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Ageing, the socioeconomic burden, labour market and migration. The Chinese case in an international perspective

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Abstract¹

China still lags behind Europe along the path of the demographic transition and therefore is still much younger. However, due to the speed with which the fertility rate dropped and life expectancy increased, China ageing process will proceed at a very fast space and around the middle of the century the population of China is projected to be as old as that of France and the UK and older than that of the USA. The paper tries to evaluate the labour market and welfare implications of this process, also by an economic indicator of dependency and socioeconomic burden.

The first part of the paper shows some of the distinctive characteristics of the ageing process that is taking place in China comparing it with that of 14 large countries from five different continents, in the general background of the world-wide unstoppable progression of the demographic transition.

Theoretical arguments and empirical evidences show that the demographic indicators of dependency (that are normally used to measure the socioeconomic impact of ageing) identify only the position of a country along the path of the demographic transition. This justifies the introduction of economic indicators that, taking into account both the demographic trends and labour market situation, allow to better evaluate the socioeconomic impact of the ageing process.

The economic indicators confirm that ageing is not yet a relevant issue for China since, on the average, the Chinese worker has a much lighter socioeconomic burden than the EU worker (804 vs. 1,276 dependents for 1000 people holding a job). This relative advantage remains if we consider only urban areas where the labour market situation is more comparable with that prevailing in the EU, and estimates of total employment are more reliable. In this case the number of dependents per 1,000 employed is 908, a value lower than the lowest value registered by any EU member country. The second element that emerges from our analysis is that both the EU member states and the Chinese provinces differ very much as to, on the one hand, the demographic dynamic and population age structure, and, on the other hand, the labour market situation; this is clearly shown by the large spread of the economic indicator of dependency of EU member states and Chinese provinces.

The last part of the paper is devoted to analyze the impact of the dramatic changes in population structure that China is forecast to experience during this century, on the basis of two hypotheses on the interaction of the demographic sphere and the economic sphere.

In a first set of scenarios, it is assumed, in line with the procedure adopted by the United Nations Population Division and the statistical institution of many countries, that population is an exogenous variable not affected by economic growth and social development. In these scenarios working age population is forecast to drop by 37 million between 2015 and 2030, and by 247 million in the following 30 years. If the rate of employment will remain constant at the present (very high level) the drop of working age population would imply a decline in employment of more than 200 million people in the next 45 years. Our computations show that under these hypotheses the socioeconomic burden would remain inside reasonable limits. However, the previous data suggests a fundamental question: is it feasible for China to

¹ The paper has been prepared under the framework of the EU-China Social Protection Reform Project (SPRP), but the content is the sole responsibility of the author and can in no way be taken to reflect the views of the European Union or of the Ministry of Finance, of the P.R. of China.

continue along its path of economic growth and social development while destroying a number of jobs roughly equal to total employment in the EU?

To face this question a concise review of the literature on the impact of computer-based technologies and AI points out that while numerous western economists are worried that technological change will cause widespread unemployment, Chinese and Japanese economists are betting on the possibility that robotization will contribute to prevent mass immigration. The paper argues that both events depend on whether a country will be capable of keeping its rate of productivity growth above the rate of growth of GDP over a long period of time. While this cannot be ruled out on purely theoretical grounds, the size of the demographic decline that will affect China, the EU and a growing number of countries the third phase of the demographic transition, together with the weight that labour intensive sectors will necessarily have in these economies, strongly support the conclusion that all these countries will have to resort to unprecedented mass immigration.

On the basis of this conclusion, the second set of scenarios assumes that migrations flows will close the structural shortage of local labour supply that will affect China due to the joint impact of the decline of working age population and economic growth. Limiting the analysis to the 2015-2030 period, we have assumed, as in the previous scenarios, two alternative rates of employment, and three rates of employment growth equal to 0%, the rate registered in that previous 15-year period (7.4%), and the intermediate value of 3.7%.

The 6 scenarios obtained combining the assumptions on the employment level and the employment rate of growth show that:

- i. Even in the most favorable conditions -a high rate of participation and a rate of productivity growth that will offset the growth in production- China will need migrants;
- ii. The migration balance will be larger than the increase in the employment level because migrants are needed not only to cover additional jobs but also to offset the decline of local WAP, and because migrant workers will come with some family members;
- iii. Between 2015 and 2030, the average migration balance is forecast to range between a minimum of 2.5 million per year (a value similar to that registered by the EU in the 2000-2015 period; Bruni, 2017) and a maximum of 14.1 million; in the intermediate "most probable" scenario the yearly migration balance is estimated at around 7 million, a value that corresponds to the present number of total international migrants;
- iv. Finally, and in net opposition to present forecasts, the decline in fertility and the consequent decline of local WAP will end up boosting demographic growth that will be directly related to economic expansion, and inversely related to productivity growth and labour market participation.

In this situation it is mandatory that China start immediately designing and implementing all the policies that can reduce the structural shortage of labour, while explaining to the population why China needs foreigners. It is however evident that, in order to do so, the government should start to seriously consider the fact that in not too far a future mass immigration will be unavoidable.

More specifically the economic growth experienced by China is producing a very complex and fragmented socioeconomic landscape as well as a notable provincial demographic polarization. Therefore, it is argued that China will witness at the same time internal migrations and a growing need for foreign labour. While developed provinces will need both household service workers and highly educated foreign labour, rural areas will need farmers to substitute the young people that will migrate to the coastal provinces. In conclusion

China will need foreign labour before becoming old and rich

Its aspiration to international leadership should push China to avoid the mistakes made by developed countries in the last thirty years and adopt a rational approach to the management of migrations flows remembering that:

The only valid measure against illegal immigration is a legal immigration that responds quantitatively and qualitative to the needs of the country.

If China will be able to adopt a pragmatic and rational approach to the problem of migration not only it will ensure the continuation of its economic miracle, but will play a central role in promoting world development and peace.

Key words: Ageing, China, EU, dependency indicators, technological change, migrations JEL codes: J11, J14, J21, F22, O33

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Aims and structure of the paper²

Ageing, the sustainability of the welfare system, and migration are the increasingly obsessive themes of today economic discourse. China is no exception although international immigration is still not openly debated and is generally dismissed as an impossible event.

The range of opinions expressed by Chinese scholars is extremely broad, going from the most catastrophic visions fomented by the sheer size of people that will be above 60, 70 or 80 in the near future, to the more optimistic ones based on the idea that there is no problem that China cannot solve, obviously in a Chinese way.

At the same time the central government has declared its intention to rationalize the extremely fragmented welfare system in order to make it more efficient and capable to better respond to the needs of a rapidly changing society. As to the pension system, the fear for sustainability created by the ageing process is pushing the Chinese government to move in the footsteps of many developed countries; the agenda includes progressively raising the retirement age, to introduce a second pillar and then a third pillar, but also moving from a system that provided a sure level of income after retirement with a system in which the pension will depend on the contribution paid during the working life.

A second important point in the political agenda is the creation of a long-term care system whose framework is now starting to be detailed. in this case also the increase in the number of elderly and the fact that a large part of life after 70 is inevitably characterized by very high level of morbidity suggest that China will have to face an incredibly complex challenge. In line with the Chinese tradition, local governments are running very interesting policy experiments that will provide the information needed to eventually choose a national model.

The European Union has been affected by ageing before China so that the process is much more advanced and therefore represents an important reference point to appraise the Chinese ageing process.

The paper is structured into three main sections. After briefly recalling the causes of ageing, pointing out the role of the demographic transition and showing its world-wide unstoppable progression, the first part of the paper tries to capture the distinctive characteristics of the ageing process that is taking place in China. The analysis is initially centered on the extraordinary speed with which fertility has declined and life expectancy has increased, taking the EU and three groups of countries classified by income level as a benchmark. It does then assess the impact of the demographic transition on population structure. A comparison with 14 other large countries allows identification of some peculiarities of the Chinese case.

The second part is devoted to the measurement of the socioeconomic impact of ageing. A critical analysis of the structural and analytical weaknesses of the demographic indicators that are normally used justify the introduction of economic indicators more suited to capture and measure the impact of the phenomenon. The following empirical analysis shows that the demographic indicators only identify the position of a country along the path of the demographic transition. More interesting results are obtained estimating the economic indicators for the EU and China and for the 28 EU member countries and the 31 Chinese provinces.

The last part of the paper presents some labour market and demographic scenarios based on economic indicators of dependency. The analysis aims to show that the sustainability of the welfare system is strictly linked to the evolution of the employment level which, in its turn, hinges on the recruitment of foreign workers. The final section discusses some policy measures suitable to the demographic and labour market situation China will have to face in

² I would like to thank Mel Cousins, Jean Victor Gruat and Mario Catani for reading a draft of the paper, and for their comments, corrections and suggestions that greatly helped to improve both form and substance of the paper.

the very near future, special attention being given to technological progress (computer-based technology and AI) and all the other measures that can reduce the need of foreign workers. However, the size of WAP decline that will affect China, especially after 2030, and the need that China has to continue along the path of economic growth and development to increase the well-being of its citizens lead to the conclusion that mass immigration will be unavoidable. It is to be hoped that, as in the past, China will resort to pragmatism and rationality to face the social complexity of this problem and that it will decide to leave the club of the "walled countries" (Bruni and Catani, 2017).

The worldwide spread of the demographic transition

The main causes of ageing are, on the one hand, the decline in fertility and, on the other, the increase in longevity. If the increase in life expectancy is the result of improvement in life conditions and the progress of medicine, the decline in fertility is the "result" of the demographic transition (DT).

The DT, for some the only theory expressed by demographers (Chesnais, 1987), for others just a statistical regularity, is defined as the passage from a traditional demographic equilibrium, characterized by high rates of fertility and mortality, to a modern demographic equilibrium, characterized by low rates of fertility and mortality. Therefore, it has been generally assumed that the decline of the total fertility rate (TFR) would stop at around 2.1 children per parent³. In substance the DT was seen as a passage from a traditional to a modern demographic equilibrium.

The evolution of the TFR level in the countries of the world is therefore a good indicator of the diffusion of the DT and its evolution. Around 1950 the TFR of more than half (103) of the countries surveyed by the United Nations Population Division (UN DESA) was above 6 children per woman and it was below 3 only in 28 (Figure 1). After 60 years the situation had reversed, only 6 countries registering a value above 6, and 132 presenting a value below 3; of these 71 had already a TFR below replacement level.





Source: Elaboration on UN DESA 2017

It is therefore evident that the DT has been affecting more and more countries and by now is a world wide phenomenon of impressive magnitude. At the same time, data clearly show that the idea that the DT necessarily brings a *modern demographic equilibrium* is totally unfunded given that there are already 71 countries in which the TFR has dropped well below 2 and their

³ One will substitute the mother the other the father. The most common expression is "per woman", but in fact it works also for men and I suggest to use "per parent" to avoid negative gender implications.

number will inevitably grow during the century. It seems therefore highly probable that what we are witnessing is a *demographic revolution* that will bring to an end the phase of continuous and sustained growth of world population that started in the middle of the XVIII century.

China's fertility and longevity in the international context

Table 1 compares the evolution of the TFR and of life expectancy at birth (LEB) in China and Europe. In China in 1950 the TFR was equal to 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.

	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 expe	ectancy at birth	
	Ab	osolute val	ue	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

Table 1 -	China and Euro	pe; total fertilit	y rate and life ex	pectancy in se	elected periods.

Source: Elaboration on 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).

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)⁴.

To better evaluate the evolution of fertility and longevity in China, we can compare it with that experienced by three group of countries: High-income countries, Middle-income countries and Low-income countries (HIC, MIC, LIC), keeping the world average in the background.

At the beginning of the 1950's, the TFR of China was higher than the average TFR of the MIC and 22% above the world value (Figure 2). In the 2010-15 period the TFR of China was below the average TFR of the HIC and 37% lower than the world average.

⁴ It would be extremely interesting to analyze 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.



Figure 2 - Total fertility rate in China, in the world and in three group of countries at different level of income; 1950-55, 2010 -15 and difference

Source: Elaboration on UN DESA 2017

A similar situation emerges for life expectancy (Figure 3). In 1950-55 China's life expectancy was the same as that of MIC and 9.3% below the world average; by 2010-15 life expectancy reached a level between that of HIC and MIC and was 9.9% above the world average.





Source: Elaboration on UN DESA 2017

Birth rate, death rate and population dynamics: China and Europe

The birth and death rates allow not only to provide a description of the evolution of the DT, but also to measure the impact of the DT on total population.

In 1950 Europe registered a death rate just above 10 per thousand; the birth rate was around 22 per thousand, but was already rapidly declining so that it fell below the death rate in the 1995-2000 period; therefore, it was at that time that the natural rate of growth (NRG) became negative (Figure 4). According to UN DESA forecast, this situation will persist throughout the XXI century, in spite of the rather optimistic assumptions about the TFR fertility made by this institution⁵.

Figure 4 - Europe; crude birth rate, crude death rate and natural rate of growth; 1950-2100



Source: Elaboration on UN DESA 2017

According to the UN DESA zero migration projection, in Europe, between 2015 (the peak year) and 2100, total population is forecast to decline by 190 million that is by 25.6%, bringing the European population back at the 1950 level (Table 2).

Table 2 - Europe; total population; absolute value, absolute change and percentagechange, relevant periods in the time interval 1950-2100

	Europe											
Total population												
	Abs. Value		Abs ∆	%Δ								
1950	549	1950-2015	191	34.8								
2015	741	2015-2100	-190	-25.6								
2060	641	2015-2060	-100	-13.5								
2100	551	2060-2100	-90	-14.0								

⁵ According to UN DESA the total fertility rate will progressively increase from a present value of 1.63 to 1.80 in 2100

Source: Elaboration on UN DESA 2017

As we already know, 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 5).

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 century⁶. As a consequence, the NRG is forecast to become negative in the 2030-35 period and to remain negative throughout the XXI century.

Figure 5 - China; crude birth rate, crude death rate and natural rate of growth; 1950-2100



Source: Elaboration on UN DESA 2017

Between 1950 and 2015 the population of China increased from 557 million to almost 1.4 billion and is forecast to reach almost 1.45 billion around 2030. After, according to UN DESA zero migration scenario, it should progressively decline to 1.05 billion in 2100, with a total loss of 392 million (-27.1 %) (Table 3).

Table 3 -	China;	total	population;	absolute	value,	absolute	change	and	percentage
change; rel	evant p	eriods	in the time i	nterval 19	50-210	0			

	China											
Total population												
	Abs. Value Abs Δ % Δ											
1950	557	1950-2015	843	151.4								
2015	1,399	2015-2030	48	3.4								
2030	1,447	2030-2060	-139	-9.6								
2060	1,308	2060-2100	-254	-19.4								
2100	1,054	2030-2100	-392	-27.1								

Source: Elaboration on UN DESA 2017

⁶ No relevant effects are expected from the abolition of the one child policy .

Demographic transition and population structure

The DT affects not only the level of the total population but also, and even more dramatically, its age structure. From this perspective it should be noticed that the DT goes through the three main phases outlined in Table 4.

- 1. In the first, the death rate declines mainly as a consequence of the decline in infant and child mortality, while the birth rate remains at the original level; therefore total population increases at an increasing rate, while the share of the young increases;
- 2. In the second phase the rate of birth starts to decline, progressively converging toward the rate of mortality; therefore, total population continues to increase, but at a decreasing rate; due to the arrival of cohorts of increasing size, the share of WAP increases, while the share of the young declines; the ageing process starts at the end of this phase;
- 3. The third phase begins when the the birth rate falls below the death rate; population declines, while the ageing process takes momentum; the share of the elderly increases, those of WAP and of the young decline.

	First phase	Second phase	Third phase
Death rate	Declines rapidly	Declines	Increases
Birth rate	Remains constant	Declines and converge toward the mortality rate	Not defined
Natural rate of growth	Increases	Declines	Becomes negative
Share of young people	Increases	Declines	Not defined
Share of WAP	Declines	Increases	Declines
Share of elderly	Declines	Start to increase at the end of the phase	Increases

Table 4 - The phases of the demographic transition

At the world level the first phase was completed in 1965 when the percentage of young people peaked at 37.9%; the second phase in 2015 when the share of WAP reached a maximum of 65.6% and the proportion of elderly began to climb at a pronounced pace (Figure 6).





6b China

2040

2000

2040 2030 2020 2050

0.0

195

In China the evolution of the DT had been much faster and the changes in the structure of the population much more dramatic, both in terms of size and speed (Figure 6b). The share of the young peaked at 41% in 1965; that of WAP reached a maximum of 73.8% in 2010, while that

0.0

195

2010

2100

2090

Source: Elaboration on UN DESA 2017

of the elderly is forecast to pass the 30% mark in 2060 and remain around this level till the end of the century.

Another way to summarize the impact of the DT on the population age structure is to recall that during the DT first the young, then WAP and finally the elderly will go through, one after the other, to: i) a phase of increasing growth, ii) a phase of declining growth; ii) a phase of contraction. Given its relevance for the supply of labour, the case of WAP is of extreme interest; moreover also in this case, the process appears extremely fast and pronounced (Figure 7). WAP increased at an accelerating rate for almost all the period from 1950 to 2005, to then increase at a decreasing rate in the following 10 years. It has now entered a long phase of pronounced decline that at present is forecast to continue till the end of the century.



Figure 7 - China; WAP; generational entries, generational exits and generational balance; 1950-2060

Source: Elaboration on UN DESA 2017

The Chinese ageing process in an international perspective

To better appreciate the speed of the Chinese ageing process, Table 5 compares China with 14 other big countries -that belong to the 5 continents and largely differ in terms of economic development- as to the percentage of people 65 and older in 2015, 2030, 2060 and 2100. The 15 countries are classified into three groups: the first includes the countries with a percentage of elderly below 15%, the second with a percentage between 15% and 30%, and the third with a percentage above 30%.

In 2015 in China the percentage of elderly was still below 10%, a situation shared by 8 other countries in the sample: the 6 poorest ones with values below 10%, Russia and the USA with values above 10%. The remaining 6 countries include Japan (the oldest country in our sample) where more than 1/4 of the population was already above 64, and 5 EU countries, with Germany and Italy above 20%.

	2015	2030	2060	2100
China	9.7	17.0	30.2	31.5
Japan	26.0	30.5	37.3	36.1
Bangladesh	5.0	7.6	21.0	33.2
India	5.6	8.4	16.5	25.7
Turkey	7.8	12.1	23.6	32.0
France	18.9	24.4	28.0	31.3
Germany	21.1	28.2	35.1	35.4
Italy	22.4	29.2	36.1	35.5
Spain	18.9	26.2	37.8	37.0
UK	18.1	22.9	29.3	32.2
Russia Fed	13.5	19.6	24.6	24.6
Egypt	5.1	6.6	12.3	21.4
Nigeria	2.7	2.9	4.7	11.3
Brasil	8.0	13.6	27.3	33.5
USA	14.6	21.3	26.3	29.8

 Table 5 - Selected countries; percentage of people 65 and above; 2015, 2030, 2060, 2100

Source: Elaboration on UN DESA 2017

With time the percentage of elderly tends to increase in all 15 countries, but the progression of China stands out for its rapidity. In 2030 China's percentage will be up to 17% so that China will join the second group together with Russia (19.6%) and the USA (21.3%). In that year Japan is expected to be only country with more than 30% of elderly people.

By 2060 also China will have broken the 30% mark together with Spain, Italy and the UK, while Bangladesh, India, and Brazil are projected to join the second group. Finally in 2100 in Bangladesh, Turkey, France and Brazil also more than 30% of the population will be old and only in Nigeria, projected to become the third most populous country in the world, the elderly will be less than 15%.

The socioeconomic impact of ageing

The percentage of people above a certain age (normally 64) represents the best indicator of ageing and allows connecting the ageing process to the DT. The indicators of dependency are used to capture the socioeconomic impact of the phenomenon.

The indicators to measure the socioeconomic burden

The demographic indicators of dependency

The indicators most commonly used to measure the socioeconomic burden are strictly demographic in nature. The Old age dependency ratio (OADR) is computed dividing the number of elderly by the number of people of working age. On the other side of the age pyramid the ratio between the number of youth (0-14) and the number of people of working age (the Young age dependency ratio, YADR) provides a measure of the socioeconomic burden represented by the children. The sum of the two indicators gives the Total age dependency ratio (TADR), which is normally taken as a measure of the total socioeconomic burden of a country⁷.

Due to the way in which they are computed, the demographic indicators, and especially the OADR, have played a major role in providing a distorted vision of the impact of ageing on

⁷ Another common indicator is the potential support ratio that is reciprocal to the demographic dependency ratio.

the welfare system, a vision that has prevented the possibility to consider the full range of policies that can be adopted to face this problem.

WAP includes a percentage of people (such as students, retired and housekeepersshould you refer todeabtes about productive role of household labour?) that do not support, but are supported. Their number depends on the level and typology of the economic development, the technologies adopted, the structure of production by economic sector, the characteristics of the education system, etc.

While the choice of WAP as the denominator of the demographic indicators probably reflects a historical phase characterized by an almost total coincidence between active population and WAP, and in which information on the employment level was absent or was collected only every 10 years by censuses, its present predominance in all analysis of ageing can be interpreted only as the result of intellectual inertia.

As a matter of fact:

- Only one part of WAP, sometimes less than 60 %, has a formal job⁸;
- Estimates of the level, structure and tendencies of employment are available almost in real time;
- The duration of the training phase of life has greatly increased, and in developed countries the average age of entry in the working phase of life is above 20;
- Differences in the education system, economic and social development, productive specialization and technologies create different percentages of students, housewives and unemployed in different countries.

In conclusion, at present the people in the15-64 age group do not correctly represent those that maintain, while those in the 0-14 and 15-64 age groups do not correctly represent the sustained and therefore the demographic indicators are not a good measure of socioeconomic dependency. These indicators have also contributed to suggest that demographic trends cannot be changed and must be taken as an exogenous variable, a datum of the problem.

The economic indicators of dependency

The problems affecting the demographic indicators can be easily solved by substituting employment for WAP (Bruni, 2008)⁹. Therefore, the Total economic dependency indicator (TEDI) is computed by dividing the total number of dependents by the number of employed, (in substance the number of those that do not work by those that have a job) and multiplying it for 1000¹⁰. Therefore TEDI tells us how many people are sustained, in a given area or in a given country by 1,000 people employed. The economic indicators allows for the following:

• Differentiate the structural burden by economically relevant typologies of dependents; for instance, a first group should include those in which the society is investing (the young and the students), the second those that provide maintenance services to the employed members of the family, the third those that have already contributed to society by producing good and services or equally important maintenance services¹¹;

⁸ In 2015 the RoE of four EU countries (Spain, Italy, Greece and Croatia) was below 60% (Bruni, 2017). This situation is quite common in many Arab countries where the official presence of women is very limited and where also men participation is often limited by social and religious segmentation.

⁹ For applications of this indicator to other countries see Bruni, 2009, 2010, 2012, and 2017.

¹⁰ A similar suggestion has been advanced by Tapinos (Tapinos, 2001), who, however, did not emphasize the change in perspective and vast implications brought about by employing this indicator. Other researchers have gone in this direction. but have used the labour force as denominator, which implies putting the unemployed between those that sustain (Carone, 2005; Bijak et al, 2005 and 2007).

¹¹ Due to lack of suitable data and the scope of the paper only demographic categories will be analyzed in the following paragraphs.

- Verify in which measure the changes in the structural burden are due, on the one hand, to demographic tendencies, and on the other, to the capacity (or lack of capacity) of the economic system to generate additional employment;
- Estimate the growth of employment, and therefore of production, needed to obtain a given level of structural burden.

The use of demographic indicators can still be justified in countries that do not have reliable employment data, but is totally inappropriate for countries, by now the majority, in which such data are available almost in real time. Let's also recall some other notable shortcomings of the demographic indicators:

- Using the 15-64 WAP for all countries will make cross section analyses highly misleading since in numerous developing countries many children start working before becoming 15 and/or the retirement age is below 65¹²;
- The increase in the duration of the training phase and in life expectancy will soon redefine working age first between 20 to 70 and then, later on in the century, between 25 and 74; this will make extremely difficult to make inter-temporal comparisons.

Empirical evidences

The demographic indicators: China in an international perspective

Figure 8 reports the demographic age dependency ratios for the whole planet and China over the period 1950-2100. It is immediately evident, as we have already suggested, that the evolution of the indicators reflects the evolution of the DT.

In a first phase, that ended in 1965, the world TADR increases, reaching a maximum of 752 "dependents" for 1,000 people in working age, due to the increase in the number of the young. The second phase is characterized by the growth of WAP that, everything else held constant, has the effect of reducing all demographic indicators. This phase ended in 2010 when the TADR reached a minimum of 525. In the third and final phase the increase in the share of elderly brings to an increase of the OADR and of the TADR. However, the percentage of young dependents remains higher than that of the elderly till 2080, so that only in the last 20 years of the century the elderly will become the largest group of dependents.

In China the evolution of the demographic indicators follows the same pattern and approximately the same timing, but the oscillations are much more pronounced. The highest value of the TADR was reached in 1965 with 801 dependents; of them only 62 were elderly. In the following 65 years the TADR dropped to a minimum of 356 due to the contemporary decline in the number of the young (from 296 million to 243 million), and the expansion of WAP (from 401 million to 1,003 million). It is at this moment that an extremely pronounced increase in the number of the elderly, coupled with an equally pronounced decline of WAP, started to affect the TADR that is projected to climb to 480 in 2030, to 663 in 2045 and to 790 in 2060. It should be underlined that from 2015 to 2060 the number of people 65 and above will increase by 260 million, while those in working age will decline by 284 million.

 $^{^{12}}$ It is, for instance, the case of China where the most common retirement age is still 60 for men and 55 for women.



Figure 8 - World and China; demographic indicators of dependency; 1950-2100

Source: Elaboration on UN DESA, 2017

Table 6 reports the values of the demographic indicators in 2010 and 2060 for the same sample of large countries considered in the previous analysis. In this case the aim is to show that the demographic burden has some economic relevance only inasmuch as it is connected to the stage reached by a country along the path of the DT that, in its turn, depends mainly on the level of socioeconomic development.

Again countries are classified into three groups. The first group includes countries with values of the TADR up to 450, the second countries with values between 450 and 600, the third countries with values above 600. For each country we have also reported the weight of the OADR on the TADR.

		2015							2060								
		YADR		OADR	TA	DR	C	DADR/TADR		YADR	OADR			TADR	0	ADR/TAD	R
China		243.5		133.2		376.7		35.4		248.7		540.8		789.5			68.5
Japan		213.0		426.5		639.5		66.7		248.6		746.0		994.6			75.0
Bangladesh		448.9		76.9	52	5.8	14.6			243.1	283.1			526.1		53.8	
India		436.2		85.8	52	1.9	16.4			271.6	223.2			494.8		45.1	
Turqie		384.1		117.1	50	1.2	23.4			262.6	358.0			620.6		57.7	
France		290.9		301.6		592.4		50.9		289.8		502.4		792.3			63.4
Germany		199.5		321.1		520.6		61.7		237.5		663.3		900.7			73.6
Italy		214.8		349.9		564.7		62.0		246.7		721.6		968.3			74.5
Spain		225.1		285.1		510.2		55.9		243.5		777.2		1020.7			76.1
UK		273.5		281.9		555.4		50.8		281.9		517.1		799.1			64.7
Russia Fed		241.6		193.6	43	5.2		44.5		309.3	429.2			738.5		58.1	
Egypt	536.2		81.9		618.1		13.3		378.7		178.5		557.2		32.0		
Nigeria	830.0		51.5		881.5		5.8		547.9		70.9		618.8		11.5		
Brasil	323.8		114.5		438.2		26.1			235.9		417.4		653.4			63.9
USA		290.5		221.3		511.8		43.2		281.8		433.6		715.5			60.6

Table 6 - Selected countries; demographic indicators; 2015 and 2060

Source: Elaboration on UN DESA 2017

In 2015, Nigeria was the country with the highest TADR, followed by Japan and Egypt, these three countries being the only ones registering values above 600. At the other end of the spectrum we find, with values below 450, China, Brazil, and Russia. The other 9 countries had intermediate values. This group includes not only all European countries and the USA, but also Bangladesh, India, and Turkey.

What is the reason of this strange ranking? As we have already shown the highest total values of the TADR are reached at the beginning and at the end of the DT: at the beginning, because of the high share of young; at the end, because of the high share of elderly. As a matter of fact in 2015 the elderly represented two third of those outside working age in Japan and less than 6% in Nigeria.

In 2060 the TADR has greatly increased in the majority of countries. Let's observe first of all that China has moved from the first to the third group reaching a TADR of 790. It is forecast that also Russia and Brazil will move from the first to the third group, reaching a TADR of 738 and 653. This group includes also all the EU countries in our sample, the USA and Japan whose TADR is however second to that of Spain. Nigeria is expected to remain in the third

group, while Egypt is expected to go from the third to the second. The TADR of Bangladesh, India, and Turkey are expected to remain substantially stable.

Obviously, these movements are explained by the changes in the population age structure. By 2060, in all the countries of the third group, with two exceptions, the percentage of elderly over the total number of dependents is in excess of 60%, with maximum values of 76.1% in Spain and 75% in Japan. The exceptions are Russia where the elderly account only for 58.1% and Nigeria where the elderly continue to be a small minority (11%), but where the number of children continues to be very high.

In conclusion, demographic indicators simply reflect the stage of DT and more specifically the point along the path of the DT in which a country finds itself in a given moment of time. Moreover the same value can be associated to very different situations.

The economic indicators

Given the greater availability and reliability of data, we will start applying TEDI to the European Union as a whole and then to the single EU member countries; we will then estimate it for China and for the Chinese provinces.

The European Union

From 1991 to 2015 the number of dependents for 1,000 workers (TEDI) has been equal on the average to 1,334, but notable variations have been registered (Figure 9).



Figure 9 - EU; Total economic dependency indicator; 1991-2015

Source: Elaboration on EUROSTAT data

TEDI reached a maximum of 1,450 in 1994, then progressively declined during the long expansionary phase that lasted till 2008 when it reached a minimum of 1,216. During the financial crisis TEDI increased again passing the 1,300 mark in 2014 when a new phase of decline came in. In 2015 it was equal to 1,274.

These tendencies reflect both the demographic trend and the economic cycle (Table 7). Starting from a long run perspective, between 1991 and 2015 total population increased by almost 27 million (5.6%), of which 19 million employed (9.4%) and 9 million inactive (2.9), which explains the improvement of TEDI (-88 points).

	Population	Population Employed Inactives			Population	Employed	Inactives	Population	Employed	Inactives
	Absolute value				Absolute change			Yearly percentage change		
1991	478.2	203.0	275.2	1991-1994	6.1	-5.7	11.8	0.4	-0.9	1.4
1994	484.3	197.3	287	1994-2008	15.1	27.3	-12.2	0.2	1.0	-0.3
2008	499.4	224.6	274.8	2008-2013	4.8	-6.3	11.1	0.1	-0.2	0.3
2013	504.2	218.3	285.9	2013-2015	1.0	3.7	-2.7	0.0	0.1	-0.1
2015	505.2	222.0	283.2	1991-2015	27.0	19.0	8.0	5.6	9.4	2.9

Table 7 - EU; population, employed and inactive; absolute values (1991, 1994, 2008, 2013 and 2015) and percentage change (1991-94, 1994-2008, 2008-2013 and 2013-15)

Source: Elaboration on EUROSTAT data

Over the period we are considering, the yearly percentage increase of total population has been progressively decreasing, while the percentage change of employment reflects the cyclical phases that have affected the EU economy, the two most relevant being the positive phase between 1994 and 2008 and the negative one between 2008 and 2013, in which the EU was affected by the international financial crisis. As a consequence, the short term changes of TEDI have been mainly determined by the economic dynamics and, more specifically, by its capacity to increase employment.

Moreover, in the 25 year period we are considering the structure of dependents by typology has registered notable changes (Figure 10):

- I. The student economic dependency indicator (SEDI) decreased after 1994 from around 450 to around 350 in 2008 to then remain substantially constant;
- II. The unemployed economic dependency indicator (UEDI) has oscillated around a value of 100, the yearly values being included between a maximum of 125 and a minimum of 75;
- III. After reaching a peak of 529 in 1994, the dependency indicator of the people in working age that take care of the workers allowing them to perform their daily duties (i.e. doing maintenance to the human capital) (MEDI) has progressively declined to 408 in 2015, due to the long-run positive trend of the RoE (Bruni, 2017 and 2018a);
- IV. Finally the retired and elderly economic dependency indicator (REDI) has progressively increased from 307 to 404, getting very close to the value of MEDI.



Figure 10 - Specific rates of economic dependency; 1991, 1994, 2008, 2013, 2015

Figure 11 represents the long term trends of the three main groups of dependents. Two long term trends of opposite sign and largely offsetting each other clearly emerge: on the one hand, the increase in the share of REDI (from 22.7 % to 31.8 %) and, on the other, the decline in the share of SEDI (from 33.6 % to 27.8 %). As a consequence, the share of MEDI (inclusive of

Source: Elaboration on EUROSTAT data

the unemployed) does not present major changes, the values remaining always above 40%, so this remains the largest group of dependents.





Source: Elaboration on EUROSTAT data

In conclusion at the EU level:

✓ TEDI presents a long term negative trend, that is the socioeconomic burden has been progressively declining in spite of the growth in total population,

and

- ✓ Is characterized by short term oscillation which are explained by the economic cycles; it increases in period of crisis, declines in period of economic growth;
- ✓ Finally we can observe a progressive decline of the share of the students, a progressive growth of the share of the elderly and retired, while the share of the people of working age in charge of the maintenance of the employed and other members of the family has been substantially constant, so that this has remained the most relevant group of dependents.

EU member countries

Moving our attention to the EU member countries, we can observe that the national values are spread over a very large range and present different trends.

As to the first point, we can observe that the range of the average values registered by the 28 countries in the period 1991-2015 is 690 points, but a more detailed analysis shows that the spread reached a minimum of 720 in 2008 and a maximum of 1,099 in 2004 (Table 8).

Table 8- EU member countries; TEDI, minimum and maximum values registered in selected years

	Average va	lues 1991-2015	-	1991	1994		
Max	Italy	1681	Spain	1995	Spain	2135	
Min	Denmark	990	Denmark	992	Denmark	1036	
Diff.		690		1003		1099	
	2	2008		2013	2015		
Max	Malta	1612	Greece	2084	Greece	2017	
Min	Netherland	892	Netherland	996	Germany	994	
Diff.		720		1088		1023	

Source: Elaboration on EUROSTAT data

Data also show that the spread tends to increase during downturns and decrease in periods of economic expansion (Figure 12). For instance, it declined by 379 points between 1994 and 2008 and increased by 368 points between 2008 and 2013 (Figure 12).





Source: Elaboration on EUROSTAT data

Table 9 reports the ranking of the 28 EU member countries in terms of the total economic dependency index. We have also indicated in red the three countries that moved up from the second group of the last fourteen to the first group (Luxembourg, Cyprus and Poland) and the three that moved down form the first to the second group (Finland, Portugal and Romania).

Data clearly suggests that there are countries that seem to be characterized by a situation of low socioeconomic burden and others by high socioeconomic burden. In the first group we can include Sweden, Estonia, Germany, the Czech Republic, the UK, but also the Netherlands and Austria always in the very top positions, while Luxembourg has climbed from the 15th to the 9th position. The second group includes Italy, Greece and Spain, while we must underline the worsening registered by France, Belgium and Croatia.

	1991		2015		1991		2015
Sweden	903	Germany	994	Luxembourg	1371	Slovenia	1252
Estonia	921	Netherlands	999	Croatia	1388	Finland	1261
Denmark	949	Sweden	1022	Poland	1408	Portugal	1262
Germany	1109	Estonia	1046	France	1463	Romania	1276
Czech Republic	1118	Austria	1051	Slovenia	1478	Hungary	1331
Portugal	1134	United Kingdom	1053	Cyprus	1575	Ireland	1355
Finland	1146	Denmark	1070	Hungary	1608	Malta	1362
United Kingdom	1152	Czech Republic	1088	Italy	1619	Bulgaria	1383
Austria	1223	Luxembourg	1149	Bulgaria	1638	Belgium	1461
Latvia	1255	Latvia	1159	Belgium	1662	France	1484
Slovakia	1266	Lithuania	1185	Greece	1688	Spain	1594
Netherlands	1313	Cyprus	1222	Malta	1778	Croatia	1679
Lithuania	1337	Poland	1232	Spain	1891	Italy	1726
Romania	1369	Slovakia	1233	Ireland	2043	Greece	2017

Table 9 . EU	member	countries	TEDI in	1991	and 2015
1 able 3 - EU	member	countines.		1771	anu 2013

Source: Elaboration on UN DESA 2017 and EUROSTAT

As to the long term trends of the single countries, from 1991 to 2015, TEDI declined in 19 countries (i.e. the socioeconomic burden became lighter), and increased in 9 (Table 10). Moreover, the percentage changes are included between -33.7% for Ireland and +21% for Croatia, but some positive variations have been registered also by top ranking countries like Sweden, Denmark and Estonia.

Between the countries whose TEDI increased, together with Italy, Spain, Greece and Croatia, we find Portugal and Finland that have lost 10 and 9 positions, respectively. Between the countries in which the socioeconomic burden declined, some gains are particularly impressive like that of Ireland (that moved from the 28th (last) to the 20th position) and that of the two Mediterranean islands, especially Cyprus, that entered into the first group of countries

	Abs. change	% change		Abs. change	% change
Ireland	-688.3	-33.7	United Kingdom	-99.4	-8.6
Malta	-416.5	-23.4	Latvia	-96.0	-7.6
Cyprus	-352.9	-22.4	Romania	-93.1	-6.8
Netherlands	-313.8	-23.9	Slovakia	-33.6	-2.7
Spain	-296.6	-15.7	Czech Republic	-30.2	-2.7
Hungary	-277.6	-17.3	France	21.5	1.5
Bulgaria	-254.7	-15.6	Italy	107.0	6.6
Slovenia	-226.1	-15.3	Finland	114.5	10.0
Luxembourg	-222.5	-16.2	Sweden	119.7	13.3
Belgium	-200.5	-12.1	Denmark	121.0	12.8
Poland	-175.3	-12.5	Estonia	124.7	13.5
Austria	-171.6	-14.0	Portugal	128.0	11.3
Lithuania	-151.3	-11.3	Croatia	291.1	21.0
Germany	-114.9	-10.4	Greece	328.8	19.5

 Table 10 - EU member countries; TEDI; absolute and percentage change of national values; 1991-2015

Source: Elaboration on UN DESA 2017 and EUROSTAT

To explicit the relationship between TEDI and the employment level we have built the scatter diagram reported in Figure 13 that shows the pronounced negative relationship between TEDI and the RoE, which clearly indicates that the socioeconomic burden that the employed of a country have to bear is inversely related to the capacity of a country to provide jobs to the people of working age.





Source: Elaboration on UN DESA 2017 and EUROSTAT

Finally let's analyze the specific indicators of dependency and their evolution (Table 11). As we have previously said, the specific economic indicators of dependency single out three economically relevant groups that have very different economic and social roles, but have in common the fact that they do not take part in production, do not earn money, at least in a regular way, and need therefore to be sustained. The first group includes children in the pre-training phase and the young people enrolled in schools, universities and vocational training programs. The second includes mainly those people in working age that provide maintenance services to the people engaged in producing market goods and services. Finally, the third group is composed by the elderly that have already participated actively in production and have retired or have provided maintenance services, an activity many of them continue to perform also in the last phase of life.

The consistence of each group depends not only on demographic trends, but also on the laws and customs related to education and retirement as well to the economic structure and social development. The share of students, for instance, depends not only on the length of the compulsory phase, but also on the political setting and the importance attributed to education at the political, social and household level. The number of maintenance people in working age is inversely related to the RoE, but can be also heavily influenced, as is the case in many Muslim countries, but not only, by sexual discrimination and social customs. Finally the number of elderly and retired dependents will depend on demographic factors, the age of compulsory retirement and, more generally the legislation on pension, but also on the rules related to the labour market participation of retired people.

Starting from 1991 we can observe that in all EU member countries, except Sweden, the largest group of "dependents" was the second. It must however be underlined that this group, as improperly measured here, includes a large share of students since the average length of the training phase has been progressively increasing due to, but not only, the increasing demand for theoretical and practical knowledge coming from the production sector. In all countries the second largest group is represented by students, the exception again being Sweden where this is the most important group. It would therefore seem probable that in 1991, if properly measured, SEDI would represent the largest groups of dependents in all EU member countries.

	SEDI	MEDI	REDI	TEDI		SEDI		MEDI		REDI
Austria	30.8	42.5	26.6	100.0	Italy	26.6	Sweden	27.1	Poland	14.0
Belgium	29.0	47.1	23.9	100.0	Belgium	29.0	Estonia	32.3	Cyprus	14.7
Bulgaria	33.0	46.6	20.4	100.0	Luxembourg	30.0	Denmark	35.2	Ireland	14.8
Croatia	34.1	47.8	18.0	100.0	Greece	30.3	United Kingdom	36.7	Malta	15.1
Cyprus	41.2	44.1	14.7	100.0	Germany	30.4	Czech Republic	36.9	Romania	16.6
Czech R.	40.6	36.9	22.5	100.0	Spain	30.4	Slovakia	37.1	Slovenia	16.9
Denmark	35.0	35.2	29.8	100.0	Austria	30.8	Finland	39.7	Lithuania	17.3
Estonia	46.7	32.3	20.9	100.0	Netherlands	31.9	Portugal	39.8	Slovakia	17.7
Finland	36.2	39.7	24.1	100.0	Bulgaria	33.0	Germany	42.1	Croatia	18.0
France	33.4	43.4	23.1	100.0	Hungary	33.0	Romania	42.2	Latvia	18.7
Germany	30.4	42.1	27.5	100.0	France	33.4	Latvia	42.3	Spain	19.8
Greece	30.3	49.6	20.0	100.0	Croatia	34.1	Austria	42.5	Greece	20.0
Hungary	33.0	45.4	21.6	100.0	Slovenia	34.7	Poland	42.9	Bulgaria	20.4
Ireland	40.5	44.7	14.8	100.0	Denmark	35.0	Lithuania	43.1	Estonia	20.9
Italy	26.6	50.5	22.9	100.0	UK	35.5	France	43.4	Netherlands	21.5
Latvia	39.0	42.3	18.7	100.0	Finland	36.2	Cyprus	44.1	Hungary	21.6
Lithuania	39.6	43.1	17.3	100.0	Malta	37.4	Ireland	44.7	Portugal	22.1
Luxembourg	30.0	47.3	22.7	100.0	Sweden	37.7	Hungary	45.4	Czech Republic	22.5
Malta	37.4	47.4	15.1	100.0	Portugal	38.1	Netherlands	46.5	Luxembourg	22.7
Netherlands	31.9	46.5	21.5	100.0	Latvia	39.0	Bulgaria	46.6	Italy	22.9
Poland	43.1	42.9	14.0	100.0	Lithuania	39.6	Belgium	47.1	France	23.1
Portugal	38.1	39.8	22.1	100.0	Ireland	40.5	Luxembourg	47.3	Belgium	23.9
Romania	41.1	42.2	16.6	100.0	Czech R.	40.6	Malta	47.4	Finland	24.1
Slovakia	45.2	37.1	17.7	100.0	Romania	41.1	Croatia	47.8	Austria	26.6
Slovenia	34.7	48.5	16.9	100.0	Cyprus	41.2	Slovenia	48.5	Germany	27.5
Spain	30.4	49.8	19.8	100.0	Poland	43.1	Greece	49.6	United Kingdom	27.8
Sweden	37.7	27.1	35.2	100.0	Slovakia	45.2	Spain	49.8	Denmark	29.8
UK	35.5	36.7	27.8	100.0	Estonia	46.7	Italy	50.5	Sweden	35.2

 Table 11 - EU countries; specific economic indicators of dependency;1991

Source: Elaboration on EUROSTAT data

Coming to the third group, in 1991 its share was still quite modest, only Sweden registering a value above 30%. The countries with the lowest number of elderly dependents were the two Mediterranean islands of Malta and Cyprus, catholic Ireland that was still characterized by high fertility, and north eastern countries. Together with Sweden, the EU countries with the highest share of elderly dependents (more than 1/4) were Austria, Germany the UK, and Denmark.

Moving to 2015, the maintenance group remains the largest in all countries, but now the exceptions are two, Sweden and Germany, where the largest group is represented by the elderly (Table 12). The ageing process that has taken place in the 1991-2015 time interval is made evident by the fact that in 17 countries the second place has now taken by the elderly and the retired. Moreover the shares of this group are now included between a minimum of 20% in Ireland and a maximum of 39.8% in Germany.

	SEDI	MEDI	REDI	TEDI		SEDI		MEDI		REDI
Austria	27.8	37.8	34.3	100.0	Italy	21.9	Sweden	30.8	Ireland	20.0
Belgium	28.5	41.8	29.7	100.0	Greece	22.1	Denmark	33.6	Cyprus	21.1
Bulgaria	24.3	42.7	33.0	100.0	Croatia	24.0	Netherlands	33.6	Slovakia	24.1
Croatia	24.0	47.1	28.9	100.0	Bulgaria	24.3	Germany	34.1	Luxembourg	24.8
Cyprus	30.3	48.6	21.1	100.0	Spain	24.3	UK	34.6	Romania	25.1
Czech R.	28.8	38.8	32.4	100.0	Portugal	25.6	Finland	36.7	Poland	26.1
Denmark	33.1	33.6	33.3	100.0	Hungary	25.6	Estonia	37.2	Croatia	28.9
Estonia	31.2	37.2	31.6	100.0	Malta	25.6	Austria	37.8	Belgium	29.7
Finland	29.5	36.7	33.7	100.0	Germany	26.0	France	38.2	Spain	29.7
France	31.1	38.2	30.6	100.0	Slovenia	26.5	Czech R.	38.8	Slovenia	29.8
Germany	26.0	34.1	39.8	100.0	Lithuania	26.9	Latvia	39.9	Hungary	30.3
Greece	22.1	47.4	30.6	100.0	Poland	27.2	Lithuania	40.4	Greece	30.6
Hungary	25.6	44.1	30.3	100.0	Slovakia	27.5	Belgium	41.8	France	30.6
Ireland	37.9	42.1	20.0	100.0	Latvia	27.5	Ireland	42.1	UK	30.7
Italy	21.9	44.5	33.6	100.0	Austria	27.8	Portugal	42.1	Malta	30.8
Latvia	27.5	39.9	32.5	100.0	Romania	28.0	Bulgaria	42.7	Estonia	31.6
Lithuania	26.9	40.4	32.7	100.0	Belgium	28.5	Malta	43.5	Portugal	32.3
Luxembourg	30.8	44.4	24.8	100.0	Czech R.	28.8	Slovenia	43.7	Czech R.	32.4
Malta	25.6	43.5	30.8	100.0	Finland	29.5	Hungary	44.1	Latvia	32.5
Netherlands	33.5	33.6	32.8	100.0	Cyprus	30.3	Luxembourg	44.4	Lithuania	32.7
Poland	27.2	46.7	26.1	100.0	Luxembourg	30.8	Italy	44.5	Netherlands	32.8
Portugal	25.6	42.1	32.3	100.0	France	31.1	Spain	46.0	Bulgaria	33.0
Romania	28.0	46.9	25.1	100.0	Estonia	31.2	Poland	46.7	Denmark	33.3
Slovakia	27.5	48.5	24.1	100.0	Denmark	33.1	Romania	46.9	Italy	33.6
Slovenia	26.5	43.7	29.8	100.0	Netherlands	33.5	Croatia	47.1	Finland	33.7
Spain	24.3	46.0	29.7	100.0	Sweden	34.0	Greece	47.4	Austria	34.3
Sweden	34.0	30.8	35.2	100.0	UK	34.6	Slovakia	48.5	Sweden	35.2
UK	34.6	34.6	30.7	100.0	Ireland	37.9	Cyprus	48.6	Germany	39.8

Table 12 - EU countries; specific economic indicators of dependency; 2015

Source: Elaboration on EUROSTAT data

An even clearer representation of the changes that have taken place in the interval is provided by the absolute and percentage changes of the specific indicators (Table 13). SEDI has declined in all EU member countries, with the only exception of Denmark and Sweden that have however registered a very modest increase. The most dramatic decline in the number of young people were registered, with values above 40%, by Malta, Poland, Cyprus and Slovakia; in nine other countries, mainly in north and eastern Europe, but also in Spain, the decline was in excess of 30%

The percentage changes of MEDI vary enormously, from -45.1% of the Netherlands to +29.7% of Estonia. Let just observe that MEDI declined in 20 countries and increased in 8. The changes of REDI are very homogeneous as to the direction (REDI increases in 26 countries and declines only in two), but extremely different in terms of values, the positive changes being included between the maximum values of Croatia (93.1%) and Greece (82%) and the minimum of Belgium (8.9%) and the UK (0.5%).

In substance, data clearly suggest that the negative impact of ageing can be substantially contained by economic growth and immigration.

	SEDI	MEDI	REDI	TEDI		SEDI		MEDI		REDI
		Absolute	e values				Percentage	change		
Austria	-82	-120	37	-165	Malta	-47.5	Netherlands	-45.1	Croatia	93.1
Belgium	-66	-173	35	-204	Poland	-45.1	Ireland	-38.8	Greece	82.0
Bulgaria	-205	-176	119	-262	Cyprus	-42.7	Malta	-29.7	Estonia	69.9
Croatia	-71	125	234	287	Slovakia	-41.3	Germany	-26.6	Lithuania	68.8
Cyprus	-274	-97	27	-345	Lithuania	-39.3	Slovenia	-24.4	Poland	62.0
Czech R.	-146	2	96	-48	Ireland	-39.2	Austria	-23.2	Latvia	61.7
Denmark	21	25	73	119	Bulgaria	-37.9	Bulgaria	-23.0	Portugal	60.7
Estonia	-106	89	135	117	Romania	-36.6	Spain	-22.8	Malta	56.2
Finland	-45	5	145	104	Hungary	-36.1	Belgium	-22.2	Italy	55.9
France	-29	-70	114	15	Slovenia	-36.0	Luxembourg	-20.9	Finland	52.6
Germany	-75	-123	94	-104	Latvia	-34.5	Hungary	-20.1	Slovenia	48.3
Greece	-67	116	277	326	Spain	-32.9	Lithuania	-16.3	Romania	40.0
Hungary	-192	-148	52	-288	Czech R.	-32.0	Cyprus	-14.2	Czech R.	37.9
Ireland	-327	-358	-36	-722	Portugal	-25.9	UK	-14.0	Bulgaria	35.6
Italy	-55	-52	207	100	Estonia	-24.7	Latvia	-12.6	France	33.8
Latvia	-168	-66	144	-91	Germany	-22.5	France	-11.0	Germany	31.0
Lithuania	-207	-94	158	-142	Austria	-22.0	Italy	-6.4	Slovakia	30.9
Luxembourg	-55	-134	-24	-214	Netherlands	-20.1	Poland	-5.3	Denmark	25.9
Malta	-314	-249	150	-412	Croatia	-15.1	Czech R.	0.6	Spain	25.7
Netherlands	-84	-274	45	-313	Belgium	-13.8	Finland	1.0	Netherlands	15.9
Poland	-273	-32	122	-182	Luxembourg	-13.6	Romania	3.3	Hungary	15.0
Portugal	-113	76	154	117	Greece	-13.2	Denmark	7.6	Sweden	11.8
Romania	-206	19	91	-96	Italy	-12.9	Greece	13.9	Cyprus	11.6
Slovakia	-237	123	69	-44	UK	-11.3	Portugal	16.7	Austria	11.5
Slovenia	-185	-175	120	-239	Finland	-11.0	Croatia	18.8	Belgium	8.9
Spain	-190	-215	96	-309	France	-5.9	Slovakia	26.2	UK	0.5
Sweden	3	67	37	108	Sweden	1.0	Sweden	27.3	Luxembourg	-7.8
UK	-46	-59	1	-104	Denmark	6.3	Estonia	29.7	Ireland	-11.9

 Table 13 - EU member countries; specific economic indicators of dependency; absolute and percentage change over the period 1991-2015

Source: Elaboration on EUROSTAT data

China

Some background considerations on population and employment statistics - In estimating and interpreting the Chinese economic indicators of dependency we must keep in mind some characteristics of the statistical information on population and employment and some demographic phenomena, unique for their relevance and speed, that have affected China in the last 30 years.

Data clearly suggest that in rural areas employment, especially male employment, tends to largely correspond to population. In fact the RoE by sex for rural areas shows that up to the age of 64 almost all men are counted as being present in the labour market and their presence remains quite high also after 64; at the same time the presence of women is much higher than in urban areas (Figure 14).





Source - Elaboration on Census data; 2010

If it is true that the great majority of farmers start working in the fields when they are still at compulsory education age and will continue to do so as long as they are physically sufficiently fit, it is also true that many of them could be classified as disguised unemployed, and should therefore be included in the dependants¹³. The implication is that the TEDI of rural areas, and therefore that of whole China, underestimates the social burden. Moreover, since the level of urbanization largely differs between provinces, the larger the proportion of rural population the more underestimated is the provincial socioeconomic burden.

China has witnessed what has been defined as the greatest migration process of all time¹⁴: up to now around almost 300 million people have moved from rural to urban areas and toward the coastal provinces that have been at the center of the Chinese economic miracle¹⁵. This internal migration has also been the main engine of the ongoing urbanization process whose evolution is summarized in the following 4 graphs: the two on top (15a and 15b) represent, respectively, the absolute and percentage change of total, urban and rural population between 1995 and 2015; those below (15c and 15d) the same variables for employment.

As we have already seen, the growth of total population has progressively declined from more than 12 million per year in 1995-96 to less than seven million (around 0.5 %) in 2014-15¹⁶. In all this period China's population has been affected by a massive redistribution from rural to urban areas: between 1995 to 2015 rural population declined, on the average, by 12.8 million per year, and urban population increased on the average by 21 million.

Figure 15 - China; population yearly total change (15a) and percentage change (15b); employment yearly total change (15c) and percentage change (15d); 1995-20152 15a 15b



¹³ According to personal estimates, in 2010 almost half of the employed in agriculture could be be considered disguised unemployed were concentrated in the emigration provinces. However only a minority of the disguised unemployed could represent a potential supply for the modern sectors due to age and educational level (Bruni Tabacchi, 2011, p. 48).

¹⁴ According to the last International Migration Report, in 2017 International migrants amounted to 259 million and their number had increased by 58 million in the previous 7 years at an average rate of 8 million per year; 80 million lived in Asia, 78 million in Europe, and 58 million in northern America; more than 2/3 were concentrated in just 20 countries, those raking ion the top of the list being USA, Saudi Arabia, Germany, the Russian Federation and the United Kingdom.

For a more detailed analysis of internal migration flows, see Bruni and Tabacchi, 2011, pp.21-24

¹⁶ It should be recalled that at this moment only the elderly sub-population is increasing, while the young and the people in working age are already declining.

Source: Elaboration on data of China' Statistical Yearbook, 2016

This huge redistribution of population has been paralleled by a redistribution of employment from rural to urban areas. On average, rural areas were affected by the destruction of 6 million jobs per year, while urban areas saw the creation of an average of 10.7 million additional jobs per year.

As a consequence of the urbanization process the share of urban population has increased from 29% in 1995 to 56% in 2015^{17} and that of the employed from 28% to 52.2%.

If we put migration in the contest of the *hukou* system¹⁸, we obtain a situation in which the population *present* in any given area includes two components: the resident population and the floating population. The first is composed by people living where they were born, the second people who are registered in a different area. In spite of some recent efforts to provide residence permits to migrants, the phenomenon has still large proportion. At the national level the floating population accounts for around 20% of total population, but its size is much larger in such places as the municipalities of Beijing and Shanghai, where residents account for less than 40%, but also in the coastal provinces of Zhejiang and Fujian where residents account for around 60%. Since residence permits still represent an important starting point to estimate population and employment, it is possible that the accuracy of these statistics is affected, both in the areas of departure and arrivals, the size of the error being probably related to that of the so called floating population. This consideration is also supported by the fact that rural counties have an incentive to over-report population to receive more benefits from the government, while city districts tend to report lower figures to attain population control target.

The national level - In China in the 1995-2015 period, TEDI registered an average value of 761, the time series presenting a U shape with values included in quite a small interval: in 1995, 1,000 employed sustained, beside themselves, 779 dependents that declined to 750 in 2004 to then climb back to 775 in 2015 (Figure 13).



Figure 13 - China; total number of dependents per 1,000 workers; 1995-2015

Source: Elaboration on data of China' Statistical Yearbook, 2016

As we noted for the EU, the changes of TEDI are the result of the interaction of demographic long term trends and economic cyclical and long term trends; in China long term trends play a predominant role. However, we can observe that (Table 14):

¹⁷ At the end of 2017 it was already estimated at around 58%

¹⁸ The *Hukou* system is a system of household registration that identifies a person resident stratus either as rural or urban, based on the registered birthplace. In practice, this means a migrant worker from the countryside is not entitled to public services in Shanghai, despite working and living in the city.

- The rate of growth of total population and employment have both progressively declined;
- Between 1995 and 2004 the average growth in employment exceeded that of population and therefore of the inactive;
- Between 2004 and 2015 the situation reversed and the average growth of employment was lower than that of population and therefore of that of the inactive.

	Population	Employed	Inactives	TEDI					
		Absolute values							
1995	1,240	681	559	822					
2004	1,314	743	571	769					
2015	1397	775	623	804					
	Absolute change								
1995-2004	74	62	12	-52					
2004-2015	83	32	51	34					
1995-2004	157	94	63	-18					
	ŀ	Percentages	change						
1995-2004	0.7	1.0	0.2	-0.7					
2004-2015	0.6	0.4	0.8	0.4					
1995-2004	0.6	0.7	0.6	-0.1					

Table 14 - China; total population, employed, inactive, and TEDI in 1995, 2004 and 2015

Source: Elaboration on data from China' Statistical Yearbook, 2016

Moving to the specific indicators (Table 15), we can observe, in the first place, that the number of students for 1,000 employees has progressively declined from 493 to 290 in 2013, to then slightly increase in the following two years. In parallel the value of MEDI has first increased from 196 to 313 in 2010, to then decline to a present value of 296. The only variable characterized by a positive trend over the whole period is the number of retired and elderly per 1,000 workers that remains however relatively low (184 in 2015).

Table 15 – China; Sspecific economic indicators of dependence; absolute value and percentage composition; 1995-2015.

	SEDY	MEDI	REDI	SEDY	MEDI	REDI
1995	473	196	110	60.7	25.1	14.2
1996	469	193	114	60.5	24.9	14.7
1997	460	195	116	59.6	25.3	15.0
1998	454	194	118	59.2	25.3	15.4
1999	448	193	122	58.7	25.3	16.0
2000	402	233	122	53.1	30.8	16.1
2001	394	234	124	52.4	31.1	16.5
2002	393	232	128	52.2	30.9	17.0
2003	387	234	131	51.5	31.1	17.5
2004	376	241	133	50.2	32.2	17.7
2005	355	262	135	47.2	34.8	17.9
2006	346	268	139	46.0	35.6	18.5
2007	341	272	141	45.2	36.1	18.7
2008	333	279	145	44.0	36.9	19.1
2009	325	286	149	42.8	37.6	19.6
2010	292	313	156	38.4	41.1	20.5
2011	290	312	161	38.0	40.9	21.1
2012	291	309	166	38.0	40.4	21.7
2013	290	307	171	37.8	39.9	22.3
2014	292	301	178	37.9	39.0	23.1
2015	293	296	186	37.9	38.2	24.0

Source: Elaboration on data from China' Statistical Yearbook, 2016

In conclusion, at present in China the dependants include two groups of almost equal size, the students and the inactive in working age that account for around 38%, while the third group, that of the retired and elderly, amounts to only 24%.

Urban and rural areas - Figure 14 compares the level and trend of urban and rural TEDI and compares them with the national values. As expected from the previous discussion, urban TEDI is notably higher than the national TEDI and obviously of the rural TEDI.

Over the 1995 to 2015 period the average value of urban TEDI has been 940 and the yearly values have moved in the direction opposite to that followed by the national and rural TEDI, increasing from the 1995 value of 847 to a maximum of 997 in 2003, to then decline to 908 in 2015.

During the same period the average value of rural TEDI was 677 with values decreasing from 753 to a minimum of 611 around 2005-2007, to then increase to a present value slightly above 620.





Source: Elaboration on China' Statistical Yearbook, 2016

These trends are "explained" by Figure 15 showing that:

- ✓ In urban areas (15a) the rate of growth of population has been higher than that of employment from 1995 to 2003, and lower in the following period;
- ✓ In rural areas (15b) both rates of growth have always been negative, the rate of growth of population being lower in absolute terms till around 2005 and then higher for most of the following years





Source: Elaboration on China' Statistical Yearbook, 2016

The population age structure of urban and rural areas makes evident the impact of the large migrations flows that have characterized China in the last 30 years: rural areas have a larger

share of young and elderly, urban areas a larger share of people in working age. Another relevant implication is shown by the ratio between the age group 0-15 (that includes those that will enter working age in the next 16 years) and the age group 50-64 (approximately those that will exit in the same period). At the national level the value of this indicator is 94.5 %, which shows a potential lack of labour force for the country as a whole. The gap is much more pronounced in urban areas where the value of this indicator is 85.4 %. In rural areas the entrants in working age slightly exceed those that will exit. This suggests that also in the near future urban areas will continue to provide work opportunities for young rural people and internal migrations will continue.

	China	Urban	Rural
0-14	15.6	13.2	18.0
15-64	74.9	78.5	71.3
65+	9.5	8.3	10.7
0.15/50-64	94.5	85.4	102.6

Table 16 -	China. urb	oan and rura	l areas: population	age structure ¹
			· ··· · ···· · · · · · · · · · · · · ·	

Source: Elaboration on Census data; 2010

Census data allow estimating the specific economic indicators of dependency at the urban and rural level with some minor adjustments. In the first place, we have to define as young those between 0 and 15 and working age population between 16 and 64; then, given the availability of employment data for people above 64, we included in REDI only the elderly not employed.

The specific economic indicators of dependency so obtained reflect both the previous considerations on the age structure and the different rates of labour market participation discussed earlier (Table 17). As expected, urban areas are characterized by a much higher percentage of inactive in working age and rural areas by a much higher percentage of students and a slightly higher percentage of elderly and retired.

Table 17 - China, urban and rural areas; total and specific economic indicators of dependency

	China	Urban	Rural					
	Ab	Absolute valuee						
TEDI	780	942	640					
SEDI	329	309	345					
MEDI	320	490	175					
REDI	131	143	120					
	Percen	tage compositi	ion					
SEDI	42.2	32.8	54.0					
MEDI	41.1	52.0	27.3					
REDI	16.8	15.2	18.7					

Source - Elaboration on Census data; 2010

The Chinese provinces

The ageing process is affecting all Chinese provinces, but pronounced differences still exists in the age structure (Table 19). More specifically, the percentage of elderly people is included between a maximum of 14.1 % in Chongqing and a minimum of 5.5 in Tibet. Only eleven provinces (mainly in the north east) are characterized by values above the national level.

¹⁹ Given the purely demographic nature of this table we go back to the standard age groups.

Region	0-14	Region	15-64	Region	65+
Tibet	24.6	Beijing	81.3	Chongqing	14.1
Guizhou	22.1	Shanghai	80.2	Sichuan	14.0
Guangxi	21.9	Heilongjiang	79.0	Liaoning	12.2
Xinjiang	21.1	Zhejiang	78.4	Jiangsu	12.1
Henan	20.9	J ilin	77.6	Tianjin	11.7
Jiangxi	20.7	Liaoning	77.6	Shandong	11.5
Ningxia	19.7	Tianjin	77.5	Hunan	10.9
Hainan	19.0	Inner Mongolia	77.1	Shaanxi	10.6
Yunnan	19.0	Shanxi	76.6	Anhui	10.4
Hebei	18.6	Guangdong	75.3	Hubei	10.3
Hunan	18.3	Fujian	74.8	J ilin	10.2
Qinghai	18.3	Gansu	74.7	Shanghai	9.7
Anhui	17.9	Qinghai	74.6	Zhejiang	9.6
Fujian	17.6	Shaanxi	74.5	Guangxi	9.5
Guangdong	16.5	Jiangsu	74.2	Heilongjiang	9.4
Gansu	16.4	Hubei	73.8	Inner Mongolia	9.3
Sichuan	16.2	Ningxia	73.5	Hebei	9.3
Hubei	16.0	Hainan	73.3	Jiangxi	9.2
Shandong	15.8	Shandong	72.7	Guizhou	9.2
Chongqing	15.3	Yunnan	72.3	Gansu	8.9
Shaanxi	14.9	Hebei	72.1	Henan	8.8
Shanxi	14.8	Xinjiang	72.0	Yunnan	8.7
Jiangsu	13.8	Anhui	71.7	Beijing	8.5
Inner Mongoli	13.6	Hunan	70.8	Shanxi	8.5
Jilin	12.2	Chongqing	70.6	Guangdong	8.3
Zhejiang	12.0	Henan	70.3	Hainan	7.7
Heilongjiang	11.6	Jiangxi	70.0	Fujian	7.6
Tianjin	10.8	Tibet	69.9	Qinghai	7.1
Liaoning	10.3	Sichuan	69.8	Xinjiang	6.9
Beijing	10.2	Guizhou	68.7	Ningxia	6.8
Shanghai	10.1	Guangxi	68.6	Tibet	5.5
<u><u> </u></u>	16.5		70.4		10.1

Table 18- Chinese provinces; age structure by main age group; 2015

Source: Elaboration on China' Statistical Yearbook, 2016

More generally, the share of the young declines from west to east (Map 1a) and conversely that of the elderly declines from east to west (Map 1b). However a few relative young provinces are located in the south east, while the oldest (Chongqing and Sichuan, where the elderly represent respectively 14.1 and 14%) are in the central area²⁰.



Map 1 b



Source: Elaboration on China' Statistical Yearbook, 2016

 $^{^{20}}$ This situation is coherent with the fact that western provinces are still characterized by higher birth rates and lower death rates, while the opposite is true for the eastern provinces. This does also suggest that, generally speaking, the DT is more advanced in the eastern regions that have reached a higher level of economic development (Bruni and Tabacchi, 2011)

For what relates to the demographic indicator of dependency we just recall a quite counter-intuitive and interesting result presented in Figure 16, the presence of an inverse relationship between the TADR and the percentage of elderly. In other words, the provinces with the highest TADR are those with the highest YADR. These provinces are still in the initial phase of the DT and in the near future their TADR will tend to decline due to the increase in the size of WAP. At the other extreme we find the provinces in which, for natural reasons or as a consequence of migration, the percentage of WAP is higher. In these provinces the TADR will necessarily increase in the near future due to the decline of WAP and the parallel increase in the number of elderly.

Figure 16 – Chinese provinces; total demographic dependency ratios and percentage of elderly between the dependents; 2015



Source: Elaboration on China' Statistical Yearbook, 2016 need axis labels

This result provides an additional argument against the use of demographic indicators to analyze the problem of ageing and even more so the economic implication of this process. The large difference in the provincial age structure does moreover suggest the extreme relevance of producing demographic projections at provincial level; at the same time it would seem obvious that the policies to face ageing should be phased depending on the ageing level reached by each province and the forecast evolution.

In 2010, according to Census data, the provincial TEDIs present a wide range of values. The highest value, and therefore the worst situation from the perspective of the socioeconomic burden, was registered by Tianjin with 1,047 dependents for 1,000 workers; at the other extreme there is Shandong with 628. However, only 8 provinces register values below the national average. The percentage of students on the total number of dependents²¹ -reported in the second column- range from a minimum of 14% registered in Beijing and a maximum of 66.2 % in Guizhou.

On the basis of the previous discussion we have investigated the relationship between the provincial TEDIs and the level of urbanization. What we found is a strong negative relationship between the share of young dependents and the level of urbanization (Figure 17a) which obviously implies an opposite relationship between the share of the other dependents and urbanization. The general implication is that the lack of relationship between TEDI and urbanization is due to the offsetting relationships between, on the one hand, the share of the students and urbanization and, on the other, the positive relationship between the share of the elderly and urbanization.

²¹ Census data do not allow to estimate MEDI and REDI, but only their joint value.

		TEDI	SEDI	% rural			TEDI	SEDI	% rural
	China	780	42.2	49.7	16	Shaanxi	811	37.2	54.3
1	Tianjin	1047	23.4	20.6	17	Shanghai	801	21.2	10.7
2	Shanxi	1011	38.2	51.9	18	Tibet	799	59.8	77.3
3	Guizhou	988	56.0	66.2	19	Hunan	799	43.5	56.7
4	Hainan	937	46.5	50.3	20	Inner Mongo	798	35.4	44.5
5	Chongqing	899	40.7	47.0	21	Jilin	785	30.5	46.6
6	Beijing	892	20.3	14.0	22	Fujian	783	39.1	42.9
7	Jiangxi	889	50.5	56.2	23	Guangxi	782	55.4	60.0
8	Ningxia	871	50.8	52.0	24	Hebei	757	42.1	56.1
9	Heilongjiang	855	29.1	44.3	25	Guangdong	751	43.9	33.8
10	Gansu	855	45.1	64.1	26	Sichuan	741	45.0	59.8
11	Qinghai	843	50.6	55.3	27	Hubei	722	38.1	50.3
12	Henan	843	49.8	61.5	28	Jiangsu	689	35.4	39.8
13	Xinjiang	842	50.2	57.2	29	Yunnan	674	57.2	65.3
14	Anhui	834	45.6	57.0	30	Zhejiang	646	37.2	38.4
15	Liaoning	813	28.2	37.9	31	Shandong	628	44.3	50.3

Table 19 – Chinese provinces - TEDI; 2010

Source - Elaboration on Census data; 2010

But then what determines the vast range of TEDI's provincial values? As shown by figure 17b, which shows the relationship between provincial TEDIs and RoEs, TEDI is just a way to quantify the impact on the socioeconomic burden of the capacity of a geographical area to provide jobs to its inhabitants.





Source: Elaboration on China 2010 Census

Some final remarks

The previous observations and analyses suggest that, all other things equal, the process of urbanization will determine a decline of the RoE and a concentration of the employed in the central age group. In its turn this will determine an increase of the total economic indicator of dependency. The amount and speed of the quantitative change will depend on the speed with which employment will continue to increase in urban areas under the impact of two conflicting forces: on the one hand, the expansion of the labour intensive service sector and, on the other, the impact on productivity of technological innovation and robotization. There is however a big question hanging on the background and that will be addressed on the last part of the paper: will China have a sufficient labour force to carry on its process of economic

growth and social development? And if not what will be the size of the national labour shortage and where it will arise first? Finally, how will China address the problem?

A comparative look to China and EU

The first element which emerges from a comparison of the EU and China is that the Chinese population is still much younger than the EU population (Table 20): in 2015 in China the percentage of elderly was almost ten percentage points lower, while the percentage of WAP was 7.5 points higher. This is due, as we have previously argued, to the fact that China still lags behind the EU on the path of the DT.

This demographic situation is reflected by the TADR that is 159 points lower than the corresponding indicator for the EU. However, all forecasts show that in China ageing will proceed at a very fast space so that around the middle of the century, the Chinese population is projected to be as old as that of France and the UK and older than that of the USA.

Table 20 - China and EU; Population age structure, demographic indicators andeconomic indicators of dependency; 2015

	Population age structure			Demographi	ic indicators of	Economic indicators of dependency				
	0-14	15-64	65+	YADR	OADR	TADR	Young	Inact	Elderly	TEDI
China	17.7	72.6	9.7	243	133	377	319	310	175	804
EU	15.4	65.1	19.5	237	299	536	354	515	406	1,276
Diff	2.2	7.5	-9.8	6	-166	-159	-35	-205	-232	-472

Source: Elaboration on UN DESA, Eurostat and China's 2016 Statistical Yearbook

The economic indicators -that take into account both the demographic and labour market situation- confirms, in an even stronger way, that the in China ageing is not yet a relevant problem, while showing that, on the average, the Chinese worker has a much lighter socioeconomic burden than the EU worker (804 vs. 1,276 dependents for 1000 people holding a job). As we have shown, this relative advantage remains true also if we consider only urban areas where the labour market situation is more comparable with that prevailing in the EU and estimates of total employment are more reliable. In this case the number of dependents per 1,000 employed is 908, a value lower than the lowest value registered by any EU member country.

The second element that emerged from our analysis is that both the EU member states and the Chinese provinces differ very much as to, on the one hand, the demographic dynamic and population age structure and, on the other hand, the labour market situation. As a consequence the spreads of EU member states TEDIs and Chinese provincial TEDIs are both extremely wide.

A look to the future

The demographic indicators

The indicators of future demographic dependency are immediately and uniquely computed once a demographic forecast by major age group is available. On the basis of UN DESA estimates and demographic forecasts, in China:

- I. From 2000 to 2015 the TADR declined since WAP increased faster than the number of elderly (Table 21);
- II. From 2015 to 2060 the TADR is forecast to more than double, increasing from 377 to 790, and the share of elderly is expected to grow from 35.4% to 68.5%.

As we have already stated, in this approach the ageing process is seen as a product of unchangeable demographic trends and therefore its impact on the pension system can be faced only by acting on the system itself, mainly by parametric interventions reforming contribution, coverage, the legal age of retirement, moving to a generalized system of capitalization, and convincing people to address the pension problem at the individual level by buying private insurances.

		Total pop	ulation		Demographic indicators of dependen				
	0-14	15-64	65+	Total		YADR	OADR	TADR	
		Absolute	values			Ab	solute values		
2000	316	879	89	1,283	2000	360	101	461	
2015	247	1,015	135	1,397	2015	243	133	377	
2030	223	978	246	1,447	2030	228	252	480	
2060	182	731	395	1,308	2060	249	541	790	
	!	Percentage co	omposition			Percentage composition			
2000	24.6	68.5	6.9	100.0	2000	78.1	21.9	100.0	
2015	17.7	72.6	9.7	100.0	2015	64.6	35.4	100.0	
2030	15.4	67.6	17.0	100.0	2030	47.5	52.5	100.0	
2060	13.9	55.9	30.2	100.0	2060	31.5	68.5	100.0	
		Absolute	change						
2000-15	-69	136	47	114	2000-15	-116	32	-84	
2015-30	-24	-37	111	50	2015-30	-16	118	103	
2030-60	-41	-247	149	-139	2030-60	21	289	310	
2015-60	-134	-147	307	25	2015-60	-111	440	329	

Table 21 - China; total and specific demographic indicators of dependency; 2015-2060

Source: Elaboration on UN DESA, 2017

The economic indicators

The previous analysis has shown that in recent years the economic indicator of socioeconomic burden has slightly increased due to the parallel slowdown of demographic dynamics and economic normalization. However the Chinese TEDI remains quite low in comparison to that of HIC.

In order to forecast future values of the economic indicators we don't only need forecasts of demographic variables, but also of labour market variables. Moreover, we have to assume that the demographic and economic spheres interact. We will therefore proceed by steps, presenting two sets of scenarios. In the first (Scenarios A) we assume that population is not affected by economic trends and therefore remains an exogenous variable²². In the second (Scenarios B), we consider a situation in which international immigration provides the labour force necessary to bring employment to the level requested by production. In this case population becomes an endogenous variable whose level is determined by the economic sphere²³, by migration, and will then impact on it through consumption and savings.

Scenarios A

Adhering to the basic hypothesis of these scenarios, the future values of WAP are taken from UN DESA zero migration scenarios (UN DESA, 2017.) Moreover, in order to compute the employment level we have assumed:

- 1. A rate of employment equal to that registered in 2015 (76.3%)
- 2. A rate of employment of 70% more in line with the increasing urbanization that China will register in the future. According to UN DESA, working age population is expected to decline by 37 million between 2015 and 2030 and by 247 million in the following 30

²² This is a standard hypothesis on all demographic forecasts, *in primis* those by UN DESA.

²³ For full fledged demographic scenarios in which immigration affects also the demographic evolution by increasing the number of births see Bruni, 2013 and 2014.

years, so that it would drop from 1,015 million in 2015 to 978 million in 2030, and to 731 million in 2060^{25} .

Under these assumptions the decline of WAP will cause a reduction of labour supply that, everything else held constant, will translate to a proportional reduction in employment (Table 22). Therefore:

a) If the RoE would remain constant at the 2015 level, employment would drop by 28 million in the first period and by 188 in the second, for a total amount of 216 million;

b) If the RoE would drop to 70% employment would decline by approximately 90 million in the first period and by 173 million in the second, for a total of 263 million, that is employment would decline by an additional 7.5 million for every 1 percentage point drop of the RoE.

	Total population			Enom	Dec	Econom	ic indicate					
	0-14	15-64	65+	Total	Empi.	ROE	Young	Inact	Elderly	TEDI		
		Absolute	values									
2000	316	879	89	1,283	721	82.1	438	219	123	780		
2015	247	1,015	135	1,397	775	76.3	319	310	175	804		
2000-15	-69	136	47	114	54	-5.7	-119	92	52	24		
				Scenari	os with no	migratio	n					
					Constant	RoE					Δ EMPL.	Migr. Bal.
2030	223	978	246	1,447	746	76.3	299	310	330	938	-28	0
2060	182	731	395	1,308	558	76.3	326	310	709	1,345	-188	0
					RoE =7	0					Δ EMPL.	Migr. Bal.
2030	223	978	246	1,447	685	70.0	326	429	359	1,114	-90	0
2060	182	731	395	1,308	512	70.0	355	429	773	1,556	-173	0
				Scenarios v	with migra	ation 201	5-30				Δ EMPL.	Migr. Bal.
CE	223	1,015	246	1,484	775	76.3	288	310	318	916	0.0	37
3.7	223	1,053	246	1,521	803	76.3	277	310	306	894	28.8	75
7.4	223	1,090	246	1,559	832	76.3	268	310	296	874	57.7	112
CE	223	1,106	246	1,575	775	70.0	288	429	318	1,034	0.0	128
3.7	223	1,148	246	1,617	803	70.0	277	429	306	1,012	28.8	170
7.4	223	1.189	246	1.658	832	70.0	268	429	296	992	57.7	211

Table 22 - China; total and specific economic indicators of dependency; 2000-2060²⁶

Source: Elaboration on UN DESA, 2017 and China Yearbook, 2016

Let's now analyze the evolution of the total economic dependency index in the two A scenarios:

- a) In both scenarios TEDI is forecast to progressively increase;
- b) Everything else held constant, the increase is higher in the scenario with the lower rate of employment;
- c) However, even in the scenario associated with the lower rate of employment, TEDI reaches a maximum of 1,556 in 2060, a value lower than that registered in 2015 by four EU countries: Spain, Croatia, Italy, and Greece. In the scenario with constant rate of employment the maximum is 1,345 not much higher than the present EU value and lower than the values registered by 9 EU countries;
- d) In both scenarios the share of the elderly is forecast to increase: in 2015 the elderly represented 21.7% of the socioeconomic dependents; their share is forecast to increase to around 1/3 in 2030 and then to half or more in 2060; in this case the highest values are those of the scenario with the highest rate of employment²⁷.

Our computations therefore suggest that from the perspective of the socioeconomic burden the future situation of China will not be very dramatic. What appears dramatic is the trend of

²⁵ For a comparative analysis of UN DESA demographic forecasts and the Chinese population age structure as estimated by the 2010 Census, see Bruni, 2014

²⁶ The lower part of this table is explained and discussed in a future paragraph (p. 38).

²⁷ This is due to the fact that with a higher RoE the number of dependent in working age is lower.

WAP. The decline in the potential source of labour forecast for China would imply, as we have already seen, a decrease of available labour by 28%, in the scenario at constant RoE, and by 34% in the scenario with the RoE equal to 70%. In absolute terms, this means that in next 45 years China would have to destroy more than 200 million jobs (that is around the total employment in the EU), at an average rate of 4.5 million jobs per year.

This raises the question whether and under which condition China could continue on the path of economic expansion and social development promised by the government and which represent an essential element for the political stability of the country.

A digression on robots and computer-based technologies

Considering the opposite ways in which numerous scholars of different countries are representing the role that computer based-technologies and AI will play during this century, you can get the impression that Technology is a modern Janus bifrons²⁸.

One narrative is that we are entering a new historical phase in which the labour force will be decimated and according to the most pessimistic vision "those displaced by the machines could turn to socially damaging activities, even possibly bringing about the end of civilization"²⁹. A more moderate vision just affirms that robots take our jobs, that technological change causes unemployment and this will be especially true and dramatic during this century since the pace of change is considerably faster than in the past due to the diffusion of computer-based technologies and AI³⁰.

At the other extreme, in China and Japan computer-based technologies and robots are looked upon more and more as the solution to the dramatic reduction in labour supply that is already affecting Japan and will very soon affect China, and therefore as welcome substitutes for foreign migrants. This is especially evident once you give even a cursory look to the fast increasing literature on the use of robots for the assistance to elderly people³¹.

As a matter of fact numerous national studies have failed to find empirical evidences to sustain the thesis that new technologies cause a reduction in the amount of available work³², the main reason being that the negative impact of technology on the employment level stands on a static perspective and 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 33 .

In the first place the savings from increase productivity are recycled back into the economy to create the demand that in turns creates jobs. This obviously requires the hypothesis, in my opinion quite realistic, of non-satiation of consumers. However it seems to me that this

²⁸Janus, an old Italic and Roman god that played an extremely important role in both the public and religious spheres, was the guardian of all forms of change and the protector of all that concerns an end and a new beginning. He is usually depicted as having two similar faces, both bearded and of serene appearance, which according to the legend allow the god to see the future and the past.

From a speech delivered by Professor Chris Weeramantry, cited in Borland Coelli, 2017.

³⁰ For instance Jeremy Rifkin in his book The End of Work states that: "(technological change) is now leading to unprecedented levels of technological unemployment". See also Ford, 2015 and Dunlop, 2016. For a very interesting and quite surprising compendium of expressions of fear of technology coming from a wide range of commentators including Nobel Prize winners Paul Krugman and Joe Stiglitz, but also Erik Byrnjolfsson and Andrew McAfee see Miller and Atkinson, 2013. ³¹ Chau Osborne , 2017; Gerling et al, 2016, Zhou and Salvendy (eds), 2016 but also

yhttps://theupsidetoageing.com/2017/07/11/the-use-of-robotics-in-long-term-care-facilities-a-step-into-the-future/, https://www.leadingage.org/magazine/march-april-2017/Long-Term_Care_Gets_Feet_Wet_in_Robotics_V7N2;htt ps://theupsidetoageing.com/2017/07/11/the-use-of-robotics-in-long-term-care-facilities-a-step-into-the-future/

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

³³ Technological change does also affect the distribution of earning between employed and determine an increasing earning inequality (Coelli and Boelly, 2016).

hypothesis needs to be redefined in order to understand why technological change does not have a negative impact on the employment level. What we should consider is that not only people prefer more to less even when the level of consumption is high, but that the number of goods present in the market is not given and that the human mind has what it appears to be a limitless fantasy for its needs and the goods that can satisfy them. Once we take this into consideration, it should be evident that new technologies while satisfying old needs create new needs and new ways of satisfying them and therefore will impact positively on the employment level.

In the second place new technologies may be substitute for some types of labour, but are very often complementary to, and hence will increase the demand for, other types of labour (more specifically workers who perform non routine cognitive-intensive work).

In conclusion, empirical evidence supports the idea that new technologies do not have a negative impact on the employment level. However, there is evidence that:

i. they can increase the rate of job destruction requiring workers to shift between jobs more frequently

and

ii.they impact on the employment structure in terms of skills provoking a job polarization characterized, on the one hand, by an increase in the share of high skill jobs and, on the other, by the decline of the share of low and middle skill jobs (Borland Coelli, 2017; Michaels et al. 2014).

More specifically it has been shown that computer-based technologies bring to the substitution of labour doing routine tasks with labour who can perform non-routine cognitive tasks, and therefore with high level of education attainment (Goldin and Katz, 2008).

Let's now turn to the second face of technological change. In the early 2000, shortages of migrant workers started to occur in the Pearl River Delta. The phenomenon then spread to the Yangtze River Delta, and even to provinces in central China (Cai, 2006). While these phenomena were reported with astonishment by the press (Bruni, 2014), Chinese scholars explained that the Chinese labour market was approaching the so called Lewis turning point (LTP), i.e. the situation in which the labour supply is no more unlimited and labour demand is faced by an upward sloping supply curve (Cai 2008a, 2008b; Cai and Wang, 2010). They pointed out that the labour shortages signaled "the beginning of the end to the unlimited supply of labour", and that "the demographic transition implies that China may soon face much more serious supply constraint in the labour market especially for unskilled workers, in rural as well as urban areas" (Garnaut and Huang, 2006). It was then suggested that this would also require a change in China's economic growth model³⁴.

So while in recent years western countries have witnessed a growing fear of technology (especially during periods of high unemployment), in China and Japan there is a growing hope that technological change will allow to face the problem of labour shortage (and will contribute to avoid mass immigration).

To bring this issue to the simplest terms and show that the two faces of the modern Janus are exactly the same, we can observe, first of all, that in western countries also the main labour market problem of this century will be a dramatic shortage of labour. Secondly, that both the negative and the "positive and helpful" impact of migration stand on the same condition that the rate of growth of productivity will be higher than the rate of growth of GDP for a long period of time. Finally, both narratives are dangerous: the first because it creates fear of technology and could slow down economic and social progress; the second, because it creates totally unfunded hopes in technological progress, and makes people forget that the only

³⁴ Following papers have tried to asses whether an when the TLP had been reached both at the national and provincial levels (Bruni and Tabacchi, 2011; Bruni, 2011; Das and Papa, 2013).

possibility to bring a country back to demographic equilibrium is immigration (UN DESA, 2000).

But let go back to the basic problem: the feasibility of a rate of technological progress *structurally* higher than the rate of growth of production.

Let's observe first of all that the adoption of a neoclassical analytical framework with its implicit equilibrium mechanism has prevented Chinese scholars even considering the possibility that China could become a country of mass immigration³⁵. According to the standard narrative the Chinese economic system will be able to face the incoming shortage of labour by increasing productivity³⁶.

Already in 2006 Cai Fang maintained that "China should adjust to the new situation by cultivating greater productivity" (Cai, 2006). This idea is fully adopted in a 2012 study of the World bank and of the Development Research Center of the State Council (World Bank, 2012) that acknowledged the fact that labour supply will start shrinking at around 2015. Employment is then projected to decline, in parallel with WAP, by 0.2% per year between 2016 and 2025 and by 0,4% between 2026 and 2030, which amount to a total decline of the employment level over the 15 year period by more than 30 million (Bruni, 2013). This does not worry the authors of the report because "workers will become more productive as physical and human capital stock per worker continues to rise". This position is also shared by the 13th Five Year Plan 2016-2020 that posit an increase in productivity in excess of GDP growth, in line with the suggestion of the WB.

Politicians obviously accept the economist view. For instance, in March 2017, speaking at a briefing on the sidelines of the National People's Congress, Wang Peian, vice-minister of the National Health and Family Planning Commission, stated that a sufficient labour force will not be a problem at all since what matters is quality not quantity. According to Wang "labour shortage ... will not be an issue when improved technology and other alternative measures are in place" (Zhuang Pinghu, South China Morning, 2017). A cursory analysis of the "Report on the Work of the Government" delivered by Li Keqiang at the recent first Session of the National People's Congress (Li, 2018) shows that China is ready to put technological change at the center of its future economic and social development and give a pivotal role to innovation in the growth and development model that will be followed by China in the next years³⁷.

³⁵Mass immigration seems even ridiculous to many people that limit themselves to the consideration that China's WAP amounts to 1 billion; at the same time it is evident that China is not free from xenophobic and racist feelings that, as it is happening in numerous European countries, do not allow to consider the problem of labour shortage from an objective and rational perspective.

³⁶ We can also recall that in 2003 IMF estimated in around 150 million the reservoir of underutilized agricultural labour (Brooks and Tao, 2003). For a much more limited estimate that takes into consideration the age and educational structure of the rural population, see Bruni, 2011.
³⁷However it should not be forgotten that Chinese politics has always been characterized by realism and

pragmatism. As in the 70s China did rapidly move from a hardline pro-fertility position clearly expressed in the Bucharest Population Conference of 1974 to the one child policy (Bruni 2016), so today Chinese authorities, while avoiding to openly acknowledge the need of migrants, have already taken some interesting initiatives. It has been reported that Chinese officials have started to discuss with the labour department of the Philippines the possibility to allow household service workers in five mainland cities including Beijing, Shanghai, and Xiamen, as it already happens in Guangzhou (Raul Dancel, 2017). Obviously this is a consequence of the fact that there is already a massive presence of Filipino household services workers in many Chinese cities (about 200,000 in September 2016 according to the secretary of the Department of Labour and Employment, Silvestre Bello) in response to a massive and growing demand of middle class Chinese families (Jiang and Huang, 2017) that appreciate their professionalism and knowledge of English. Even more important, the decision of the recent National People Congress to set up a new immigration bureau. According to the State Councilor Wang Yong that presented the proposal to the fourth plenary meeting of the first session of the 13th National People's Congress, the main duties of the new agency are creating and implementing immigration policies, managing affairs and procedures related to border control, and providing services for expatriates and Chinese citizens who are entering or exiting the country on personal business. The new administration will also manage refugee affairs, as well as coordinate the governance and repatriation of illegal immigrants. Finally it will also engage in international cooperation on

To my knowledge there are no theoretical reasons to refuse the idea that productivity can increase in excess of production. Therefore, empirical considerations have to be carefully considered, keeping in mind that, on the one hand, the demographic revolution we are witnessing is unprecedented and, on the other, that the demographic decline that China and many other developed countries will witness during this century is not a short term phenomenon, but a long run structural event.

In the next 45 year, in absence of migration, the Chinese WAP will decline by 30.4% and by another 21.6% in the following 40, passing from 1,007 to 546 million³⁸. Assuming that the rate of activity will remain constant at the very high present level this would translate to a decline of the labour force (and employment) of the same percentage. The supply of labour will remain sufficient if the growth in productivity will exceed the growth in production of the same amount. Is this feasible?

Empirical evidence shows that in the post war period only the Japanese economy has been able to do so, but in recent years and in a situation of economic stagnation characterized by rates of growth of production below 1%. In all other major economies employment has made a contribution, albeit of different dimension, to economic growth (Bruni, 2013).

The feasibility of a growth in productivity in excess of that of GDP cannot be excluded, but the size of the demographic decline that will affect China, the EU^{39} and other countries in the third phase of the demographic transition, together with the predominance that labour intensive sectors will have in all these countries, strongly support the conclusion that the XXI century will be characterized by an unprecedented phenomenon of mass migration.

Scenarios B

After having understood that it is extremely unlikely that technological change will be sufficient to completely offset the impact of economic growth on labour demand over a long time period once we consider the problem in its complexity, that is we allow for the secondary effects of technological change and we give space to the ever ending capacity of human beings to "discover and invent" new consumption needs, let's consider the second set of scenarios, that allows for a positive migration balance.

The basic assumption of this scenarios is that the demographic and economic spheres interact and migrations comes in to close the structural gap between labour demand and local labour supply. Moreover:

a) The analysis has been confined to the 2015-2030 period to avoid the always difficult task to make assumptions on the fertility rate of migrants, an assumptions necessary be to estimate WAP after 2030⁴⁰;

immigration (Zhang Zhihao, 2018-03-14). Unfortunately as it has been a tradition in western countries also China has decided to put the new agency under the Ministry of Public Security, a position that puts in second place what should be the core issue, the needs of the labour market.

³⁸ Similar values are registered by many other areas and countries. For instance the WAP of Europe is forecast to decline by 33.4% between 2015 and 2060 and by 12.6% between 2060 and 2100; even more impressive the values registered by some Asian countries: Singapore -39% and -39.5%; Thailand -33.1% and -28.3%; Republic of Korea -38% and - 25.3; Japan -36% and -20.1%.

 ³⁹ For fully fledged labour market and demographic scenarios for EU and the 4 biggest member countries, see Bruni, 2017, 2018.
 ⁴⁰ All the young people that will enter working age between 2015 and 2030 are already born so they represent a

⁴⁰ All the young people that will enter working age between 2015 and 2030 are already born so they represent a datum of the problem, while those that will enter in the following years will be those born after 2015 and their number will be affected by the number of immigrants and their rate of fertility. For a more complete set of scenarios see Bruni, 211, 213, and 214.

- b) We have assumed, as in the previous scenario, two rates of employment, that is two upper levels of local human resources' availability, net of physiological unemployment;
- c) We have then assumed three rates of employment growth equal respectively to 0%, half the total rate registered between 2000 and 2015 (3.7%), and the same rate registered in that period (7.4%).

We have then estimated 6 scenarios combining the two sets of assumptions on the rate of employment and on the rate of employment growth as follows:

i. The rate of employment growth and the rate of employment allow computing the "needed" WAP coherent with each set of assumptions;

ii. The difference between the "needed" WAP and the WAP that would be present in absence of migration determines the migration balance.

As implicit in the assumptions and computational procedure the migration balance is positively related to employment growth and inversely related to the rate of employment (Table 23).

More specifically, China would need migrants even if employment would remain constant at the 2015 level, a scenario based on the implicit hypothesis that GDP growth would be produced only by technological change. More specifically

✓ if the RoE remains constant, China would need 37 million migrants;

 \checkmark if the RoE declines to 70% the number of migrants would be 128 million, that is 14 million migrants more for each 1 percentage point decline of the RoE.

Table 23	3 -	Chin	a; En	nploy	men	it, WAP	and	Tota	al po	pulatio	on ch	ange,	and	l Migration
balance;	in	two	scena	arios	of e	employm	ent	rate,	and	three	scen	arios	of e	employment
growth;	201	5-203	80; val	lues ii	n mi	llions								

	∆ Empl.	MB	ΔWAP	ΔΤΡ	∆Empl.	MB	ΔWAP	ΔΤΡ			
		Total v	alues	Yearly values							
	Constant RoE										
Emp. constant.	0.0	36.8	0.0	86.7	0.0	2.5	0.0	5.8			
Δ Empl. = 3.4 %	28.8	74.6	37.8	124.5	1.9	5.0	2.5	8.3			
Δ Empl. = 7.4%	57.7	112.3	75.5	162.2	3.8	7.5	5.0	10.8			
	RoE = 70,0%										
Emp. constant.	0.0	128.5	91.7	178.4	0.0	8.6	6.1	11.9			
Δ Empl. = 3.4 %	28.8	169.6	132.8	219.5	1.9	11.3	8.9	14.6			
∆ Empl. = 7.4%	57.7	210.8	174.0	260.7	3.8	14.1	11.6	17.4			

Source: Elaboration on UN DESA, 2017 and China Yearbook, 2016

Coming to the impact of employment growth on the need of migrants, our computations show that every additional million jobs would require approximately 1.3 million migrants, if the RoE remains constant, and 1.4 million if the RoE declines to 70%.

Therefore in the extreme case of a growth rate of employment equal to that registered between 2000 and 2015 (7.4%) and a decline of the RoE to 70% China would need 211 million migrants over the 2105-2030 period⁴¹.

⁴¹ But at the end how many migrants will China need? To make forecasts is the job of fortune tellers; economists should limit themselves to produce scenarios showing policy makers the dangers and opportunities they will have the face and the impact of alternative courses of action. What we can say is that in the next 15 years:

^{1.} It will be difficult for China to maintain the present RoE, given the relevance of the ongoing urbanization process and the need to have a higher percentage of young people with university degrees;

^{2.} It is likely that the rate of growth of employment will be lower than in the recent years, due to the normalization of the economy and the centrality the government is giving to technological innovation;

Finally, table 24 shows the percentage of foreign migrants over total employment and WAP in the six scenarios, by 2030. In general, the percentages are inversely related to the RoE and directly related to the rate of growth of employment. To be noted that the percentage of migrants with respect to employment ranges between a minimum of around 5%, in the scenario with both the RoE and the employment level constant, and more than 25% in the scenario with a RoE of 70% and an employment rate of growth of 7.4%. The pattern of the percentages of foreign workers over WAP is similar, but values are lower. Obviously the percentages would be even lower if they were computed for the total population.

Table 24- Percentage of foreign	migrants in W	VAP and	Employment	at different	RoE a	nd rate
of employment growth in 2030						

	Consta	nt RoE	RoE=70%			
	WAP	Empl	WAP	Empl		
0.0	3.6	4.7	11.6	16.6		
3.7	7.1	9.3	14.8	21.1		
7.4	10.3	13.5	17.7	25.3		

Source: Elaboration on UN DESA, 2017 and China Yearbook, 2016

As a final step let's go back to Table 22 to analyze the impact on the socioeconomic burden (and therefore on the sustainability of the welfare system) of migration flows coherent with labour market needs.

In all six scenarios TEDI is projected to increase with respect to 2015. However, the changes are quite modest suggesting that (once we account, everything else equal, for the impact of urbanization) China will move toward the value registered today by the EU. Moreover, the changes registered with respect to the initial value are inversely related to the level of the RoE and to the employment level. In other words the value of TEDI will be higher, and therefore the socioeconomic burden heavier, the lower the rate of employment and the lower the rate of growth of employment. Finally, as expected, between 2015 and 2030 we register a decrease of SEDI and an increase of REDI, while the level of MEDI is inversely related to the employment rate that determines also the number of dependents in working age.

In conclusion, a Chinese economy that will continue to strongly expand the employment level (and as we have already argued this is not only totally coherent with the utilization of the most advanced technologies, but the most probable outcome of a development model based on technological innovation) and will solve the ensuing unavoidable shortage of labour with foreign human resources, quantitatively and qualitatively coherent with its need, will be affected by a contained socioeconomic burden. This result does obviously depend on the fact that such economy would have more people to pay social contributions than an economy with a closed labour market, where the increase in the number of elderly would be paralleled by a decline in the number of those that can financially contribute to the welfare system.

In summary:

- Even in the most favorable conditions -a high rate of participation and a rate of productivity that will offset the growth in production- China will need migrants;
- The migration balance will be larger than the increase in employment because migrants are needed not only to cover additional jobs but also to offset the decline of local WAP and because migrant workers will not come alone;

^{3.} Given the demographic trends, the need of foreign labour will peak in the second half of the next decade

- In the six scenarios, the average yearly migration balance over the 2015-2030 period, ranges between a minimum of 2.5 million (a value similar to that registered by the EU in the 2000-2015 period; Bruni, 2017) and a maximum of 14.1 million; however in the intermediate "most probable" scenario the yearly migration balance is estimated at around 7 million, a value that corresponds to the present yearly total number of international migrants;
- Finally, and in net opposition to existing forecasts, the decline in fertility and the consequent decline of local WAP will end up boosting demographic growth that will be directly related to economic growth and inversely related to productivity growth and labour market participation.

Some policy considerations

The fact that migration would slow down the ageing process (that it should be remembered is a relative not absolute phenomenon) and positively impact on the socioeconomic burden should not make us forget that for a ethnic homogeneous country like China, mass immigration (for the moment still an almost totally unforeseen event) will represent a cultural shock and entail considerable integration problems whose costs will not be limited to the financial sphere (Lynn-Ee Ho, 2018). So, while the problem of immigration should not be demonized and should be dealt from a rational perspective, it is mandatory for China to design and implement all the policies that can reduce the structural shortage of labour, while explaining to the population why China needs foreigners. It is however evident that, in order to design and implement such policies, the government should start to seriously consider the fact that in not too far a future mass immigration will be unavoidable.

By structural shortage of labour we define a situation in which the labour demand⁴² will remain much larger than the local supply for a long time period and the gap is such that it cannot be closed by normal market mechanisms such as an increase of the wage rate, an increase of the rate of participation to the maximum physiological level, or by tapping the remaining excess labour supply available in less developed agricultural areas. Since the structural shortage is the result of the interaction between the supply and the demand of labour, a possible reduction of the labour shortage can be the result both of an increase of the supply or a reduction of the demand.

In previous papers I have already presented comprehensive discussions of the policies that can be adopted to reduce labour shortages (Bruni, 2011, 2014, 2017). Here I will limit myself to briefly recall the most relevant.

For what relates to the supply we can distinguish between short run policies, that is those that can increase labour force for a given level of WAP, and those aimed to increase WAP.

In the short run the labour supply can be increased by increasing the rate of participation. In China this goal is not an easy one for many reasons. In the first place the typology of economic development that China is choosing will require an increasing percentage of young people with high education. This process will also be coherent with the aspiration of Chinese families, whose income is progressively increasing, to provide a better education to their children. The immediate impact of a longer training phase is a lower rate of participation. In the second place, the fragmentation of the family and internal migrations have reduced the possibility for young couple to receive help from their families to take care of their children. At the same time, it is very probable that in the absence of specific policies, the ageing process will oblige more and more women to choose between the presence in the labour market and providing care to the elderly.

⁴² For the moment the discussion has concerned whether and where the LTP has been reached.. However as our model suggest, reaching the LTP does not mean to have an immediate need of foreign labour.

A second policy measure is to raise the legal retirement age, that brings to the co-presence in the labour market of a larger number of generations. The Chinese government has already decided to adopt this measure, but to proceed at a very slow pace. However, this is not the only reason why this measure will not have a relevant impact on the labour force. In fact we can expect that the average age of entry will progressively increase so that the difference between average age of entry and average age of exits could remain the same. The second reason is that the rate of activity of people above 60 is already quite high 43 .

Finally, the availability of labour can be increased by eliminating any limitation to the free circulation of people over the Chinese territory, especially if labour mobility would respond to correct information on labour demand.

In the long run an increase in the WAP, and therefore of the potential supply of labour, can be obtained only by increasing the number of births. However reaching t equilibrium between generational entries into and generational entries from WAP would require a substantial increase in the fertility rate in the 2015-2030 period. According to UN DESA estimates (UN DESA, 2017) between 2030 and 2045 the yearly average difference between entries into and exits from WAP will be substantial, more than 7 million in the 2030s and around 4 million in the following 5 years (Figure 18).



Figure 18 - Generational entries, generational exits and generational balance; 2030-2045

Source: Elaboration on UNDESA, 2017

These values are a good indication of how much the number of births should increase between 2015 and 2030 to maintain WAP constant at the 2030 value⁴⁵. The first statistical evidences clearly show that the abolition of the one child policy will have just a marginal impact on the forecast decline of WAP.

Moving now to the demand side, beside the increase in productivity, the only policy that could reduce labour demand is delocalization, a road that is already largely followed by many countries with labour shortages, Japan in primis. It is very difficult to estimate the possible quantitative impact of such a policy. It should however be remembered that:

- i. Not all types of production can be delocalized;
- ii. Abundance of cheap labour is not sufficient to make delocalization convenient;
- iii. All developed countries will be affected by a situation of labour shortage and many of them have already much more experience in delocalizing production using local labour, a strategy that China companies have not followed up to now.

⁴³ According to census data, in 2010 the RoA was equal to 49.5% (58.3% and 40.6% for men and women respectively) for the age group 60-64 and of 36.3 (44.8% and 27.6%) for the age group 65-69. ⁴⁵ The number of birth should increase from a present value of around 17 million to 24 million.

In conclusion, while it is mandatory that China will adopt all the policies that can bring to a reduction of the need of foreign labour, empirical evidence strongly suggest that mass immigration will not be avoidable.

Finally, it should not be forgotten that the need of foreign labour will continue as long as the fertility rate will not go back to replacement level. It is therefore mandatory that in the next decades China will pursue this goal with the same determination employed to reduce fertility, being aware that this is a much more complex problem that cannot be dealt by enacting and enforcing a law, but requires a large spectrum of social, economic, and cultural measures difficult to define and enact.

Final considerations

By now the demographic transition is affecting all the countries of the world that are spread along the same DT path, mainly according to their level of economic growth, once the differences in political system and social values are considered. They are also affected by the same series of demographic events: a decline in mortality followed by a decline in fertility that determines an increase in total population, first at increasing and then decreasing rates, while after a period of rejuvenation each country experiences an increase of the population in working age to then reach the ageing phase. Empirical evidence also strongly suggests that, at least for the moment, the last phase of the DT is not represented by a *modern equilibrium*, but by a *modern disequilibrium* characterized by a negative natural balance⁴⁶.

Some countries have been affected by the demographic transition for around two centuries, others are starting the process only now. As a consequence, this century will be characterized by a growing demographic polarization with an increasing number of countries whose WAP, and then total population, will decrease and a declining number of countries - the poorest of the planet- that will be affected by a veritable demographic explosion.

This situation will produce unprecedented international migrations flows *pulled by the labour needs* of the countries more advanced along the demographic transition path. If properly managed and organized, this will allow economic growth and social development to continue in the more advanced economies, while bringing some reliefs to the desperate socioeconomic situation of the poorest countries and give them some hope of development (Bruni 2017, 2018). To make this process fair the arrival countries should refund the training costs of the human resources they need, recognizing that the acquisition of human capital should also be properly remunerated to the nations that have produced it⁴⁷.

The economic growth experienced by China has produced a very complex and fragmented socioeconomic landscape: Chinese provinces greatly differ not only with regard to natural resources, production structure, endowments of technological and physical infrastructure, and labour force educational attainment, but also in terms of their position along the path of the demographic transition (Bruni and Tabacchi 2011, Bruni 2014). Therefore, China is also affected by a provincial demographic polarization, albeit of a more modest extent than the international one and that will rapidly evolve to a situation of generalized labour shortage as all Chinese provinces will reach the Lewis turning point. This suggests that China will witness, at the same time, internal migration flows and a growing need for foreign labour. The interesting point is that while the developed provinces will soon need both highly educated foreign labour and household service workers, rural areas will soon need farmers to substitute the young people that will migrate to the coastal provinces.

It is therefore my conviction that

⁴⁶ In the past such situations were determined by war, famine and natural disaster, that is mainly by men lack of capacity to control their environment: the present disequilibrium is, on the contrary, the result of men economic success and its capacity to control its reproduction process.

⁴⁷The Institution of a Education Migration Fund has been proposed in Bruni, 2012 and again in Bruni. 2017

China will need foreign labour before becoming old and rich

Given its dimension and the expected size of its structural shortage of labour, China will become a major player in the international labour market. Its aspiration to international leadership should push China to avoid the mistakes made by developed countries in the last thirty years and adopt a rational approach to the management of migrations flows.

A myopic vision, justified only on ideological bases, that foreign workers are not needed, together with growing xenophobic feelings, has promoted the adoption of restrictive measures that are giving rise to the "of the walled countries" (Bruni and Catani, 2017) in Europe, America, and Middle East. Empirical evidence shows that the countries characterized by a structural labour shortage cannot avoid the arrival of the migrants needed by the productive system and that the only results of the expensive measures adopted to defend the borders are the deaths of thousands of people, many women and children, and a good business for criminal organizations. It is may belief that

The only valid measure against illegal immigration is a legal immigration that responds quantitatively and qualitative to the needs of the country.

In order to do so China should build labour market and demographic scenarios at the provincial level allowing to organize, at the same time, internal and international migration flows that will also help to mitigate the increase of wages that is affecting the coastal provinces so keeping China more competitive. In order to obtain the human resources that it will need, China could also finance and organize education and vocational training courses in potential departure countries starting from the countries belonging to the Belt and Road initiative that will be affected by a structural excess of labour (Bruni, 2018b).

If China will be able to follow a pragmatic and rational approach this will not only ensure the continuation of its economic miracle, but will play a central role in promoting world development and peace.

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