Optimal Population Size

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2025-01-22

I recently saw this YouTube video [1]. The host wanted to address or debunk the topic of the Chinese Demographics Crisis. The current, observed birth rate in China is well below the maintenance rate of 2.1[2]. This could mean according to some forecasts that the population can shrink to more than half of the current 1.4 billion people today in China by the year 2100[3]. In 75 years, we can have a China with only 700 million people, still roughly double the size of the current population of the United States.

A doomsday narrative follows the logic that with a reduction in population, there will be a reduction in the market size, consumer demand, manufacturing capacity, etc. Therefore, China's economy will be slashed by at least half, and it is doomed.

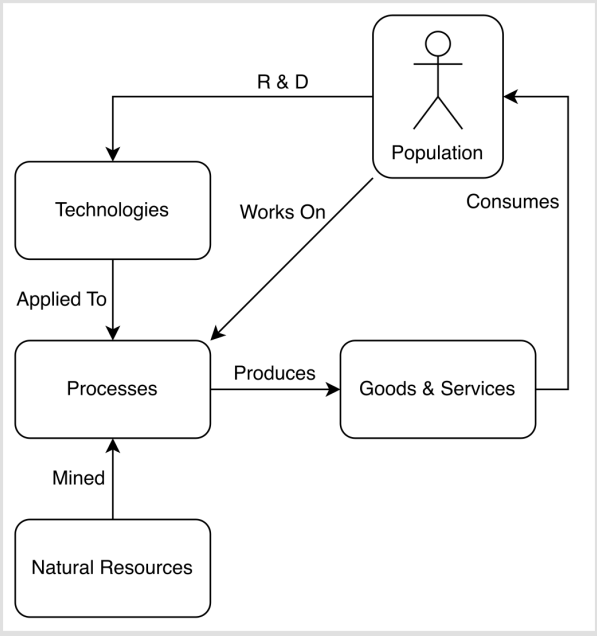

Figure 1: Population in Macro Economy

The video discusses the concept of an "Optimal Population Size" and compares different population sizes in different countries. I personally think the debate should not be on size alone, but we need to take the rest of the Macro Economy (see Figure 1) in context and see how the population will participate in that economy. I propose that instead of focusing on an optimal population size, nations should strive for population flexibility - the ability to adjust population growth according to economic and social needs. This flexibility would allow a country to encourage population growth when beneficial, while maintaining the ability to meet basic needs and continuously improve individual quality of life.

[1] How Chinese see demographic issue and impact on economy? by @Awakening_Richard (video link)

[2] Britannica - fertility rate

[3] China's Population Could Shrink to Half by 2100 by Lex Rieffel & Xueqing Wang - May 1, 2024 Scientific American

Economic Context

In most economies, a country's population participates as both a labour force and consumers. Assuming a nation's goal is to:

1. Maintain and develop the cultural identity and values of the nation;
2. Improve the quality of life of the current and future generations, with new and better goods and services;
3. Advance technologically so that existing processes can be more efficient (use less time, resources, and more automated with equal or better quality), and new and better processes can be developed to offer new and better goods and services to the populace;
4. Identify, address, defend and protect against actors that threaten the above goals;
5. Maintain a minimum "population" base to support the above goals, and create an environment to "grow" the population at a pace that the nation organically desires (usually survival);
6. **OF COURSE**, there are many other goals but these are the main ones.

A nation's existence depends on many factors. The geographical borders that define the land mass of the nation are just one factor. Beyond the land, the culture(s) of a nation must also be defined by its citizenry. The people of a country must maintain and practice a common moral foundation shared by all. The combination of cultural traditions and a cohesive moral landscape creates an environment of stability, defining what is tolerable, acceptable, and what should be rejected. A stable environment is a critical requirement for a nation to grow and develop.

Under stable conditions, people can concentrate on achieving a better life. The first priority is meeting basic needs such as food and shelter. Historically, we achieved this through the agricultural revolution, so we should consider what the minimum population is to achieve this. The answer is probably not many. One can achieve this stage of stability with a "clan" or a small village tribe. However, at this stage, the risk of sustainability and survival is largely at the mercy of nature - from weather patterns to animal migration and natural disasters. A larger population has a greater chance of survival. However, the flip side is that the productivity of the people must be able to sustain the basic needs of the entire group.

A stable environment creates opportunities for populations to improve their cultivation techniques and develop systems to produce, store, and manage surplus goods. This ensures greater security against potential crises. As populations become more efficient and basic needs are met without requiring everyone's participation, labor specialization emerges. This leads to specialized roles like doctors for improved healthcare and toolmakers for more efficient agricultural production, even entertainers and artists contribute by retaining the cultural heritage of the country. A growing population fuels these specializations by providing new talent and diverse perspec-

tives. Larger populations increase the probability of having individuals with unique ideas and behaviors. While not everyone may contribute equally - some may even hinder progress - the law of large numbers suggests greater potential for exceptional individuals. What population size is needed to produce figures like Einstein, Mozart, da Vinci, or Newton? While larger populations statistically increase the likelihood of geniuses emerging, they also increase the probability of destructive figures like Hitler or Caligula[4]. However, historical progress generally follows a pattern of significant advancement with occasional setbacks.

In essence, when a nation aims to meet its basic needs, it should strive to maximize its population size while ensuring it doesn't exceed its capacity to provide for that population, until it can establish a surplus. The large population correlates with a higher survival rate, and help society to climb the technology ladder. When your technology level is low, you depend on people power as much as or more than horse power. People can retain memories, stories, and skills. Their collective wisdom can be retained and passed down to the next generation.

Once a nation progresses beyond basic agriculture on the technology ladder, its people can focus on harnessing natural resources more effectively, developing new capabilities, and exploring new possibilities. At this stage, a larger population contributes to increased research and development efforts. More graduates with higher education fuel innovation, expanding existing industries and creating new ones. As basic needs are met, the population's focus shifts from consuming necessities to pursuing wants and desires. These wants drive improvements in quality of life, while the collective knowledge and practices developed through these industries enhance overall economic efficiency. This creates a positive feedback loop that enables the nation to support and sustain a larger population size.

The industrial revolution and the information age represent significant rungs on the technology ladder. This ladder extends both symbolically and literally toward the skies effectively without limits. As nations ascend this ladder, they must maintain a stable population that ensures safety, happiness, and overall well-being. This presents a complex balancing act, as human nature inherently drives some individuals to excel beyond others. Such differentiation is natural and inevitable, resulting in an enduring status and power divide between leaders and followers. The magnitude of this gap requires careful management to preserve societal stability while avoiding excessive control that might stifle innovation. During the early stages of technological advancement, the population remains a crucial asset, with new ideas emerging from and being implemented by people. However, as technology progresses, automation increasingly displaces human involvement in this positive feedback loop of development.

We are on the cusp of reaching the next major rung on the technology ladder. This next stage is characterized by artificial intelligence coupled with robotics in both humanoid and non-humanoid forms. Reaching this pinnacle of achievement means that research can be performed by AI, and tasks requiring human dexterity can now also be performed by robots. In essence, the economic

[4]Caligula - Wikipedia

value that humans can contribute is diminishing. Similar to past transitions such as industrialization and the information age, people will need to find new roles in the economy, or the economy itself will need to be reshaped to accommodate surplus labor by distributing the net wealth generated by this new level of automation. The speed of this transition exceeds the nation's ability to adjust its population size to accommodate. Nations including but not solely China may feel they have more population than they need.

Contextual Scenarios

Let us explore a few scenarios. Some of these are extreme cases, but they serve to illustrate the impact of population size at different stages of societal development.

Consider a minimal example where the population consists of only two people. Such a society would clearly be at high risk of extinction. The only exception would be if technology advanced to the point where the positive feedback loop of the economy could be sustained without their direct involvement. This scenario would require full automation, where the existence of these two individuals (or gods) serves merely to maintain their cultural identity and symbolic presence. This also means that a nation at this advanced stage of development could choose to grow its population to any size it desires, assuming that the stability of economic development remains intact and they have solved the DNA diversity problems. This scenario illustrates that at a certain technological level, population size may no longer be a relevant concern, as it ceases to be a critical factor or contributor to the economic feedback loop.

Consider a nation with a sizable population that still possesses abundant resources, where human capital remains essential to sustain the economic feedback loop. In such cases, numerous untapped opportunities exist that could be realized through population growth. Under these circumstances, it becomes strategically advantageous for the nation to encourage population expansion, enabling it to capitalize on these opportunities and continue advancing up the technology ladder.

In the opposite case, if the same sizable population's needs exceed the nation's resources and technological capability to provide, then this is a clear case in which a population reduction strategy is required. Some nation may even choose to go to war to kill two birds with one stone, limit the population size, while the war effort acquire new resources.

As the previous scenarios illustrate, the economic contextual constraints have direct impacts on the desirable size of a nation's population and its planning. In particular, the abundance and accessibility of resources, along with the technological level of a society, greatly influence how large a population a country can sustain. If the population is a laggard in our macroeconomic feedback loop, then a reduction is required. If the population size is a bottleneck with untapped opportunities, then an increase is required.

Conclusion - Does China Have a Crisis?

Coming back to China, in the 1950's to 1970's, China relied heavily on manual labor for both agricultural production, industries, and national defense. It also realized that its attempt with its Great Leap Forward[5], that with the economic level of the early 1960's, it was incapable of sustaining its population base, unable to meet the basic needs of its people. It is with this backdrop, that the Communist Party of China (CPC), instituted the One Child Policy, swinging the fertility pendulum of the country drastically in reduction mode. This policy effectively replace every two fertile adults with a single child.

Over the past 40 years, China has transformed from an agricultural society to a world-class industrialized nation, providing modern amenities for its citizens. It has lifted 800 million of its citizens out of poverty.[6]

China has made significant infrastructure improvements, including:

- Expanded power generation capabilities with huge hydro projects[7], solar projects[8], and nuclear research and up coming power plants;
- Enhanced logistics networks with extensive road systems and a comprehensive high-speed rail network;
- Increased its food production[9];

Today, no one is starving in China, though the country faces a surplus of university-educated graduates, creating challenges in workforce allocation. The size of its current 1.4 billion population provides China with a very large consumer market, which it can use to power many of its industries. These include:

- Financial services that include the world's most successful cashless society rollout;
- The world's largest New Electric Vehicle (NEV) market, supported by public charging infrastructure that most countries would envy;
- The widest and most ubiquitous rollout of advanced 5G communication networks;

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[5]Great Leap Forward - Wikipedia

[6]Lifting 800 Million People Out of Poverty – New Report Looks at Lessons from China's Experience – World Bank Group, Press Release, April 1, 2022

[7]Three Gorges Dam - Wikipedia

[8]China's Largest Solar Power Tower Project Linked to Power Grid - YouTube

[9]China making strides in grain self-sufficiency - by Arvin Donley 12.26.2024 WORLD-GRAIN.com

- A growing and thriving AI and robotics industry fueled by the vast amounts of data generated by its large population;

There are many more examples. Clearly, China recognizes that given its current technological achievements, it can sustain - and desires to maintain - a larger population than it currently has. The country understands the advantages that a larger population base brings. It eliminated its One Child Policy in 2015, replaced it with a Two Child Policy, and finally in 2021 moved to the current Three Child Policy[10]

China's position at the current height of the technology ladder places it in a strong position to manage its population effectively. The country faces two potential paths: continue advancing technologically while gracefully handling the organic decrease in population, or create conditions where modern families desire more children as modern services make child-rearing and caring more affordable and enjoyable. Either way, China is at an inflection point where it appears capable of sustaining both approaches. While each path has its own advantages and disadvantages, the key point is that China has the capacity to manage either scenario, although its clear preference is to grow.

Does China have a demographics crisis? No, it does not. While China can manage its population whether shrinking or growing, I believe a larger population is in China's best interest. A family size of four or more creates a more stable family structure than one with just three members. Stable families give rise to stronger extended families and communities, ultimately contributing to a more harmonious country.

[10]How family planning policies shape intergenerational mobility - by Yun Xiao - 2024-05-30 CEPR Article