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The World at the Crossroad
Demographic Polarization and Mass Migration
Global threat or global opportunity

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Abstract

The unstoppable progress of the demographic transition is determining a progressive decline of the rates of growth of the total population and working age population of the planet, two phenomena that could have a very positive global socioeconomic and environmental impact. Unfortunately, it is also determining a growing demographic polarization between an increasing number of countries, the most developed ones, where working age population will drop, and a decreasing number, the poorest ones, in which it will explode. The former will be affected by a dramatic structural shortage of labour that will make immigration unavoidable, the latter by a dramatic structural excess of labour that will make emigration necessary to avoid political and socioeconomic havoc.

This phenomenon will have extremely disruptive effects not only at the country level but also at the planet level unless both groups of countries will understand that the disease provides its own medicine in the form of well planned and organized migration flows that, while responding to the quantitative and qualitative needs of potential arrival countries, will relieve the poorest countries from their structural excess of labour. Obviously there is a problem: this rational solution is in stark contrast with the myopic and xenophobic vision of an emerging political class that funds its success on the fear of immigrants and fuels xenophobic feelings talking advantage of ignorance and fake news.

The incoming demographic polarization does also signal the passage from a situation in which labour markets were affected by economic cyclical disequilibrium to a situation in which they will be affected by a demo-economic structural disequilibrium. This new situation calls for an integrated demo-economic modeling and the use of coordinated sets of demographic and economic measures.

Key words: migration, labour market, demographic transition, demographic polarization, structural shortage of labour, structural excess of labour.

JEL codes: J11, J2, J61

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The long term demographic trends of planet earth

An unprecedented demographic event is expected to take place before the end of the century. As a consequence of a phenomenon known as demographic transition (DT), the growth of working age population (WAP) and then of total population will progressively level off. It is therefore highly probable that both WAP and total population will decline in the next century¹.

There is no doubt that both events could have an extremely positive impact. A slower growth of total population would reduce the rate of growth of GDP necessary to keep GDP per capita constant, while a declining population would reduce the amount of resources that are consumed and the amount of pollution produced². At the same time, even more importantly, a decline of the rate of growth of WAP would lower the number of jobs necessary to keep constant the ratio between employment and WAP. Therefore, after a very long period of time during which the growth of WAP has been so fast to make impossible for the economic system to create a number of additional jobs coherent with the increase of the potential supply of labour, the moment is coming when this result will be easy to reach. This could open the road to defeat the poverty, the desperation and the moral debasement coming from lack of job opportunities, an endemic characteristic of the poorest countries of the world, and not only.

Unfortunately planet Earth is not a pacific and industrious village, but an increasingly crowded place divided in numerous villages whose tribes range from a few thousands to more than 1 billion people and stand on different ideological premises. These tribes are run by different political and economic regimes, worship different gods, have achieved levels of economic development so dissimilar that GDP per capita ranges from more than 100,000 to less than 1,000 dollars. Many of them are increasingly aggressive and warmongering, harshly competing and fighting to obtain or maintain economic and political primacy and to impose their ideological position (mine is the only and true way to heaven on earth) and religious beliefs (mine is the only true god).

As if all this were not enough, a new divide is coming into existence that could have extremely disruptive consequences on the precarious equilibrium on which our planet stands: an increasing demographic polarization. The approaching demographic equilibrium will in fact be the result of two opposite tendencies: in an increasing number of countries WAP will drop, in a decreasing number, the poorest ones, it will explode. As a consequence, an increasing number of countries will be affected by a dramatic and structural lack of human resources; a decreasing number by a dramatic structural excess. Before discussing the

¹ This is what is presently suggested by the median scenario of the United Nation Population Division (UN DESA, 2017). I believe a strong case could be made for a decline of total population and working age population before the end of the century. This opinion was shared by the United Nations Population Division of the Department of Economic and Social Affairs (UN DESA) until 2010. In fact the 2010 World Population Prospects assumed that the Total fertility rate would converge, from above or from below, to 1.85 in all countries of the world (UN DESA 2011). The implication was that the world population would start to decline during this century. In the 2012 Revision this assumption was changed and it was assumed that the Total fertility rate would converge to 2.1 (UN DESA, 2013). This new “politically more correct” hypothesis, in line with the standard narrative of demographic transition, warrants the convergence of world population toward a stable value of a little more than 11 billion by the end of the century. See also Lutz, 2001.

² The relationship between population and environment is a very complex one; to fully asses the impact of population on environment it is not sufficient to consider the number of people living on the planets; population concentration in poverty stricken countries, urbanization, pattern of consumption and production and many other human produced factors have also extremely relevant consequences. However it should be self evident that, everything else kept constant, a declining population would be a positive element for our environment. Today humanity uses the equivalent of 1.5 planets to provide the resources we use and absorb our waste, which means that it takes the Earth one year and six months to regenerate what we use in a year (Global Footprint Network).

demographic polarization, we need to understand the phenomenon that is behind this unprecedented phenomenon and its characteristics: the demographic transition³.

The demographic transition

The still most accredited narrative defines the DT as the process that brings a population from a traditional demographic regime, characterized by high rates of fertility and mortality, to a modern demographic regime, characterized by low rates of fertility and mortality. It is also generally assumed that at the beginning and at the end of the DT total population is substantially stable.

As a matter of fact this simplistic vision of the DT, that often carries with it also positive overtones, hides a very complex process that has and will have dramatic consequences not only in the single affected countries, but also for the whole planet⁴.

Empirical evidence shows that all the countries affected by the demographic transition follow the same path, albeit with different speed, depending on their economic, political, cultural and social characteristics.

The phases of the demographic transition

To fully understand the DT, it is necessary to recall the phases⁵ that every country affected by it has to go through and their characteristics (Bruni, 2018):

1. In the first phase the death rate declines, mainly as a consequence of the decline in infant and child mortality⁶, while the birth rate remains at the original level; therefore the share of young people increases, while the total population increases at an increasing rate⁷;
2. In the second phase the birth rate starts to decline, progressively converging toward the death rate; therefore total population continues to increase, but at a decreasing rate; due to the arrival of cohorts of increasing size, the share of working age population (WAP) increases, while the share of young declines; it is at the end of this phase that the ageing process starts;
3. The third phase begins when the birth rate falls below the death rate; this implies a decline in total population and an increase in the share of the elderly, while the shares of WAP and of the young decline.

In conclusion, the DT is a process that brings a country from a phase of demographic explosion to a phase of demographic contraction, from a phase of rejuvenation to a phase of aging; moreover, it does not determine the passage from a traditional equilibrium to a modern

³ The demographic transition for some just a statistical regularity, for other the only demographic theory (Chesnais, 1987) was discovered by Warren Thompson in 1929 (Thompson, 2029) and independently by Landry (1934) and perfected between 1944 and 1946 by Dudley Kirk (Kirk, 1944), Kingsley Davis (1943) and Frank Notenstein (Notenstein, 1945).

⁴ It is by now widely accepted that global warming represents a terrible menace for humanity so that, in spite of the opposition of numerous and powerful lobbies, some measures have been agreed upon and begin to be enacted, by countries while public awareness is increasing. The so called demographic transition and the ensuing demographic polarization could have even more dramatic consequences, but for the moment they have attracted very little attention not only from the politicians, but also from the academic world.

⁵ According to the standard narrative, the demographic transition has four phases: in stage one that characterizes traditional societies death rates and birth rates are high and roughly in balance; in stage two, the death rates drop quickly while the birth rate remains at the existing level; in stage three, the birth rates fall to the level of the death rates; in stage 4 that characterizes modern societies death rates and birth rates are low and roughly in balance.

⁶ The birth rate is computed by dividing the total number of births by total population and the death rate by dividing the number of death by total population.

⁷ This is due to the fact that the decline in the mortality of the children allows a high and increasing number of boys and girls to reach the reproduction stage in a situation in which the birth rate is still at the “traditional” level.

equilibrium, but from a traditional disequilibrium to a modern disequilibrium, from population growth to population decline⁸.

Finally, the DT has the same impact on the sub-populations composing the total population, and more specifically on WAP: a growth at increasing rates followed by a growth at decreasing rates, and then a phase of decline (Bruni, 2017b).

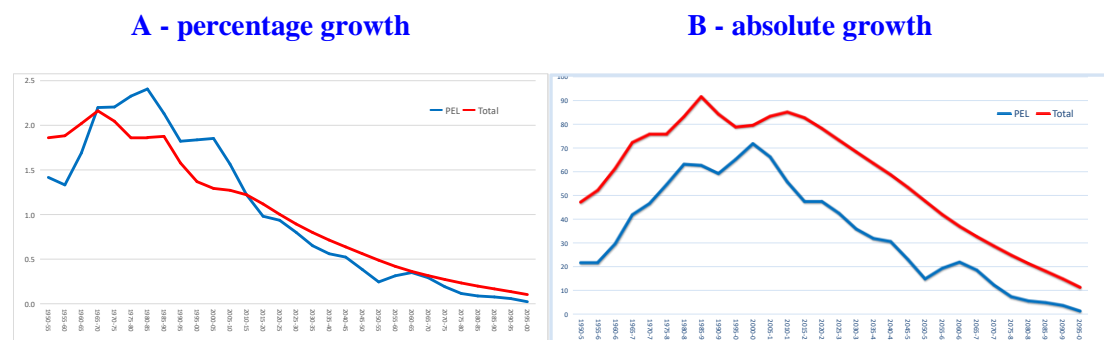
The demographic transition at the planet level

To have a comprehensive vision of the demographic transition, we can analyze its development at the planet level. The data for the planet discounts the different timing in which the DT has taken and is taking place in different countries, but offer the advantage of being only marginally affected by migrations. Therefore, although the yearly changes are less pronounced, they are sufficient to show the general pattern of the DT.

Figure 1 documents the rates of growth of total population and WAP from 1950 to 2100, according to the United Nations Population Division of the Department of Economic and Social Affairs (UN DESA) estimates and forecasts⁹. The yearly rate of growth of total population increased to the end of the 1960s, when it reached a maximum of 2,2%; since then it has progressively declined to a present value of 1.1% and is projected to half in the 2050s and to go almost to zero by the end of the century (Figure 1A). For the moment, there are no indications suggesting that this tendency will not continue and that during the XXII century world population will not decline¹⁰.

Coming to WAP, the yearly average rate of growth has increased till 1980-85 when it reached a maximum of 2.4%; the following decline has been faster than that of total population, so that its present value is 1% and it is forecast to be 0,2% around 2050 and zero at the end of the century (Figure 1A).

Figure 1 - Total population and working age population; yearly average growth from 1950 to 2100



Source: Elaborations on UN DESA data; UN DESA, 2017

Total population reached the highest average absolute increase in 1985-90 (Figure 1B) with 90 million (it was less than 50 million at the beginning of the 1950s). Since then the absolute increase has progressively declined; it is estimated at around 83 million now; its is expected

⁸ According to available estimates, human population has increased from a few hundreds of thousands in the period in which man manifested its first representational capacities to around 6 million in 10,000 B.C. and then to 770 million in 1750. It seems therefore evident that also in the first two demographic phases identified by population historians - the hunting and gathering phase and the agricultural phase - the demographic success of the human species has been much bigger than that of the other species which adopt the K strategy, and especially of our closest relatives, chimpanzees and gorillas.

⁹ All forecasts come from the zero migration scenario produced by UN DESA.

¹⁰ If as suggested here, the world will witness migrations of unprecedented size the birth rates could fall faster than presently envisaged bringing to a decline of total population before the end of the century.

to decline at 50 million around 2050 (the value registered in 1950) and to 10 million at the end of the century (Figure 1B).

The absolute increase of WAP reached its maximum in 2005-10, twenty years after that of total population, with 72 million; it has then declined faster and it is now down to 47 million; it is projected to be 15 million in 2050 and zero at the end of the century (Figure 1B).

The previous data clearly documents that it is the DT that is bringing world population from less than one billion at the beginning of the XIX century to more than 11 billion at the end of the XXI century and then, hopefully, to a decline in the following century (UN DESA, 2017). They do also clearly show that the same process explains the structural decline of WAP affecting more developed countries and the structural explosion of WAP in the poorest countries.

Therefore, the DT will not be, as heralded by demographers, the passage from an equilibrium to another equilibrium situations, but a transition between two different types of disorders and inefficiency (Bruni, 2008). It must also be underlined that the probable demographic decline will not be as in the past the consequence of famine, diseases, natural disasters and wars, that is of the incapacity of men to control “natural” phenomena, but by his capacity to control his reproductive mechanisms.

Demographic polarization and economic growth

The DT made its appearance more than 200 years ago in the countries first affected by the industrial revolution to then progressively affect the other countries as they reached a given level of socioeconomic development and only now is starting to affect the poorest countries of the world (Bruni, 2008, 2017a, 2017b).

A simple way to show that the DT is an unavoidable process whose development is connected to the level of socioeconomic development is to consider the Total Fertility Rate (TFR) that measures the average number of children per woman¹¹.

Table 1 - Total fertility rate; world; regions by different level of economic development and continents; absolute values in 1950-55, 2010-15 and 2050-55 and absolute change in the relevant intervals.

	1950-55	2010-15	2050-55	1950-55 to 2010-15	2010-15 to 2050-55
	Absolute values			Absolute change	
World	5.0	2.5	2.2	-2.4	-0.3
MDR	2.8	1.7	1.8	-1.2	0.2
LDR	6.0	2.4	2.0	-3.6	-0.4
LTDR	6.6	4.3	2.7	-2.3	-1.6
Africa	6.6	5.1	2.9	-1.5	-2.2
Asia	5.8	2.2	1.9	-3.6	-0.3
Europe	2.7	1.6	1.8	-1.1	0.2
Latin America and teh Caribbean	5.9	2.1	1.8	-3.7	-0.4
Northern America	3.3	1.9	1.9	-1.5	0.0
Oceania	3.8	2.4	2.1	-1.4	-0.3

Source: Elaborations on UN DESA data; UN DESA, 2017

If on the average every woman has two children, the total population will remain stable since one child will substitute the mother and the other will substitute the father; lower (higher) values will determine a decline (increase) of the population. After WWII on the average each woman of the planet had 5 children. However the situation differed sharply between countries at different level of economic development. The TFR was equal to 2.8 in the Most developed

¹¹ The Total fertility rate is defined as “the number of children who would be born per woman if she were to pass through the childbearing years bearing children according to a current schedule of age-specific fertility rates”.

regions (MDR), 6 in Less developed regions (LDR) and 6.6 in the Least developed regions (LTDC)¹². In the following 65 years the TFR has declined in all groups of countries, but the ranking has not changed so that at present it is down to 1.7 in the MDR, 2.4 in the LDR and 4.3 in the LTDR. According to UN DESA, this trend will continue over the next 40 years, but at a slower pace and will be directly related to the starting value so to generate a general convergence toward the replacement level of a little more than 2 children per woman.

Table 2 considers the same situation, but at the “village” level. In 1950-55, in 51.7% of the countries of the planet the TFR was above 6 children per woman¹³ and in no country it was below 2. After 60 years only 7 countries register a TFR of 6 or above and in 66 countries the TFR is below the replacement level. According to UN DESA projections, in 40 years this situation will be present in 2/3 of the countries of the world, and only in one country it will be above 4.

Table 2 - Total fertility rate; number of countries by TFR in 1950-55, 2010-15 and 2050-55 and absolute change in the relevant intervals.

	1950-55	2010-15	2050-55	1950-55	2010-15	2050-55
	Absolute values			Percentage composition		
= or > 6	104	7		51.7	3.5	0.0
4 ' 5.99	52	41	1	25.9	20.4	0.5
2 - 3.99	45	87	66	22.4	43.3	32.8
< 2		66	134	0.0	32.8	66.7
Total	201	201	201	100.0	100.0	100.0

Source: Elaborations on UN DESA data; UN DESA, 2017

We have already argued that WAP goes through a DT similar to that of total population. The transition of WAP does however presents some specific characteristics that have already emerged from the analysis at the planet level and are due to the fact that WAP includes the central age groups, those between 15 and 64 years of age. In the first place, it starts after that of the TP, it proceeds at a faster pace and reaches the third final phase, that of the decline, before TP. In the second place, it presents more pronounced increases and declines. As a consequence, we can expect that the countries more economically advanced and/or in which more attention has been paid to the demographic, social and educational issues, be already in the third phase, while the poorest countries be still in the first phase or even at its beginning.

Table 3 - Countries with declining WAP by continent and region; total number and percentage composition; 2015-2020 and 2050-55

	N. Countries	Declining WAP			
		2015-20	2050-55	2015-20	2050-55
		Number		Percentage composition	
Africa	57	0	8	0.0	14.0
Asia	51	10	20	19.6	39.2
Europe	40	38	39	95.0	97.5
NWC	4	2	4	50.0	100.0
Latin America	38	6	19	15.8	50.0
Oceania	11	0	2	0.0	18.2
Total	201	56	92	27.9	45.8

Source: Elaborations on UN DESA data; UN DESA, 2017

¹²More developed regions comprise Europe, Northern America, Australia/New Zealand and Japan; Less developed regions comprise all regions of Africa, Asia (except Japan), Latin America and the Caribbean plus Melanesia, Micronesia and Polynesia; The group of least developed countries, as defined by the United Nations General Assembly in its resolutions, includes 47 countries: 33 in Africa, 9 in Asia, 4 in Oceania and one in Latin America and the Caribbean (UN DESA, 2017).

¹³ In was 7 or above in 37 countries

Table 3 reports the number of countries registering an absolute decline of WAP. Between 2015 and 2020 more than one fourth of the countries of the world are already affected by this phenomenon. The great majority are developed countries in Europe, North America and Asia, but there are also some Caribbean and Latin American countries like Cuba and Chile. In 40 years, in absence of migrations, the countries in this situation will increase from 56 to 92, and they will be present in all continents.

In conclusion, in the next 40 years the change in the world WAP will be the result of the increases registered by the countries more advanced along the path of the DT and the declines registered by those still in the first phase.

More specifically, as shown by Table 4, in the next 40 years the WAP of the planet is forecast to increase by 1.37 billion (+28.3%), from 4.85 billion to 6.21 billion. The increase is the result of national positive balances of 1.9 billion and of negative national balances of 524 million.

Table 4 - Working age population; absolute values by continent in 2015 and 2055; sum of countries positive balances, negative balances, and total balances by continent for the period 2015-2055

	WAP (2015)	Positive balances	Negative balances	Net balance	WAP (2055)
absolute values in million					
Africa	662.8	1,077.5	-0.7	1,076.8	1,739.6
Asia (excluding China)	1,979.4	712.1	-95.6	616.5	2,596.0
China	1,020.6		-252.0	-252.0	768.6
Europe	495.0		-133.9	-133.9	361.1
NWC	254.8		-20.0	-20.0	234.8
Latin America	422.2	97.9	-21.4	76.5	498.8
Oceania	6.6	6.6	-0.4	6.2	12.8
Total	4,841.4	1,894.1	-524.0	1,370.1	6,211.5
Percentage composition					
Africa	13.7	56.9	0.1	78.6	28.0
Asia (excluding China)	40.9	37.6	18.2	45.0	41.8
China	21.1	0.0	48.1	-18.4	12.4
Europe	10.2	0.0	25.6	-9.8	5.8
NWC	5.3	0.0	3.8	-1.5	3.8
Latin America	8.7	5.2	4.1	5.6	8.0
Oceania	0.1	0.3	0.1	0.4	0.2
Total	100.0	100.0	100.0	100.0	100.0

Source: Elaborations on UN DESA data; UN DESA, 2017

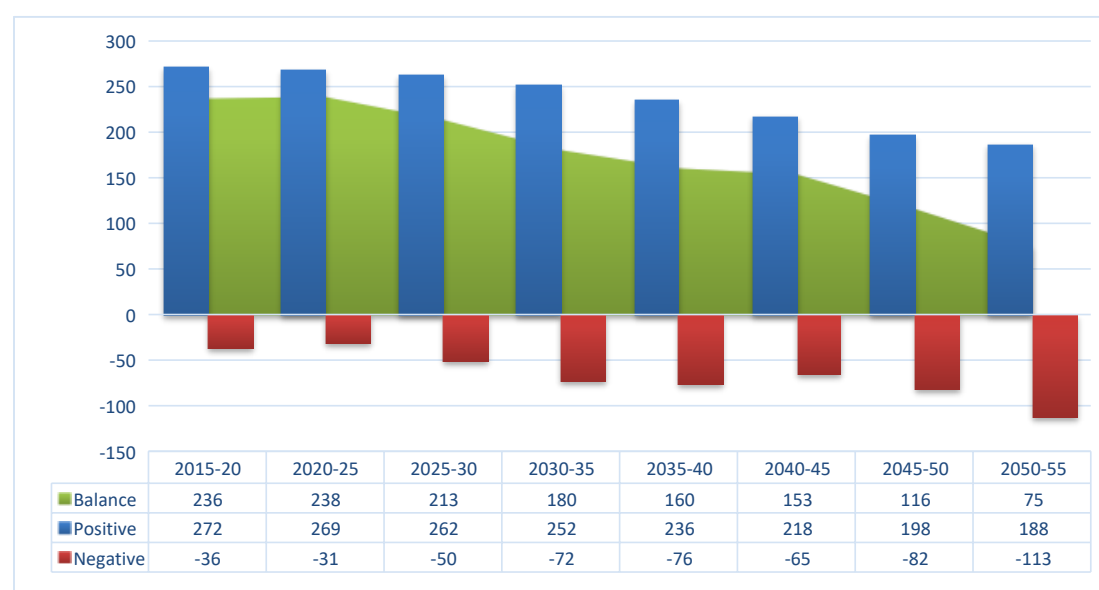
The increases are located mainly in Africa and in some Asian countries, with a minor contribution of South American and Caribbean countries. The declines are located in Europe, China, some other Asian countries (especially in Japan, and Korea) and, in a minor way, in the New world countries (Canada, USA, Australia and New Zealand).

These trends will have a huge impact on the distribution of WAP. In 2015 Africa accounted for only 13.7% of WAP, much less than Asia (62%, including China), with Europe at 10.2%, Latin America at 8.7%, and the NWC at 5.3%. In absence of migrations, this structure will notably change in the following 40 years. The share of Asia, without China, will slightly increase reaching 41.8% and that of Latin America slightly decline to 8%, but Africa will double its share up to 28%, while the shares of China, Europe and of the NWC will sharply decline to 12.4% (from 21.1%), to 5.8% (from 10.2%), to 3.8 (from 5.3%) respectively.

It must be underlined that China accounts for 48.1% of the negative balances, Europe for 25.6%, Asia excluding China for 18.2%, Latin America for 4.1% and the NWC for just 3.8%. Coming to the positive balances, 56.8% will be concentrated in Africa and 37.6% in Asia.

A visual representation of the incoming polarization of WAP is provided by Figure 2 that shows the decline of the yearly absolute increase of WAP as the result of the decrease of the positive balances from a yearly value of 54 to 37 million, while the absolute values of the sum of negative balances increases from 7 to 22 million.

Figure 2 - WAP; sum of countries positive changes, sum of countries negative changes and total balance from 2015-20 to 2050-55; average annual values in million



Source: Elaborations on UN DESA data; UN DESA, 2017

How did situation come about and especially what happened in China to make this country progress so rapidly along the DT? To answer this question we will provide a parallel analysis of the development of the main demographic indicators of Europe and China.

The Chinese and European demographic transition

European countries have been the firsts to experience the DT (Bruni, 2018). In 1950 Europe was already in the second phase of the DT: the death rate was just above 10 per thousand and was starting to climb, while the birth rate was around 22 per thousand and was already rapidly declining. Europe entered the third and last phase of the DT between 1995 and 2000 when the birth rate fell below the death rate and the natural rate of growth (NRG) became negative (Figure 3). It is forecast that this situation will persist throughout the XXI century¹⁴.

In 1950 China was much less advanced along the path of the DT than Europe: the death rate was still above 20 per thousand, while the birth rate was above 40 per thousand, a value normally associated with traditional societies (Figure 4).

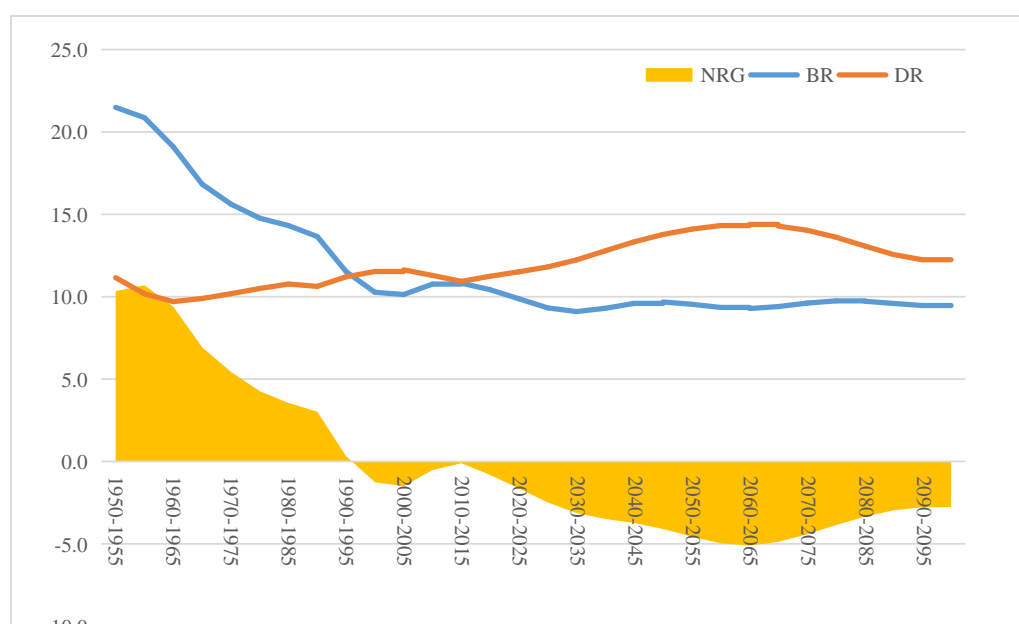
Both rates did however drop at a very fast pace. Also due to the very young average age of the population, the death rate fell to 6.9 per thousand at the end of the XX century and is expected to remain below 10 per thousand to the beginning of the 2030s. The birth rate fell below 20 per thousand before the end of the XX century and is expected to fall below 10 per thousand by 2030 and remain below that mark till the end of the century¹⁵. As a consequence,

¹⁴ This in spite of the fact that, according to UN DESA, the TFR will progressively increase from a present value of 1.63 to 1.80 in 2100

¹⁵ No relevant effects are expected from the abolition of the one child policy.

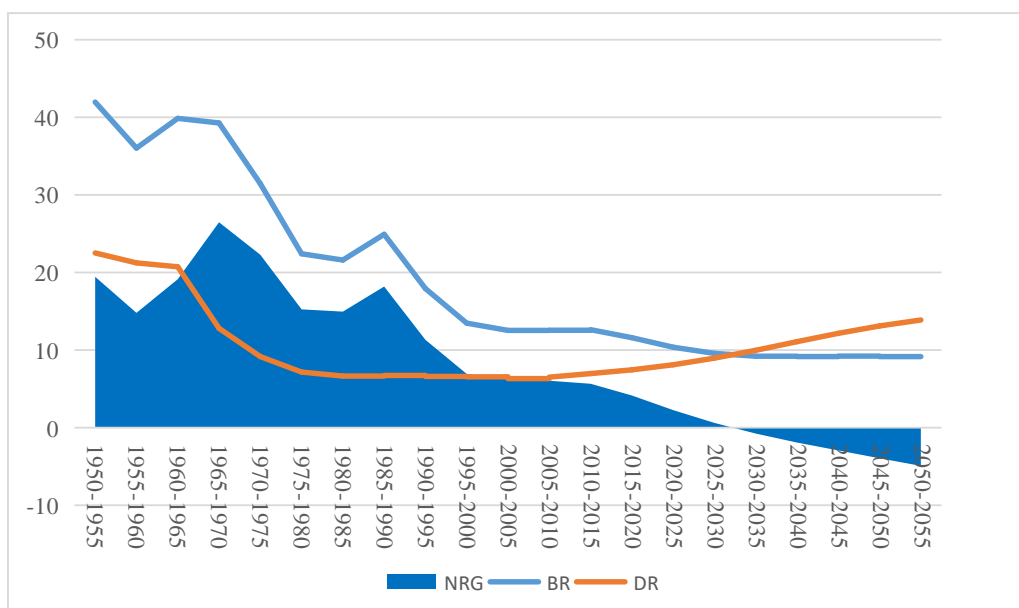
the NRG is forecast to become negative in the 2030-35 period and remain negative throughout the XXI century.

Figure 3 - Europe; crude birth rate (BR), crude death rate (DR) and natural rate of growth (NRG); 1950-2100



Source: Elaborations on UN DESA data; UN DESA, 2017

Figure 4- China; crude birth rate (BR), crude death rate (DR) and natural rate of growth (NRG); 1950-2100



Source: Elaborations on UN DESA data; UN DESA, 2017

A perception of the speed with which the DT proceeded in China emerges very clearly comparing the evolution of its main demographic indicators; the Total fertility rates and the Life expectancy at birth (Table 5).

In China in 1950 the TFR was 6.1 children per woman, while in Europe it was already largely below 3. After 30 years the Chinese TFR had more than halved, while in Europe it had

already gone below 2. In 2015 the process of convergence was completed, China and Europe being aligned on a value (around 1.6) well below the replacement level.

Table 5 - China and Europe; total fertility rate and life expectancy at birth in selected periods.

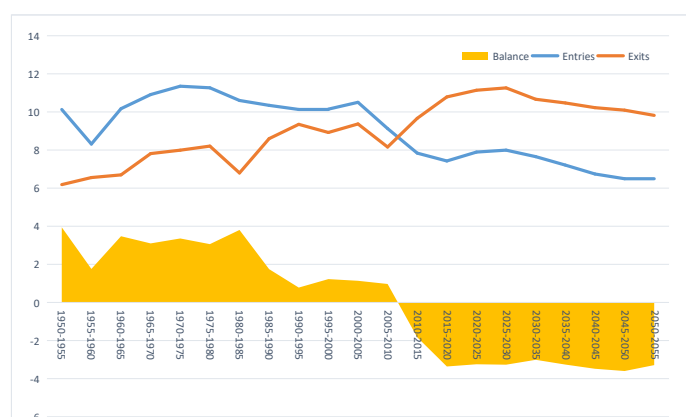
	1950-55	1980-85	2010-15	1950-55/1980-85	1980-85/2010-15
Total fertility rate					
	Absolute value			Absolute change	
Europe	2.7	1.9	1.6	-0.8	-0.3
China	6.1	2.5	1.6	-3.6	-0.9
Difference	-3.4	-0.6	0.0	2.8	0.6
Life expectancy at birth					
	Absolute value			Yearly average change (months)	
Europe	63.6	71.6	77.0	-3.2	-2.2
China	43.4	67.4	75.4	-9.6	-3.2
Difference	20.2	4.2	1.6	6.4	1.0

Source: Elaborations on UN DESA data; UN DESA, 2017

Life expectancy presents a similar process of convergence. In 1950 the difference between the average duration of life in China and Europe was of 20 years (Europe 63.6, China 43.4); in 1985 the difference was already down to 4.2 years and in 2015 to just 1.6 years (77 vs 75.4 years)¹⁶.

Even more compelling is the analysis of the DT of WAP. When we analyse the DT of the total population we consider the evolution of births and deaths; when we discuss the DT of the WAP we consider generational entries and generational exits related to WAP. The firsts are represented by the number of people who become 15, the seconds by the sum of the number of people who die between the age of 15 and 64 and those that become 65 (Bruni, 1988). Figures 5 and 6 represent the generational flows and balances of WAP in Europe and China, respectively. Europe has entered the third phase of the WAP transition in the 2010-15 period, while China is entering in the present five year period.

Figure 5 - Europe; WAP; generational entries, generational exits and generational balance; average yearly values in million; 1950-5 to 2050-55

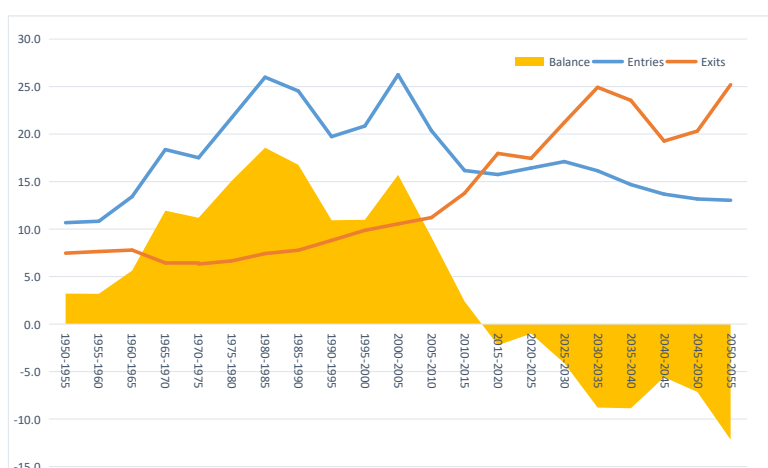


Source: Elaborations on UN DESA data; UN DESA, 2017

¹⁶ It is worth underlying that in China the TFR underwent its major changes before the introduction of the one child policy, while the increase in life expectancy between 1950-55 and 1980-85 was really dramatic and unprecedented (9.6 months per year on the average). It would be extremely interesting to analyse how this did happen and which were the main factors that brought to this historical and extraordinary result. During a seminar on the DT held in Beijing prof. Don Keyong suggested that this incredible accomplishment could be ascribed to the institution of the doctors without shoes.

In Europe the yearly negative balances after 2020 are rather stable, around 3 million per year, while in China they will progressively increase in absolute value up to a maximum of more than 12 million in the 2050-55 period.

Figure 6 - China; WAP; generational entries, generational exits and generational balance; average yearly values in million; 1950-5 to 2050-55



Source: Elaborations on UN DESA data; UN DESA, 2017

Considering the entire period, Europe will register 290 million generational entries into WAP and 422 million generational exits that will result in a negative balance of 133 million; the values for China are roughly the double, with generational entries amounting to 600 million, generational exits to 849 million, and the balance to -250 million.

Table 6 - WAP; generational entries, generational exits and generational balance; 2015-2055

	Europe	China	Europe	China
	Absolute values		Percentage of WAP in 2015	
Generational entries	290	600	58.7	59.1
Generational exits	422	849	85.5	83.7
Balance	-133	-250	-26.9	-24.6

Source: Elaborations on UN DESA data; UN DESA, 2017

Some first summary considerations

Let's briefly review the main elements that have emerged from the previous analysis:

The DT is an unstoppable process that by now is affecting all the countries of the planet determining an unprecedented demographic polarization. We can visualize this process imagining all the countries of the planet distributed on a long line that proceeds along the path of the DT. The path is initially uphill, but after reaching a peak it goes straight downhill. The countries that have entered the DT firsts or that, as China, have been proceeding at a faster pace, are already in this last part of the path where WAP is decreasing. The countries that have entered the path of DT later or that have been proceeding at a slow pace are still in the first part of the path where WAP increases at an increasing speed. In the next years numerous countries will reach the top of the path and their WAP will start to decline. Only the poorest

countries of the world will still be climbing, slowly and painfully, and will be affected by an extremely high growth of WAP.

In conclusion, the DT is bringing to a situation in which an increasing number of countries, the richest and most developed, will be affected by a declining WAP and a decreasing number of countries, the poorest ones, will see their WAP literally explode.

The second element that has emerged is that the epicenter of this demographic earthquake is the Afro-Eurasian continent that will host 94.5% of WAP positive balances and 92% of WAP negative balances.

It is now time to assess the implication of the phenomenon we have just described.

Images from the future 1

Data do not speak by themselves. It is how we read them, the glasses we use to evaluate them that make them talk. Given the controversial nature of the topic we are discussing, it is to be expected that opposite interpretations would be proposed.

Once these data will be fully understood, I expect that the most probable reaction will be of disbelief and fear¹⁷. Politicians, but most probably also demographers and economists, will start vividly seeing in front of them millions of desperate men, women and children leaving their native countries, pushed by poverty, famine and desperation, trying in any way to cross the borders of their country to reach neighbouring countries where they would bring social and economic havoc. This image will then immediately evoke the need of walls and soldiers lined up along the borders, and of boats to patrol the sea (Bruni and Catani, 2017).

Unfortunately this vision is also fully supported by standard economic theory that has always explained migrations from the supply side (Bruni, 2017a and 2017b)¹⁸.

Demographic trends and technological innovation.

Is there some other way to interpret these data and represent migrant behaviour?

Let's start observing that WAP is the origin and the upper limit of the supply of labour. In any given moment of time the supply of labour will be determined i) by the level of WAP and ii) by the percentage of people willing to work (that is by the rate of activity, (RoA).

Given the evolution of WAP, the effective supply will be then determined by the RoA. Generally speaking for men to work is both a right and a duty: in all countries their participation to the labour market is universal, being generally limited only by the level of labour demand¹⁹. The participation of women does, on the contrary, presents an extremely large range of values, depending on social customs. It varies from values in line with those of men in Northern European countries to extremely low values, below 20%, in Arab countries. However, in all countries the rate of activity presents very modest and slow variations over time: the main causes can be the change of the time young people spend in education and training, the change of the legal retirement age (these two factors pushing in opposite directions and therefore tending to offset each other), but mainly the level of demand.

¹⁷ Forecasts similar to those just presented have been published by UN DESA for a long time, but they have attracted extremely limited attention not only from politicians, but also from demographers and economists.

¹⁸ According to this perspective the migrant is a rational agent that carefully weights its future confronting what life would reserve to him if he remains in his country or if he moves to any of all the other countries, and going where the net present value of its future monetary and non monetary earnings would be higher.

¹⁹ Educational attainment play a limited role for men; moreover in the standard neoclassical model the supply and demand of labour are assumed to be independent, in opposition of all empirical evidences that clearly show their strict and direct relationship.

We can therefore assume, without loss of generality, that in the next 40 years the number of people available and willing to work will decline by 27% in Europe and by 25% in China, while in Africa it will increase by an astonishing 163%.

As explained long time ago by Adam Smith's example of the pin factory, the level of production can be increased only in two ways: by increasing the number of people employed or by increasing their average contribution to production. Therefore, the question is: can China, Japan, Europe and all other countries affected by similar long lasting declines of WAP continue to increase their level of production, while their labour force will decline by 1/4 or more? Can Africa increase its production so much to provide a sufficient number of jobs to a labour force that will increase by more than 2 times and half, while keeping production costs competitive?

I have confronted these issues in previous papers (Bruni, 2017, 2018). While admitting that there are no theoretical reasons to discard both possibilities, I have reached the conclusion that in both cases the answer is a very clear no.

Lets consider first the case exemplified by Europe and China. In the first place no advanced economy in the last 40 years was able to increase its GDP relying only on productivity, with the exception of Japan, during a prolonged phase of economic crisis (Bruni, 2008). Obviously this argument is far from conclusive: the fact that something has never happened is not sufficient to ensure that it will not happen in the future. Therefore, the answer hinges on the role that technological progress can play.

The idea that AI and robots will determine an unprecedented level of technological change has been heralded by numerous economists, including Nobel prize winners. Two narratives have been proposed: the first fears that the labour force will be decimated by technological progress creating massive unemployment; the other hopes that the new technologies will provide the solution to the incoming dramatic reduction in labour supply and represent a welcome substitutes for foreign migrants.

As a matter of fact numerous studies devoted to this issue have failed to find empirical evidences to sustain the thesis that new technologies cause a reduction in employment²⁰, the main reason being that the negative impact of technology on the employment level stands does not take into consideration second order effects. While it is certainly true that computer-based technologies cause jobs to be destroyed, it is also true that the same technologies cause the creation of extra and new jobs. To state it differently, new technologies may be substitute for some types of labour, but very often are complementary to, and hence will increase the demand for other types of labour.

However, the most important reason why new technologies have always ended up not reducing bu increasing employment (the introduction of computer and especially of the PC is a good example) is that the human mind has what it appears to be a limitless capacity and fantasy to "invent" new needs and a limitless capacity to invent and produce new goods to satisfy them. So while new technologies can reduce employment in the production of existing goods, they also foster the appearance of new needs and with them the production of new goods and new jobs to produce them (Bruni, 2018).

For what relates to the case of countries and regions whose working age population is projected to explode during this century the case of Africa is paradigmatic. The first question to consider is how many jobs Africa will have to create in the next 40 years to keep the percentage of employment with respect to working age population constant at let's say 66%. The answer is: around 720 million which greatly exceeds the number of jobs created by China in the past 40 years (around 400 million). It is therefore difficult to believe that a continent

²⁰ Borland and Coelli (2017) have analyzed the case of Australia: Autor (2014, 2015) that of the United States; Gregory et al, (2016) that of Europe, while Raghnail and Wllianson (2014) provide a general review of the studies in this field.

disrupted by war, endemic problems of corruption, and low educational level will be able to outperform the Chinese economic miracle.

The unavoidable consequence of the previous considerations is that in the next 40 years in numerous countries labour supply will not be sufficient to satisfy labour demand and in numerous other countries labour demand will not be sufficient to satisfy labour supply.

We can summarize the previous discussion saying that the first group of countries will be affected by a potential *structural shortage of labour* and the second group of countries will be affected by a potential *structural excess of labour*. This does also allow us to classify countries into two groups: *potential arrival countries* and *potential destination countries* (Bruni, 2008, 2009, 2012a).

The need of foreign labour and the excess of local labour

To transform the potential situations we have just described into an actual situation we have to take into consideration, together with the demographic sphere, the economic sphere. Economic trends could in fact obliterate or enhance the potential shortage or potential surplus of labour and be sufficient to originate both of them. An economic crisis could bring a country from a situation of shortage of labour to a situation of excess of labour, while an impetuous economic development could absorb a potential excess of labour; it is also possible that a country without a potential demographic shortage of labour relies on relevant amount of foreign labour due to the characteristics of its labour supply. These three situations are well exemplified by Moldova (Bruni, 2010), China (2011, 2013, 2014) and the Gulf countries (2017a).

The actual need of foreign labour is the result of two components: the need generated by the decline in labour supply due to the decline of WAP, and the need generated by the change in the employment level deriving from the combined effect of production and productivity. Equally the actual excess of labour will derive from the increase in labour supply generated by demographic trends and the change in labour demand due to the changes in GDP and productivity (Bruni, 2008, 2009, 2012a).

Let's clarify these concepts considering the case of China, on the one hand, and Africa, on the other (Table 7). What we will present is a simulation of the situation that the geographical areas with shortage of labour and excess of labour will have to face and the role that international migrations could play²¹.

China - In the next 40 years, the Chinese WAP is forecast to decline by around 250 million. At a RoE of 70%, the country will need 175 million foreign workers to substitute the Chinese workers that will leave the labour market for good (Bruni, 1987)²². Let's then assume three scenarios of employment growth (Additional Demand): in scenario 1 employment will increase by 75 million (10% of the present level), in scenario 2 by 113 million (+15%), in scenario 3 by 150 million (+20%). Summing up the labour needs originated by the decline of WAP with those generated by the increase in employment, China would need 250 million workers in scenario 1, 288 million in scenario 2, and 325 million in scenario 3. In the next 40 years China will therefore need a minimum of 175 million foreign workers if AI and robots will make the miracle to sustain all the growth in production China needs for its political stability, but their number could be considerably higher depending on the rate of growth of production. Moreover, if we assume realistically that migrants will bring with them some relatives, the number of migrants will certainly be higher in all scenarios.

²¹ For simplicity of computation and without loss of generality we will use rounded figures

²² Alternatively we could say that this would create the need of 250 million migrants. This would be in line with one of the scenarios proposed by UN DESA in its 2000 Report on Replacement Migration, that considered the number of migrants necessary to keep the level of WAP constant (UN DESA, 2000).

Table 7- China and Africa; demographic and labour market scenarios; 2015-2055; values in million

China		Africa		Total
ΔPEL	-250	ΔPEL	1000	750
Shortage of labour due to RD	-175	Potential shortage of jobs	700	525
Shortage of labour due to AD1	-75	AD1	125	50
Shortage of labour due to AD2	-113	AD2	250	138
Shortage of labour due to AD3	-150	AD3	375	225
Total Shortage of labour (Scen.1)	-250	Excess of labour (Scen. 1)	575	325
Total Shortage of labour (Scen.2)	-288	Excess of labour (Scen. 2)	450	163
Total Shortage of labour (Scen.3)	-325	Excess of labour (Scen. 3)	325	0

Source: Elaborations on UN DESA data; UN DESA, 2017

Africa - Rounding up for simplicity of computation the increase of Africa's WAP to 1 billion, we can assume that the supply of labour will increase by 700 million people. This is the potential shortage of jobs, that is the number of additional jobs that Africa would have to create in order to satisfy the increase in labour supply. As we have already discussed such a growth of the number of jobs is unrealistic. Also in this case let's assume three alternative scenarios of employment growth: in the first Africa will create 125 million jobs over the next 40 years, in the second 250 million and in third 375 million. Comparing these data with the increase in supply, in scenario 1 the excess of labour supply over the entire period would be of 575 million people; in scenario 2, of 450 million and in scenario 3 of 325 million

We can now imagine that China and Africa were one labour market and workers could freely move from one country to the other. It is then evident that the free flow of workers between the two continents would not only help to solve the opposite problems of the two areas (the shortage of labour of China and the excess of labour of Africa), but it would do so in an economic way. In fact while Africa would need 700 million additional jobs to face its future supply of labour if it were surrounded by a wall, a little more than 300 million jobs (a much more realistic figure) would be sufficient if China and eventually Europe would decide to satisfy their labour shortage with African workers.

Images from the future 2

Let's now come back to the original question: what do the demographic trends we have previously discussed suggest, once we take into consideration the analysis we have just presented?

The first consideration is that the countries affected by a structural decline of WAP, *in primis* China, the EU, Russia, Japan, Korea, the USA cannot continue along the path of economic growth and social development without resorting to foreign labour. The actual need of foreign labour will depend on the interaction between the demographic sphere, that affects the supply of labour, and the economic sphere, that will determine the change in the level of employment. Simple considerations and computations show that ***for all these countries immigration is not an option, but a necessity***

At the same time, there are numerous countries, the poorest of the planet, where economic growth, no matter how fast and labour intensive, will never be able to face the increase in labour supply. The immediate consequence is that in the next forty years the percentage of young people exiting from the educational and vocational training system who will find a decent, or for that matter, indecent job will certainly decline; in turn this will imply an increase in the exploitation of the more vulnerable groups (children, women, uneducated

persons, etc.), expand poverty, make more difficult to provide education to the young, create a fertile soil for corruption, increase the level of violence, foster religious and tribal fights, negatively impact on the environment and on health, put the premises for the explosion of epidemics, etc. Therefore, *for all these countries emigration is not an option, but a necessity.*

The second is that the increasing demographic polarization of the planet implies that, while an increasing number of countries will have an increasing shortage of labour, other countries will have an increasing excess of labour. If for a moment we forget our prejudices, the political “evolution” many countries are going through and we reason rationally we will immediately see that the two groups of countries can play a win-win game.

So what is the image that comes to my mind if I pursue this idea? I can see investments moving from potential arrival countries to potential departure countries. They will finance, under the umbrella of some international organization (Bruni, 2017b), education and vocational training aimed to prepare a new generation of workers endowed with the knowledge and the capacities that will make them valuable in their labour market, but also in the labour market of investing countries. I can see an increasing number of well trained people moving in a orderly and humane way from the countries with excess of labour to countries with shortage of labour. I can see the activation of processes aimed to integrate the migrants in arrival societies. I can see remittance flowing from rich to poor countries. I can see a new wave of economic growth and social development triggered by education and training and fostered by remittances. I can see this development increase international demand and activate a more balanced growth of the planet.

Is it a dream? I think it should be considered a necessary plan since for the countries of both groups migration is not an option but a necessity. Moreover, what is really at stake is the peace of the planet that can be pursued only by reducing inequalities and injustice in a framework of economic and social development.

Labour market: from cyclical economic disequilibrium to structural demo-economic disequilibrium

The demographic revolution that is affecting the planet and creating an unprecedented demographic polarization is determining the passage from a situation in which the labour markets were affected by cyclical disequilibria to a situation in which they are affected by structural disequilibria. This new situation calls for an integrated demo-economic approach and the use of coordinated sets of demographic and economic measures.

After the gloomy Malthusian vision of an eternal demographic cycle induced, on the one hand, by human lust and, on the other, by the limits of productivity growth, economic thought has always taken for granted, except perhaps during a short interval in the 1930s, that population is going to continuously increase, an idea that was also embedded on the original version of the DT.

In this context, economic growth has become a fetish of our age as it leads to greater consumption and therefore “greater happiness”, while creating the additional jobs necessary to cope with population growth. At the same time the “invention” of unemployment (Salais et al, 1986) has provided one of the main objective of economic policy, with expansionary policies aimed at increasing employment and active labor policies at reducing frictional unemployment.

The current demographic situation suggests that a radical change of the general context is taking place. The economically more developed countries are faced with a completely new phenomenon: a structural decrease in the working-age population which can result in a “paradoxical” situation: a long-lasting negative difference between labor supply and demand, i.e. a negative unemployment which, for clarity, we have called structural shortage of labour.

In other words what we are witnessing in the countries in the third phase of the demographic transition is the passage from a situation characterized by potential cyclical excess of labour, to a situation of permanent structural shortage of labour. This calls for the passage from a context in which economic policies are expected to face cyclical excess of labour to a context in which both economic and demographic policies are necessary to face, at the same time, frictional unemployment (which can be a very relevant problem in a situation of rapid technological change) and structural shortage of labour.

At the same time, in the countries in the first stage of the demographic transition the rate of growth of working age population, the source of labour supply, is so high that economic policies will not be capable of facing it. In this case what we are witnessing is the passage from a situation of cyclical unemployment to a situation of structural excess of labour. Also in this case both economic and demographic policies are necessary to avoid socioeconomic disaster.

This unprecedented demographic polarization of the planet recalls the situation depicted by the Lewis model (Lewis, 1954) but projected at the planet level. In the Lewis narrative, migrations from the countryside to the urban centers respond to the attraction exerted by the labour demand of the industrial sector, in the presence of an unlimited supply present in the countryside. Now it is the labour market of the developed countries that can not meet the labour demand and attract the workers of the poorest countries, characterized by an unlimited supply of labour.

The dominant paradigm assigns a marginal role to demography and to demographic policies, the achievement of labor market equilibrium being entrusted either to the market and therefore to wage adjustments, in the most liberal visions, or to expansive, fiscal and/or monetary interventions, and active labour policies in the most interventionist ones. In the new situation the population variable must be an integral part of the model and migratory flows are essential to bring the balance between labor demand and labour supply in terms of flow.

In developed countries, we must therefore move from the present economic paradigm to a new demo-economic paradigm which must include two symmetrical sets of policies:

- Employment policies and active labor policies that generate the growth in employment necessary to increase economic well being and minimize frictional unemployment;
- Migration policies necessary to bridge the quantitative and qualitative difference between labor demand and local supply and active labour shortage policies aimed at minimizing the structural need of foreign labor.

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