmigration rate was highest for Morocco which experienced outflow between 100 and 135 persons per 1000 population per year during 1995-2010. Algeria also showed a high net outmigration rate up to 2010 and is likely to experience the same up to 2025. Though Libya and Tunisia were out migrating countries, the NMR is not so high. It is expected to be 4 persons per 1000 population during 2010-2025 (see Figure 2).

The six GCC countries presented some interesting trends of NMR. Except for Kuwait for the period 1990-1995, Oman for the periods 1995-2000 and 2000-2005, Qatar for the period 1990-1995 and Saudi Arabia for the periods 1990-1995 and 1995-2000 during which NMR was negative, the NMR was positive in the rest of the countries and periods. The patterns of NMR clearly show that almost all the six GCC countries had a large number of immigrants every year during the period 1980-2010 and the same trend is likely to continue up to 2020-2025. Among most popular countries of destination were the UAE, Saudi Arabia, Kuwait and Qatar. The high rate of immigration in these countries reflects their vibrant economies. These are the richest states with the highest per capita GDP among all the Arab countries.The next cluster of six states, namely, Comoros, Djibouti, Mauritania, Somalia, Sudan, and Yemen designated as 'Least Developed' countries had the least per capita GDP in the entire Arab world. Nearly all the states of this group have had negative NMR implying that these were labour exporting countries.

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[8]Net migration rate (NMR) is defined as the number of immigrants minus the number of emigrants in a calendar year divided by the mid-year population of the receiving country over that year. NMR is expressed as net number of migrants per 1,000 populations.

Figure 2: Trends and Patterns of Net Migration in Arab Countries, 1950-2100

Source: Computed from United Nations, 2012 (http://www.esa.un.org/unpp)
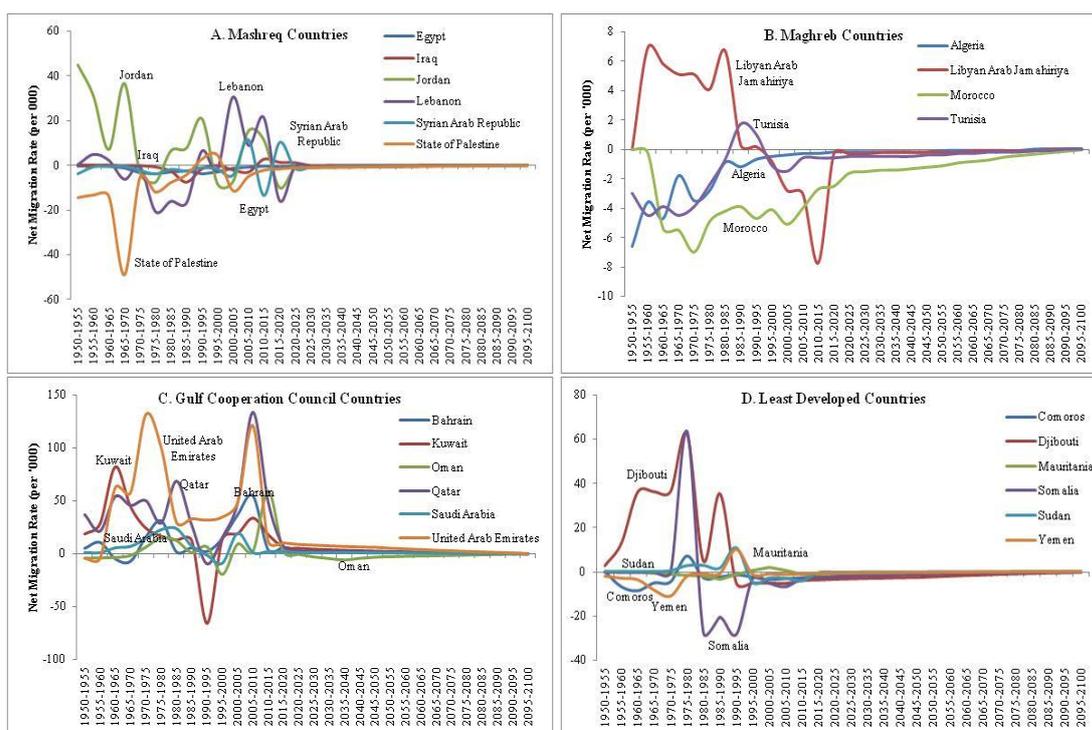
Among these six states, Somalia had heavy net outmigration till 2010. However, its NMR is likely to decline during 2010-2025. The net out migration rate (NMR) for Somalia dropped from 166 persons per 1,000 populations per year to 126 persons in 1980-1985. However, during the period 1985-1990 the NMR rose to 179 in 1990-1995 and thereafter again showed a downward trend. A heavy net out migration was seen in Sudan during the 15-year period, viz., 1985- 2000. However, in the other periods under study, the Sudan had positive NMR implying that the country was economically prepared to accommodate immigrants. Excluding the period 1990-1995, Yemen had negative NMR in rest of the periods. Though Comoros and Mauritania had negative NMR, the rate was small. Djibouti and Mauritania are among the least developed countries. It seems that these countries had per capita GDP below the threshold level required for international migration. The overall scenario of the six countries of this group suggests poor economic conditions of their citizens (UNESCWA, 2013).

Effects of Age-selective Emigration and Immigration on Timings of Opening, Closure and thus the Duration of Demographic Window - Examples from the Arab Countries

As stated earlier, due to non-availability of data on age-selective emigration and immigration, it is not possible to show quantitatively their effect on the duration of demographic window (DDW). However, for finding conclusive evidence indirectly of the impact of international migration, on Duration of Demographic Window (DDW), we first state the following three postulates:

Postulates[9]:

(i) An economically better off country, if experiences large immigration, it would necessarily be in working ages (25-64);

(ii) If a less developed country shows heavy emigration, it would be from the working ages in search of better employment avenues in host country; and,

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[9]Postulates are self-evident assumptions which do not require any proof. They are accepted as truth and used as the basis for an argument or theory.

(iii)   If a less developed country experiences large immigration, then the latter would be in 65 and above ages. These expatriates are generally those persons who return to their home country after retirement from the service in the host country.

Reason for Short/Long Duration of Demographic Window (DDW)

For finding the effect of age-selective emigration or age-selective immigration on the duration of demographic window (DDW) of a country, we first see to which group of countries it belongs to; at second step, we look at the pattern from Fig.2 of net international migration of that country and ascertain whether the country had large emigration or immigration. Finally, following the guiding principles laid down in the above postulates, we find the reason for the long or short duration of the DDW of the country of interest. For illustrative purpose, we selected 7 out of 22 Arab countries, namely, Lebanon, Tunisia, Oman, Kuwait, Jordon, Morocco and Djibouti, and found the reason of long/short durations of the demographic window. The results are presented in Table 2 below. Likewise, the reason for having long or short duration of DDW, can be found for rest of the 15 Arab countries.

As stated earlier non-availability of age-specific data on international migration has been a constraint in finding quantitatively the effects of emigration from working age-groups and immigration in ages 65 years and above due to return migration, on the timings of opening and closure of demographic window and thus the total duration of available period of economic opportunity. However, to have some idea how emigration and immigration may affect, we give the examples from 22 Arab states.

Due to political unrest in several countries of the Arab region, a vast number of youths have migrated out of the country. The out migration stream of youths depletes the working age population and in turn pushes both young and old dependency ratios upwards. Further, in Arab countries, due to prevailing unemployment a large number of skilled, semi-skilled and unskilled workers are out migrating from the country. Among the emigrants, the unskilled workers who are generally more in numbers are not absorbed as their nationals in host countries. Such expatriates after retirement are forced to return to their native country. Thus, old age dependency ratios in country of origin get further upward push from the return migrants of expatriates after retirement and this in turn pulls down the PSR trajectory forcibly to close the demographic window relatively early.The increase in both the dependency ratios pulls the PSRs down and keep trajectory to remain below the line PSR=1. The countries experiencing such situation may not have the opportunity of opening the demographic window early (see Figures1: G & H).

Table 2: Reason for Short/Long DDW* Under High and Low FertilityVariant Assumptions, in Selected Arab Countries

Under High-Fertility VariantAssumption			Under Low-FertilityVariantAssumption		
Country	DDW* in Years	Reason: Why is DDW*Short/Long?	Country	DDW* in Years	Reason: Why is DDW* Short/Long?
Lebanon	45	Large Emigrations from Working Ages	Jordon	15	Large Immigrations in 65+ Ages
Tunisia	45	Large Emigrations from Working Ages	Morocco	10	Large Emigrations From Working Ages
Oman	40	Large Emigrations from Working Ages	Djibouti	15	Large Immigrations in 65+ Ages
Kuwait	105**	Large Immigrations In Working Ages	Kuwait	90**	Large Immigrations in Working Ages
Note 1. DDW* : Duration of Demographic Window. Note 2. ** Longest					

The Conceptual Framework

Based upon previous discussions, the following factors are found to affect the timings of opening, closureand duration of demographic window:

(i) Fertility; (ii) Mortality; (iii) Age-selective Emigration (from 20-64 ages); (iv) Age -- Selective Immigration (in 65+ ages); and (v) Net effect of all the above factors impacts both the dependency ratios and ultimately on the timings of opening, closure and the duration of the demographic window of economic opportunity.

The nexus between the above factors and their net effect on the timings of opening, closure and the duration of demographic window of economic opportunity are shown by the conceptual framework in Fig.3. As can be seen from the figure, the timings of opening and closure of demographic window and hence its total duration are dependent on the two dependencies ratios namely, 'young age dependency ratio' and 'old age dependency ratio'; whereas these dependency ratios are sensitive to emigration/immigration in working age-groups (25-64) and to immigration in age-groups 65+, respectively.

Feasibility of Extending the Period of Demographic Dividend through Demographic and Social Engineering

The demographic literature states that during the course of demographic transition, every country gets a one-time economic opportunity – called the demographic dividend. This period of economic opportunity is short lived and its duration varies from country to country. We feel that the above statement may be true if and only if the country is closed for international migration. Countries having international migration (Emigration and Immigration), the nexus between fertility and mortality declines and the timings of the onset and closure of the period of demographic window becomes complex. The statements about the period of demographic dividend that it is one-time opportunity for a country and also that it is short lived may not hold true universally. From examples of the Arab countries, it is evident that the increase in young age dependency ratio may pull down the PSRs and may delay the time of opening of the demographic window; whereas, the increase in the old age dependency ratio may forcibly drag the PSR trajectory downwards to close the window early. The question thus arises: "Is it possible to extend the duration of the period of economic miracle through demographic and social engineering?".

Figure 3: Nexus between Fertility, Mortality, Age-Selective Emigration, Immigration and Duration of Demographic Window
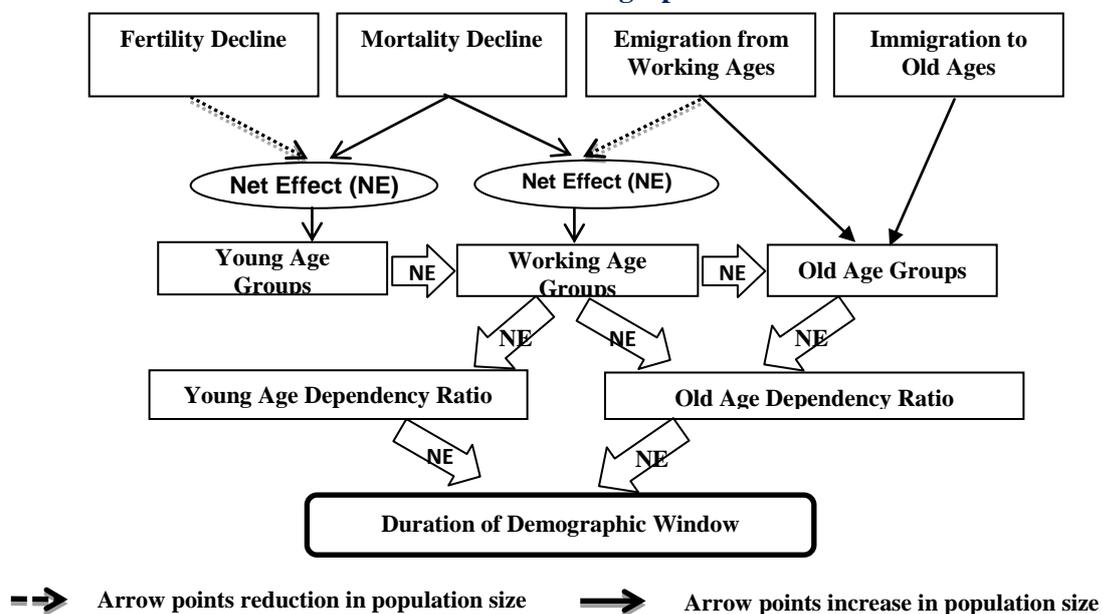
What is "Demographic and Social" Engineering?

"Demographic engineering" means planning of 'Births', regulation of emigration of labour force in age-group (25-64) and immigration in old age groups (65+) to mitigate the effects of high dependency ratios. How mortality decline affects dependency ratios? The impact of mortality decline is relatively more in increasing infant and child survival which in turn may increase child population and thus the young age dependency, as compared to the old-age dependency. However, the latter increases sharply if expatriates' return (in bulk) from host country after retirement. Again, both the dependency ratios increase heavily if the young population emigrates. All these factors affect adversely on the timings of opening and closure of demographic window of economic opportunity. Therefore, dependency ratios are the key players responsible in governing the path of the PSRs and thus in controlling the timings of opening and closure of demographic window and its duration.

Perhaps, for demographic engineering, a country can use their demographic dependency ratios as its demographic barometer. If the critical value exceeds its highest limit, efforts may be made to bring back young expatriates in phases to absorb them in productive sector of economy. In addition, working conditions of Scientists, Doctors, Engineers,highly educated and skilled persons may be improved so that they do not leave the county. Perhaps such strategy may offset the adverse effects of the slowing down of labour supply due to continued decline in fertility and the increase in old age dependency ratio on account of falling mortality, on the national economy. The decision about the size of the labour force to be imported during a given period of time has to be governed by two parameters:

(i)   Critical value[10]of the dependency ratio; and

(ii)   The number of the immigrants which the country can gainfully employ during the period.

Such exercises may be repeated by country's Economists as and when the dependency ratio exceeds its critical value. Further, fertility level in a country should not drop below the replacement level. If fertility level goes down much below the replacement level, it may prove counterproductive to country's economy in future. For instance, in early 1970's several developed countries enthusiastically made efforts to bring down their fertility much below replacement level in a short time. These countries are now facing acute shortage of labour force and to sustain their economies they are importing both skilled, semi-skilled and unskilled manpower from countries with surplus labour. China had earlier adopted one child policy which after realizing its adverse effects on country's economy in future, the country had to abandon it. In case of India, the slow decline of fertility which was high in most of the northern states of India during 1960s and early 1970s was perhaps a blessing in disguise. Presently, India's population pyramid is bulging in working ages which is demographically a favourable situation for Indian economy. The surge in the young population is good for country's economy provided enough employment opportunities are created for gainfully employing new entrants in the productive sector of economy. Maximum advantage from this favourable demographic situation could be obtained if and only if the country has full employment. However in case of India, since fertility was high earlier followed by moderate decline, the country may have a longer period of harvesting demographic dividend which may last for another 80-85 years. The proposed Birth planning may also help to ensure the supply of continued stream of labour force required in future. Thus, it seems possible to extend the duration of demographic window and also plan to have the period of demographic dividend at times when the country is well prepared to provide employment to the new entrants in the working age-groups, through demographic engineering so that the maximum economic benefits could be obtained.

The "Social engineering" is concerned with ascertaining objectively the cut-off point for old age for a country. In view of increasing longevity and continuously improving health conditions of elderly world over, we first ask the question "Whom should we call an old person?" – a 65 years old or 70 years old or a 75 years old person. In a few Middle East countries where the expectation of life

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[10]The critical value of the dependency ratio is to be fixed by country's Economists by taking into consideration the size of the new entrants in working age-groups, requiring jobs on future dates, pragmatic estimates of new jobs to be created in public and private sectors, and the estimate of the size of potential emigrants who may emigrate; and resources available.

at birth is quite high (approaching 80 years), we found even a significant number of 75 years old persons engaged in labour force. Thus, a cut-off age of 65 years for mandatory retirement from work may be too early to citizens of some countries. It is therefore, necessary to devise an objective way to decide the age at which a person of a country should be regarded as 'old' person. Once the cut-off for old age is decided, the same increased age may be fixed for mandatory retirement of the citizens of the country. Such augmentation in retirement age limit may not only help in lessening the old-age dependency burden but may also raise self-esteem which is important for healthy life and longevity (Saxena and Kumar 1997).However, since the life expectancy is increasing, the exercise of ascertaining for the new cut-off for the 'old' age may be repeated after every ten years.

Further, enhancement of self-reliance of old persons is crucial to facilitate their continued participation in country's economic growth. Necessary conditions are to be developed to enable elderly people to lead self-determined, healthy and economically productive lives and to make full use of their skills and abilities for the benefit of the society. So long a person is healthy and mentally agile, he/she should contribute to the national economy through engaging him/her in some suitable work. Human resource is very precious and should not be thrown astray. Every person irrespective of his/her age if physically and mentally fit should keep himself/herself engaged in some work and contribute to national economy. Support of governmental, non-governmental organizations and families will go a long way to achieve this goal (Saxena,2008).

Conclusions

In the present paper attempt has been made to find the effects of components of population change, namely, high and low variants of fertility assumptions', 'age-selective emigration', 'age-selective-immigration',and 'mortality change' on the timings of opening, closure and the duration of demographic window. The relationship between the factors effecting on the end variables is complex but comprehensible. The young age dependency ratio and the old age dependency ratio have emerged as the key players in controlling the timings of opening, closure and duration of the demographic window during which economic benefits can be harvested if enough employment opportunities are created for the eligible population entering into the working ages. The young age dependency is affected directly by fertility. In case fertility declines and mortality also declines then the net effect of the two may not be severe since decline in mortality will differentially affect different age segments of child population. Decline in mortality i.e., increase in the expectation of life at birth (e^0) will affect both infant mortality and under-5 mortality which together may compensate for the decline in fertility. The effect of young age dependency may be relatively less on the timing of opening of demographic window. On the other hand, in normal course the old- age dependency is affected by mortality decline which results in increase in the old- age dependency ratio that in turn may close the demographic window early. However, in case of return of expatriates (if takes place in bulk) the old-age dependency ratio may shoot up and pull down the PSR resulting in sudden closure of demographic window. Nevertheless, if the working age-group population increases through immigration in working ages, the young age dependency would decrease which may help in opening of demographic window relatively earlier. However, the total duration of the demographic window would be based on the net effect of both young and old age dependencies. All these relationships have been depicted by schematic nexus given in Fig. 3 above.

Further, turning our attention on the effects of high and low fertility variants, it is found that other factors of population change being constant, high fertility variant may invariably yield relatively longer duration of demographic window. In countries with low fertility the duration of demographic window may be shorter. It may thus be concluded that the countries with high fertility may have comparatively longer duration of demographic window provided old-age dependency ratio does not experience much increase due to mortality decline and immigration of expatriates after retirement to their home country. It may thus be recommended that for getting longer durations of demographic window for reaping economic benefits for a longer time, the fertility level should not go below replacement level. Continuation of decline in fertility to low levels in a country for a long-time may eventually result in economic disaster.

Finally, the paper discusses about the feasibility of extending the duration of demographic dividend through demographic and social engineering. While explaining the meaning of 'demographic engineering, the author suggested two ways: First through "Birth planning", and by regulation of emigration of labour force in age-group (25-64) and immigration in old age groups (65+) to mitigate the effects of high dependency ratios. The birth planning includes planning of births by newlyweds at staggering intervalsto ensure copious supply of workforce at the entry age 25 years and beyond as per the estimated size of labour required at different ages of the working age-group. Planning of births also needs complete registration of marriages and births so that social workers could pay visits at regular intervals to the households having the newlywed couple for their counseling: "when should they have first, second, …,birth?. Giving a detailed description of the scheme of birth planning is beyond the scope of this paper. However, this much can be said at this point that if this scheme is planned and implemented in its letter and spirit, it would go a long way in achieving two objectives - first, to have desired number of births at required time to ensure regular and unintrupted supply of potential labourforce to working ages, and second, to fulfill family planning targets in order to control population growth.

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