DRAFT – comments welcome
Version - August 20, 2024

On The Transformative Demographic Impact of China's Great Malthusian Campaign (1970-2021): The Minority Role of One-Child Limits

Daniel Goodkind
Independent Researcher, Arlington VA

Summary

Debates about the impact of China's half-century campaign to limit its population obscure ambiguities about what to call it. At face value, the *one-child policy* denotes one feature of a 35-year sub-era (1980-2015), a misnomer that defines away the broader program of birth ceilings, other regulations, and enforcements (1970-2021). This research reveals a more fundamental flaw – one-child *limits* accounted for a minority of the program's demographic consequences. The best-known international comparator implies that, upon concluding in 2021, Malthusian intervention had reduced China's population by more than 600 million people independent of developmental forces. An exploratory analysis indicates that one-child limits accounted for no more than166 million of that reduction if, as is often assumed, at least half of one-child era singletons resulted instead from development. However, that estimate nearly triples to 475 million when the one-child era's *enhanced enforcements* of all birth quotas and regulations are included. A companion analysis of China's missing daughters implies unwitting acceptance of the comprehensive definition. Although everywhere associated with *the one-child policy*, only 12 percent of missing daughters were first births (whose parents faced one-child limits). Intuition fails because decades of one-child images, along with every utterance of the phrase, keep refreshing the misnomer.

Acknowledgments:

The author gratefully acknowledges opportunities to present this research, as well as thoughtful feedback from audiences, at – in chronological order since 2018 – the University of Maryland, the University of California Berkeley, the University of Pennsylvania, the Asian American Forum (Washington DC), Annual Meetings of the Southern Demographic Association (2022/2023), the United Nations (Population Division), Singapore National University, Academia Sinica (Taipei), and the Annual Meeting of the Chinese Economists Society (2024).

Introduction

For over half a century, China's leaders sought to limit the country's population through birth quotas, other regulations, and relentless propaganda, all backed up by the most draconian enforcements the world has ever known (Banister 1987; Tien 1989; Aird 1990; Scharping 2003; Greenhalgh and Winckler 2005). The sacrifices compelled from families under China's "longest campaign" (White 2005) were thought necessary to lift it from poverty and accelerate economic growth, the cornerstone of a grand blueprint for national rejuvenation.

China removed the last remnants of that campaign in 2021 (*Xinhua* 2021) as fertility rates collapsed below 1.2 births per woman (UNPD 2024). Ironically, upon approaching the ultra-low birth rates once considered ideal, policymakers drafted a set of measures designed to *raise* them (Central Committee of the CCP 2021; *The Guardian* 2022) out of concern that population aging might slow China's economy (Eggleston et al. 2013). Yet as China readies to implement pro-natal measures in 2025 and beyond, the extent to which its anti-natal past shaped its present remains poorly understood (Goodkind, in Minzner et al. 2023).

Before considering whether Malthusian compulsion truly propelled China's rise, the first question is demographic – to what extent did it reduce population beyond the developmental forces that would have lowered fertility anyway? The official estimate of 400 million births averted (*Xinhua* 2006; *People's Daily Online* 2011) has sparked divisive debate (Wang et al. 2013; Goodkind 2017; Hvistendahl 2017; Wang et al. 2018; Goodkind 2018; Gietel-Basten et al. 2019; Goodkind 2019). Critics have dismissed that estimate as greatly exaggerated (Wang et al. 2013; Whyte et al. 2015; Greenhalgh 2018; Cai and Wang 2021; Whyte 2019/2024) and publicly denounced those who disagree,[1] marking an academic forbidden zone for further inquiry (Goodkind 2024; for examples of tribalism emerging from other scientific disagreements, see Pielke 2007; Chagnon 2013; Dreger 2015). The natural follow-on questions about Chinese families – how many fewer children, siblings, and other relatives do they have owing to this program? – do not simply lack answers. The questions themselves are virtually unaskable.[2]

Although this "great debate" (Gietel-Basten et al. 2019; Goodkind 2019) became especially heated in recent years (Editors of *Demography* 2018), the underlying tensions have percolated

[1]Those finding the official estimate plausible have been called "morally irresponsible" (quoted in Hvistendahl 2017), "dishonest" (Wang 2018), "naïve" (Greenhalgh 2018: 722) and "forgetting [about] … individual human beings" (Wang et al. 2018; 709-710), accusations seeming to mistake large estimates of the program's impact with support for a program seen to be immoral. Publishers of dissenting views risk similar charges of wrongdoing (Editors of *Demography* 2018). Following the exchange in *Demography*, critics have recycled the charges (Whyte 2019/2024; p. 14; Cai and Wang 2021) while pointedly refusing to cite the self-defense of the accused (Goodkind 2018). Unlike the original article in question (Goodkind 2017), none of these charges underwent a standard peer review or fact check to evaluate their validity.

[2]Such questions were bypassed in recent reviews of China's *one-child policy* (Greenhalgh 2018; Whyte 2019/2024; Cai and Wang 2021) and studies of China's household structure (Eberstadt 2019; Eberstadt and Verdery 2023). Nor have such questions been addressed since 2018 in any journal of demography or presentations at conferences sponsored by the Population Association of America or the International Union for the Scientific Study of Population.

for decades. Specialists have long cautioned that the phrase *one-child policy*, albeit routinely invoked as China's effort to control its population, is a misnomer which under-describes the broader program of quotas and regulations enforced before, during, and after the era of one-child limits (Tien 1991; Greenhalgh 2001; Scharping 2003; Hesketh et al. 2005; Gu et al. 2007; Wei and Zhang 2014; Goodkind 2017; Greenhalgh 2018; Chen and Huang 2020; Zhang and Sobotka 2021; Wang et al. 2024). Relatedly, the latest disagreements are not "about *the one-child policy*," as is often said, but rather about the meaning and categorical legitimacy of the phrase itself.

To that end, I open with two questions. First, what exactly does *the one-child policy* refer to? Most observers begin with a face-value definition – a singular policy of one-child *limits* – to mark its historical start and finish (1980-2015) and measure its demographic outcomes. Yet descriptions of that *policy* invariably include the *enhanced enforcements* that accompanied it, which, given that they applied to *all* birth quotas and regulations, presuppose a broader programmatic definition. Second, whether narrowly or broadly defined, how meaningful is it to isolate *the one-child policy* from the half-century Malthusian campaign (1970-2021)? As shown herein, these hidden ambiguities explain the sharply divergent assessments of the program's impact, both ends of which are defensible based on which definition is used.

After delving deeper into the background of this program and ongoing ambiguities, this research examines the two demographic consequences most often attributed to it: 1) population reduction (through lowered birth rates) and 2) excessively masculine sex ratios at birth. Basic arithmetic calculations, apparently the first of their kind, attempt to isolate the contribution of one-child *limits* to these consequences. In both cases, one-child limits played a minority role compared to two-child limits and all other regulations, even during the one-child era itself.

China's Great Malthusian Campaign (1970-2021) – Background

For decades, authors of book-length investigations into China's campaign to limit its population struggled to encapsulate it in a few simple words. Some of the best-known titles referred to "China's Strategic Demographic Initiative" (Tien 1989), "Coercive Birth Control in China" (Aird 1990), "Birth Control in China" (Scharping 2003), "China's Longest Campaign" (White 2005), and "Governing China's Population" (Greenhalgh and Winckler 2005), none of which showcased the phrase *one-child policy*. Their common understanding is that China's goal was Malthusian – to control its rapidly growing *population*. One-child limits were one feature of an all-embracing effort to achieve that end.

Yet unlike its best-known policy feature, the broader program has no familiar name. I propose to call it China's Great Malthusian Campaign for two reasons. First and foremost, it was inspired by the work of Thomas Malthus whose 18th century treatise showcased *China itself* as a society condemned to never-ending poverty owing to uncontrolled birth rates (Malthus 1798/1965). Second, the term "Great" reflects its compulsory connections to other seminal Chinese campaigns – The Great Leap Forward, The Great Proletarian Cultural Revolution, and Zero Covid, all of which featured controls over migration (another demographic component) – as well as its sheer historical longevity. Malthusian compulsion ground on for half a century, more than three times longer than these other campaigns *combined*.

Following the establishment of the People's Republic of China in 1949, occasional attempts to institute traditional family planning programs in the 1950s and 1960s competed with Marxist precepts that a growing and labor-rich population was a good thing. Amidst the backdrop of worldwide concerns over population explosion, Malthusian concerns won out in 1970 when Premier Zhou Enlai announced annual population growth targets over the next five years, no more than1.6 percent in rural areas and 0.9 percent in urban areas (Aird 1990; Scharping 2003).

These sectoral targets marked what became the formal start of China's population control program (Aird 1990; Lavely and Freedman 1990; Scharping 2003; Barbiarz et al. 2019, 2020; Chen and Huang 2020). In the early 1970s, "leading groups" of provinces organized local agencies to meet these targets (Tien 1989; Chen and Fang 2021) which, as soon became clear, required guidelines for individual families. In 1973, the nascent program was dubbed *later-longer-fewer* (*wan-xi-xao)* and required parents to marry later, space births more widely, and have fewer births overall. The presumption in some literature that parents were merely encouraged to follow these guidelines, which were otherwise unenforced, is implausible.

Between 1970 and 1977, total fertility rates (TFRs) fell from an expected 5.8 births per woman to 2.8, one of the steepest declines in human history (Figure 1). The primary role of government intervention is clear given that this decline occurred during a time of economic stagnation, the very stagnation China would attempt to remedy in the late 1970s through sweeping economic reforms. Coincidentally, 2.8 births per family would be expected if parents faced sustained limits of two children in urban areas and three children in rural areas (where 80 percent of citizens resided), the idealized goals promoted by the mid 1970s (Tien 1989). Yet from 1977 to 1979 the TFR appeared to stall at a floor of 2.8. Projections of China's population at the time included a high variant which assumed that the TFR would remain constant at 3.0 and implied more than 4 billion people by 2080, a number which frightened policymakers (Scharping 2003).

With these concerns in mind, central policymakers decided in 1980 to limit most families to one child.[3] This draconian new birth quota was accompanied by enhanced bureaucratic monitoring as well as punishments for non-compliance. The enhancements came about because the local surveillance mechanisms available in the 1970s under collective agriculture were diluted after de-collectivization began in 1979 (Banister 1987; Tien 1989; Greenhalgh and Winckler 2005; Goodkind 2017).

Yet one-child limits were near universal for only five years. Opposition was particularly strong in rural areas, due in part to parental preferences to have at least one son. In response, by the late 1980s most provinces allowed rural parents to have a second child if their first was a daughter, a "1.5-child" policy. When added to other exemptions, Chinese families were limited on average to 1.63 children in 1990 (Scharping 2003: 104) and 1.48 in 2000 (Gu et al. 2007). Yet the less strict quotas were accompanied by stricter enforcement mechanisms and more severe penalties

[3]Within a year of introducing one-child limits, China also relaxed the very late marriage requirements under *later-longer-fewer*, which caused a boom in marriage and first births that hindered its goal of population reduction. Why? In addition to theories proposed by Banister (1990, summarized in Goodkind, 2017), national security was likely a key concern. Relaxation of very late marriage provisions reduced the growing masses of young bachelors, a theme conjuring fears of unrest in China since the 19th century.

for violations, a strategic shift known by the slogan '*kai xiao kou, guan da kou'* ('opening a small hole to close the bigger hole'). In particular, following a 1991 central decree (*Xinhua* 1991), statutory fines tripled across the country, rising to several times local annual salaries (Scharping 2003). Areas with higher penalties had significantly lower fertility (McElroy and Yang 2000; Liu 2014), and not simply because of birth quotas. The tightening (and loosening) of regulations that specified a minimum age for marriage, first births, and second births also had a drastic impact on fertility (Zhang and Sobotka 2021).

In addition to quotas for individual parents, local communities faced annual birth quotas. Under the 1991 decree, otherwise well-performing officials could be fired if births within their jurisdictions exceeded assigned quotas (Sharping 2003). Officials had a variety of regulatory tools to comply, such as a minimum age for marriage and births, criteria allowing for two (or more) births, child spacing rules, and penalties for transgressions. The mix of regulations and enforcements chosen varied considerably across localities and even within the *same* locality over time (Short and Zhai 1998; Merli and Smith 2002; Zhang and Sobotka 2021). When community quotas were exceeded, officials might also underreport births to avoid punishments (Zeng et al., 1990; Johannson and Nygren 1991; Merli and Raftery 2000; Goodkind 2011).

Although one-child limits were relaxed in 2013 (*Xinhua* 2013) and eliminated in 2015 (*Xinhua* 2015), two-child limits and other regulations remained, along with most enhanced enforcements established in the one-child era (CNA 2015; Greenhalgh 2018). The resulting semantic mind bender is that although the era of one child *limits* ended in 2015, what we commonly call *the one-child policy* did not because its enforcement mechanisms lingered until 2021 (CNBC 2021).

In sum, there are at least four ways to conceptualize the phases of China's campaign to control its population since 1970, illustrated from least to most inclusive on Figure 1:

- The initial decade of compulsion – "leading groups" of provincial implementers followed by *later-longer-fewer* (1970-1979)
- *The one-child policy* – defined narrowly as an era of one-child limits and enforcements thereof (1980-2015)
- The *one-child policy* – defined broadly by enhanced bureaucratic enforcements ushered in with one-child limits, which applied to all birth quotas and regulations (1980-2021)
- China's Great Malthusian Campaign (1970-2021)

Language Matters – Debates Over the Phrase *One-Child Policy*

The limit of one child per family announced in 1980 contained no reference to a *one-child policy.* Instead, this now familiar shorthand phrase appears to have been coined by popular media to convey its unprecedented strictness in three simple words. Since then, media images around the world reflected and reinforced the popular term, yet with opposing messages about its outcomes. In China, propaganda posters. routinely showed parents delighting over a happy and healthy only child, images designed to promote the government's ideal even if many couples could (and did) have more than that. Most everywhere else, China's only children have been presented as lonely, spoiled, or imperious, the unfortunate offspring of misguided authoritarianism.

The fusion of such evocative images with the simplicity of the phrase has reinforced the notion – no matter what language one uses – that *the one-child policy* (*yi-tai zheng-tse*) marked the beginning of China's effort to control its population. Anti-natal efforts in the 1970s, including *later-longer-fewer*, are often viewed simply as precursors, categorically distinct from the main event – the era defined by one-child limits. Moreover, even when specialists acknowledge that many parents were exempt from *the one-child policy*, the language of exemption inadvertently reifies one-child limits as the primal category of interest, obscuring the fact that *every* Chinese citizen faced a statutory birth ceiling. Parents not limited to one child were limited to two, three, or four births (Gu et al. 2007).

Despite its semantic defects, specialists have long faced incentives to feature the *one-child policy* misnomer in their work. Its simplicity, instant familiarity, and visceral power all help to communicate with and motivate one's audience, as well as increase one's chances of publication and citation. More recently, because the phrase rivets attention on a single policy feature, it is also favored by those who argue that official estimates exaggerate the program's impact.

The following sequence of literature reveals a quiet struggle over language and labelling. In 2008, when one-child limits were still in place, program critics lauded Yicheng county (Shanxi province) as an experimental area that allowed universal two-child limits (Gu and Wang 2009). Given that Yicheng's fertility was similar to, or even lower than, adjacent areas with one-child limits, they proposed that other localities could lift one-child quotas with no increase in births.

Wei and Zhang (2014) challenged this interpretation in *The China Journal.* Their detailed investigation found that two-child limits were not universal in Yicheng – they were available only to rural parents working outside the state sector and could be revoked if annual community quotas were breached. More significantly, they redressed the conflation of strictness of quotas with strictness of enforcements. Despite a somewhat broader allowance of two-child limits (most rural parents elsewhere could have a second if the first was a daughter), in all other respects the Yicheng program was just as compulsory and punitive as anywhere else, if not more so. Given community quotas, officials would have to offset the larger share of parents allowed a second birth with tougher penalties to stop at two. This might explain in part why penalties for violations of two-birth limits in Yicheng were double those for violations of one-child limits.

The following year, *The China Journal* published an article co-authored by those whose views of Yicheng had been critiqued. Although Whyte et al. (2015) opened that they were in substantial agreement with Wei and Zhang's conclusions, they also claimed that the critique contributed to myths "about China's *one-child policy,"* a theme explored from the title on forward. By reifying this phrase, they rejected Wei and Zhang's central concern – that it obscures the compulsory enforcements of a broader program of quotas and regulations. According to Google Scholar, the reification was effective. As of May 21, 2024, there were 247 citations for Whyte et al. vs. only 18 for Wei and Zhang. Among citations after 2020, the score was even more lopsided – 96 vs. 2.

The exchange in *Demography* followed a similar script. Goodkind (2017) began by estimating the demographic impact of China's Malthusian program overall before addressing the relative contributions of its major sub-eras. The title of the commentary by Wang et al. (2018) narrowed

attention back to *the one-child policy,* never mentioning thereafter *later-longer-fewer* or the impact of the broader program. In a subsequent invited essay in *The Annual Review of Sociology,* the lead authors again fast-forwarded past the initial decade of compulsion, repeating the phrase *one-child policy* more than 80 times and calling it "the law of the land" (Cai and Wang 2021). However, in common with most other literature on this topic, their essay said almost nothing about how one-child limits actually reconfigured families, focusing far more on the enhanced bureaucratic and surveillance systems accompanying them, which enforced all program restrictions. Amidst the impassioned condemnation of *the one-child policy*, the ambiguity of the phrase itself was lost.

There were similar examples of ambiguous wording and sloppy labeling in Goodkind's (2017) original article. For example, the phrase "one-child program" was used in the abstract and several passages in the text, a term no more precise than the more familiar one it intended to replace. Moreover, the mismatched labels used in the title and legend of Goodkind's Figure 4 (ibid.) – "one-child restrictions" and "one-child limits" – were both incorrect. That figure, which examined the impact of Malthusian intervention on China's age and sex structure, had intended to isolate the impact of *the one child policy* under the broad definition of the term.

Given such pervasive imprecision and ambiguity,[4] further discussions of the impact of *the one-child policy* should be accompanied by more careful definitions of what is being measured. We will do so shortly, after stepping back to review the impact of the Malthusian campaign overall.

Common Ground: The 16-Country Comparator, Its Incorporation of Developmental Forces, and its Indication of the Impact of China's Great Malthusian Campaign

To measure the impact of China's Malthusian intervention (1970-2021), the first question is this: how much higher might China's birth rates have been in the absence of that campaign? A variety of counterfactual comparators have been proposed over the years (Zhang 1990; Goodkind 1992; Wang 2006; Wang et al. 2013; Whyte et al. 2015; Goodkind 2017; Gietel-Basten et al. 2019). Naturally, any valid comparator should incorporate the developmental forces that lead to lower fertility anyway, such as better health, improved education, and rising incomes.

The best-known and best-cited comparator is based on the average crude birth rate (CBR, annual births per thousand population) of 16 countries that had CBRs close to what China had in 1970, the start of the Malthusian program (Wang et al. 2013; Whyte et al. 2015). The comparator was employed for a specific purpose; to discredit the official estimate of 400 million averted births as an exaggeration, a claim inferred from comparisons of CBR trends starting in 1970 for the 16-country comparator, China's actual CBR, and a comparator chosen by the Chinese government, (ibid., their Figure 3).

[4]A similar linguistic thicket results from the presumption that China used to have "*a" one-child policy*, which led to the presumption that its antecedents loosened to became first *a two-child policy* and then *a three-child policy*. Such language misleads because, as noted earlier, two- or three-child limits were not uncommon – even during the one-child era, only 35.4% of localities imposed (near) universal one-child limits (Gu et al. 2007). Moreover, simple numerical labels obscure critical ambiguities – two- and three-child policies could refer to a birth ceiling or, now in a pro-natal context, a (recommended) birth floor.

The authors did not provide numerical calculations to support this claim. Goodkind (2017) "took that step" (Hvistendahl 2017) by comparing results from a pair of cohort component population projections starting in 1970 based on China's actual fertility and that of the 16-country comparator. Because CBRs cannot be used as inputs in such projections, the implied total fertility rates (TFR, expected births per woman's lifetime) for the comparator were determined so that resulting CBRs matched those listed in Wang et al. (2013) and Whyte et al. (2015). As of 2015, the year one-child limits ended, the implied TFR of the 16-country comparator had fallen to a quite low 1.8 births per woman, a reflection of both development and non-compulsory family planning programs in comparator countries. The comparator further suggested that by the end of the campaign in 2021, Malthusian intervention had reduced China's TFR on average by about half a birth (Goodkind 2017; abstract, Figure 1)[5] and its population by 609 million (Figure 2 herein, based on Goodkind 2018; Table 1). The number of averted *births* was actually higher than this, because those born in the counterfactual world were reduced by the same assumptions of mortality as in the real world.

After requesting the projection inputs from Goodkind, Wang et al. (2018) replicated the original calculations perfectly (Table 1; unpublished and unknown to this author until the exchange was finalized for publication). Since then, they have disowned their own comparator. They referred instead to "*Goodkind's* 16-country comparator" (Wang et al. 2018; p. 714) in the lone table of their commentary, which purported to show that the original calculations could *not* be replicated. They also dismissed the countries in the comparator as being "highly dissimilar" to China (Wang et al. 2018; p. 698). More specifically, along with the commentaries published in *Demography,* they argued that developmental factors were not sufficiently incorporated, claims since deemed credible by others (Desai 2021). If so, the fertility decline of their comparator would be too slow, leading to an excess gap between China's fertility and that of the comparator, with a corresponding overestimate of the Malthusian campaign's impact on the population.

Yet this claim has been repeatedly refuted. Income per capita in the 16 countries was well *above* China's, even though birth rates in China were much lower (Goodkind 2018, Figure 3; see also Goodkind 2017, Figures 5 and 6). Evidence based on The United Nations Human Development Index (HDI) further contradicts the claim. The HDI is a well-regarded indicator of development because income per capita constitutes only one-third of the index. The other two thirds is based on education and life expectancy, two measures along which countries pursuing socialist programs often excel despite lower incomes. In 1990, the earliest year the index is provided (and the historical epicenter of the program), China's HDI was below every one of the twelve comparator countries for which an index was available (see Figure 3 herein). Although China made outsized advances afterwards, its HDI was still marginally behind that of the comparator average as of 2019 (not shown), the year before the COVID-19 pandemic.

Thus, the 16-country comparator fully incorporates developmental factors. Moreover, there never was any question that the comparator confirmed the massive impact of the overall

[5]The implied half a birth reduction in China seems plausible based on recent findings that Vietnam's two-child policy resulted in 0.2 fewer children per family (Ngo 2020). The lesser impact of Vietnam's program would be expected given that, although inspired by China's, it was less coercive and enforced only in Red River delta provinces, among the world's most densely populated (Goodkind 1995).

program. The ensuing controversy was instead about what portions of the 609 million population reduction after 1970 should be attributed to the major sub-phases of the program. In a secondary set of projections which started the clock of measurement in 1980, Goodkind found that a 400 million reduction owing to *the one-child policy* was plausible if 1) one adjusts for the statutory reduction in marital ages in 1980 accompanying one-child limits, which led to an increase in first births that offset the large reduction at higher birth orders (Banister, 1987; Feeney and Wang, 1993), and 2) in the absence of enhanced enforcements under *the one-child policy,* China's TFR had bounced up by 1.2 births per woman (to levels implied by the 16-country comparator) as parents made up for births postponed during *later-longer-fewer* (Goodkind, 2017; p. 1383-1386, 1394; the two counterfactual conditions are illustrated in Goodkind 2018, Figure 5).[6]

Although a bounce of this magnitude is unusual, several countries have experienced temporary bounces above one, two, or even three full births, all following unique social or policy upheavals. These include the US baby boom following WWII (1945-1953), Romania after a ban on abortion (1966-1967), post-genocide Cambodia (1974-1977) and Rwanda (1994-1997), and China itself (1960-1961) following the famine associated with the Great Leap Forward (Goodkind 2023; UNPD 2024). *Later-longer-fewer* constituted a similar upheaval in family policy. In fact, unless one assumes a counterfactual bounce after 1980, the impact of *the one-child policy* appears to have been *pro-natal* (Goodkind 2019).

Nevertheless, although a sizeable bounce in China's fertility absent *the one-child policy* tightening is plausible, the exact height to which it would have risen is indeed uncertain (Wang et al. 2018; Goodkind 2018). Given this concern, we introduce below a different approach that requires no assumptions about a post-1980 bounce and, even more importantly, distinguishes between face-value and broad definitions of *the one-child policy* (Figure 1). It begins with a question curiously absent from earlier exchanges – just how many one-child families are there?

An Exploratory Decomposition of the Impact of China's Malthusian Program Across Birth Ceilings, Sub Eras, and Generations

To isolate the impact of one-child *limits* from the broader program, we begin by observing that it should be bounded by the number of one-child families that emerged between 1980 and 2015. Yet, nearly a decade after this draconian quota ended, there is no detailed accounting of how many one-child families China has (Wang et al. 2024).

[6]Following the published exchange, it came to light that Wang et al. (2018) did not incorporate the first of these two factors in their purported replication of Goodkind's (2017) secondary projections, which started the clock in 1980. Because of that, they overestimated the assumed TFR bounce to be 1.8 births. Another mis-replication was their switch of China's baseline population against which the counterfactual population was compared. Goodkind's baseline of China's population in 1980 (and projections thereafter) was generated internally through cohort component projections beginning in 1970 using the same assumptions of demographic change (other than fertility) as in the counterfactual. The baseline of China's population chosen by Wang et al. (2018; Appendix Table, second column from left) came instead from the United Nations *World Populations Prospects*, a switch said to be made for "transparency" and "simplicity" (ibid. p. 713). What was not transparent is that their chosen baseline was higher than the original, which guaranteed that their estimates and projections of the averted population would be lower.

Wang et al. (2013) quote that number to be 150 million, an estimate that apparently refers to one-child families from 1980 to 2009, yet they provide few sources or documentation of the methods used to calculate it. Greenhalgh (2018) provides a higher figure of 200 million which apparently relies on back-of-the-envelope calculations to extend the timeline to 2015, the year one-child limits were lifted. My review of demographic evidence (including the additional sources discussed in Wang et al. 2024) confirms the plausibility of these estimates, the latter of which forms the basis of the following analysis.

How could China's policy-averted population be 609 million (as implied by the 16-country comparator) if no more than 200 million one-child families emerged in the one-child era? The answer is that most of the population reduction was due to program constraints *other* than one-child limits. In fact, the contribution of one-child limits must have been well *below* 200 million given that many parents chose to have one child voluntarily owing to development.

Accordingly, the following analysis posits that between 50 and 150 million families had one child owing to policy restrictions (25-75 percent of the 200 million), an intentionally wide range. The goal is not to specify a best estimate within that range, but rather to explore the implications of these assumptions and better frame issues for future research.

The matrix in Table 2 decomposes the 609 million population reduction across three critical dimensions. The first of these isolates the impact of one-child limits from two-child limits and other constraints enforced under Malthusian intervention, a residual category. All families posited to have had a single child owing to policy are assumed to contribute one child to population reduction given that any additional children averted (e.g., to families who wanted three or more) would otherwise have been constrained by higher birth ceilings (Gu et al. 2007).

The second dimension is a division across two historical eras – the initial decade of compulsion (1970-1979) and *the one-child policy* era broadly defined (1980-2021). The third dimension involves inter-generational dynamics. Each birth averted directly by the program also averts the entire family tree that would have followed given that averted births (in the counterfactual universe) eventually become averted mothers (Goodkind 2017). Naturally, such spillover effects are greatest for cohorts of births averted closest to 1970.

Given the lack of available estimates for some of the cells, the matrix was assembled using a Sodoku-like approach, beginning with estimates that have already been published (green) and cells derived from demographic analysis of available evidence (yellow). Sources for these estimates are indicated in the notes on the table. The three wide-ranging estimates of the number of one-child families due to one-child limits are shown within each broad historical era (pink). Given that both rows and columns must sum to totals, once two or more colored cells are filled in, values in other cells can be calculated algebraically (white).

The matrix indicates that if half of the 200 million families with one child made that choice voluntarily only 166 million (27 percent) of the overall 609 million population reduction (1970-2021) can be attributed to one-child limits. However, that number nearly triples to 475 million when the one-child era is broadly defined to include its enhanced enforcements of all policy

regulations. Even during the one-child era itself, one-child limits account for only 35% of the population reduction (166/475 million), a surprisingly modest minority role.

Naturally, the estimated impact of one-child limits is higher when development is assumed to play a lesser role. Yet the matrix also reveals unexpected inconsistencies in conventional wisdom. One-child limits only account for a majority (52%) of the estimated population reduction from 1980 to 2021 under the scenario which assumes that 75% of one-child families (150 million) can be attributed to policy restrictions, an assumption that contradicts most literature that emphasizes the pre-eminent role of development. Conversely, if 150 million one-child families emerged owing to development, one-child limits account for only 17% of the population reduction, which would underscore the majority impact of all other program features.

The Other Demographic Consequence Mis-Attributed to One-Child Limits: Missing Female Births

The shortcomings of the face-value definition of *the one-child policy* become even clearer when we consider the other demographic consequence attributed to it: China's excessively masculine sex ratio at birth. This attribution, nearly ubiquitous throughout academic literature and popular media, rests upon the following well-regarded logical framework. In societies where parents value sons over daughters, falling fertility leaves parents with fewer opportunities to have a son, which results in greater use of prenatal sex selection to ensure having at least one son (Guilmoto 2009). At first glance, evidence from China seems consistent with this framework and implicates *the one-child policy* because reported sex ratios at birth started rising after it began in 1980 (e.g., Ebenstein 2010; One Child Nation 2019; Cai and Wang 2021; etc.).

However, multiple challenges to this interpretation have dotted the literature for decades. First, the sharp and sustained fall in China's fertility below 2 children per woman, a harbinger of increased sex selection in son preferring societies (Goodkind 2015), did not occur until 1990, a decade after one-child restrictions began. Second, most of the reported rise in China's sex ratio at birth during the 1980s was not due to sex selection but rather excess underreporting of daughters by parents to avoid penalties under the birth program (Zeng et al. 1990; Johannson and Nygren 1992, Chen et al. 2013). The dramatic rise in China's actual sex ratio at birth did not begin until after the aforementioned policy crackdown in 1991 (Goodkind 2011, 2015).

Third, the post-1990 rise was not simply due to prenatal sex selection and reporting anomalies. Sex distortions after the 1991 decree worsened due to stricter enforcement of the "1.5-child" stopping rule, which precluded half of rural parents from even *having* a daughter and interacted with sex selection to further distort sex ratios at birth. This interaction accounted for one quarter (Zeng 2007) to one third (Goodkind 2015) of the excess sex ratio at birth reported in 1.5-child areas in the 2000 census.

Fourth, other son-preferring societies without birth restrictions have also evinced elevated sex ratios at birth (e.g., South Korea, Taiwan, Georgia, and the Indian States of Punjab and Kashmir), and peak distortions in Armenia and Azerbaijan actually exceeded China's (Guilmoto, 2013; Goodkind, 2015; UN WPP24). In these societies, *anything* that brought about lower

fertility contributed to sex selection (Loh and Remick 2015). In that sense, Chinas birth restrictions may be no more blameworthy for sex distortions than improvements in education or child health, hallmarks of development everywhere associated with lower fertility.

Despite these qualifications, one *might* still make the case that China's birth restrictions contributed to sex selection, which occurs at the intersection of two criss-crossing forces – falling fertility heightens potential interest in its use, yet developmental factors associated with lower fertility eventually weaken son preference (Goodkind 2015). Thus, birth quotas could have worsened sex selection by pulling down fertility ahead of developmental forces and, if one-child limits contributed, the sex ratio of first births should have risen as parents selected a son as their first and only birth.

To what extent did first births account for China's missing females? To answer this question, Table 3 begins with the latest estimates of China's annual births and sex ratios at birth from the United Nations (UNPD 2024). Their estimates reflect demographic analysis, based on the 2020 census and other sources, that adjusts for anomalies in reported births. The total number of missing females each year is inferred here as the number of additional female births required to lower the sex ratio to a more normal 106 males per 100 females. Table 3 indicates 23.8 million missing female births in the era of one-child limits (1980-2015), with another 2.8 million occurring between 2016 and 2021, for a total of 26.6 million (1980-2021).

To calculate missing female births by birth order, Table 3 begins with shares of births by birth order and the sex ratio at each birth order as reported by censuses and intercensal surveys (estimates between those years are interpolated). As has been observed elsewhere in the world, China's sex ratios tend to be far more distorted among second and later births. At each birth order, the additional females needed to lower the sex ratio to 106 (as per above) are weighted by their respective numerical shares of the total births estimated by the UN. Since reported sex ratios by birth order are especially distorted, the preliminary tallies (totaling 33.3 million) were raked back to match the 23.8 million implied by the UN's estimate of total births.[7] Figure 4 plots the annual accumulations by births order.

From 1980-2015, the era of one-child limits, only 12.1 percent of missing daughters (2.8 million) were first births (Table 3). Even more noteworthy is that less than 17 percent of those (470 thousand) occurred within the first 25 years of one-child restrictions when enforcements were strictest. The vast majority accumulated after 2005 (Figure 4) owing to a sharp rise in the sex ratio of first births beginning in 2010 to 113.7, the world's highest ever recorded. Yet the rise after 2005 is almost certainly not due to one-child limits, given that there were no enhanced enforcements around that time, punishments against officials who exceeded community quotas were waning (in fact, officials began to *welcome* violations because the resulting fines were an increasingly important source of local revenues, e.g., Wang et al. 2013; Xu et al. 2019), the share

[7]Sex ratios by birth order here come from samples, such as census long forms, which report overall sex ratios at birth about three per hundred higher than indicated by the short form. The downward raking assumes that reporting anomalies regarding sons and daughters are consistent across births orders and time. To my knowledge, no one has ever attempted to adjust for (let alone measure) differential reporting by sex across birth orders. Preliminary attempts to do so led to a slightly lower share of first births among missing females than calculated here.

of parents allowed a two-child limit gradually rose (Goodkind 2017), and developmental forces led more parents to want only one anyway. Moreover, despite the elimination of one-child limits in 2015, the sex ratio of first births remained highly distorted in 2020 (113.2).

In sum, the ubiquitous claim that missing females were a major unintended consequence of China's *one-child policy* can only be justified if one assumes a broad definition that includes compulsory enforcements of higher-order birth ceilings. That said, three important qualifications deserve consideration.

First, a portion of daughters who went missing as second births *might* be attributed to one-child limits. Although that portion would likely be small, the conceptual landscape is tricky and remains open for further exploration.[8] Second, whatever the impact on prenatal outcomes, compulsory birth ceilings had disproportionate consequences for daughters after birth, including child abandonment and worsened health outcomes, particularly during the 1990s (Johnson 2016; One Child Nation 2019). Third, even if the recent rise in sex selection for first births was voluntary, it was likely an *indirect* result of a compulsory program that rendered sex selection acceptable for second and later births. And the vestiges of one-child compulsion continue. The 2020 census showed that sex ratios of *second births* plummeted to a near normal l06.8 (Table 3) and became slightly feminine in rural areas (104.8, not shown). The likely reason? After the universal allowance of two births in 2015, rural parents formerly required to stop at one with an only son selected on balance for daughters if they had a second.

Challenges and Rewards for Redressing *The One-Child Policy* Misnomer: A Look Back Before Looking Ahead

China's half century Malthusian campaign was fueled by fears that unchecked population growth would derail its ambitions for rapid development. Its distinct phases, features, and bureaucratic implementation have been well explored for decades in books, articles, popular media, and classrooms. Yet unbelievable as it may seem now that the campaign has ended, its demographic impact remains poorly understood (CECC 2016). Ironically, the primary obstacle to improving our understanding is the name by which everyone knows it – *the one-child policy*.

This phrase is a misnomer, not simply because many families were exempt from one-child limits or because it under-describes the broader program of regulations. It is fundamentally flawed as a primal category for defining away what really constrained China's population. As documented

[8]According to the 2000 Census, four out of five second births occurred in rural areas where the vast majority of parents could have a second child after a first-born daughter, so program-related incentives to select for a son there would be due to *two-child* limits, not one-child limits. Of the remaining fifth of second births in urban areas, although most were subject to penalties regardless of the sex of the first, son-preferring parents with a first-born daughter were likely more willing to continue, select for a son, and risk attendant penalties than parents with a first-born son. For them, one-child limits might explain a portion of elevated sex ratios among *second* births. Then again, parents tended to leave first-born daughters unregistered, saving that coveted slot (which provided free education and other benefits) for second born sons who would be misreported as first births (Merli and Raftery 2000). That reporting bias would correctly, if inadvertently, classify statistically missing daughters as first births.

herein, along with the initial decade of compulsion prior to one-child limits, it was enhanced enforcements of all other birth ceilings and regulations during the one-child era and beyond that accounted for most of the program's demographic consequences.

Once we distinguish one-child limits from other constraints, there is much common ground to acknowledge about their impact, bookend estimates of which both build from work of program critics. At the high end, China's Great Malthusian Campaign resulted in a population more than 600 million less than it would have been at the time it concluded in 2021. At the low end, one-child limits likely account for no more than 166 million of that reduction, a number well below the official government estimate of 400 million averted births. However, when *the one-child policy* is broadly defined to include its enhanced enforcements of all program features, that estimate nearly triples to 475 million, above the official estimate.

Although surprising at first glance, that one-child limits played a minority role in China's population reduction is consistent with longstanding assumptions. For instance, in the 1980s demographers argued that China could keep its population below ceiling targets without one-child limits (Liang 1979, 1985; Bongaarts and Greenhalgh 1986). The catch? – the alternate restrictions, including late ages for marriage and childbearing, wide spacing between births, and higher birth ceilings would all have to be strictly enforced. Many localities did exactly that along with one-child limits, a full-court press of coercive measures (Aird 1990).

The companion analysis of missing female births suggests implicit, if unwitting, recognition of that broader program of as well as acceptance of the minority impact of one-child limits. To the extent that *the one-child policy* increased prenatal sex selection, it was due overwhelmingly to enforcements of two- and three-child limits.

Despite its semantic flaws and the misunderstandings that have resulted, it seems unrealistic to expect that the term *one-child policy* will ever be supplanted by another. The images it conjures embedded long ago in our collective thinking. Nothing else can replace its evocative simplicity. And with every utterance, the phrase reinforces itself by narrowing attention away from the broader program of interest.

Pessimism is further warranted because the massive impact of China's Malthusian campaign is "uncomfortable knowledge" (Rayner 2012) for major institutional stakeholders, each for different reasons. First among them are academic observers. Some two decades ago, after considerable criticism of program coercion (e.g., Aird 1990, etc.), the dismissal of the impact of one-child limits became the cornerstone of a scholar-led campaign to bring *the one-child policy* to an early end. That strategy was grounded in more general presumptions following the fall of the Berlin Wall that authoritarianism was ineffective, unnecessary for achieving development goals, and destined to fail (Fukuyama 1992; Sen 1999). To maintain that narrative today, the quantification of anything beyond one-child limits is rejected as misleading and immoral, righteously covered up to deny government claims that the program had its intended impact.

Second, Malthusian compulsion continues to create unease for supporters of international family planning programs. The recommended goals of this community – to meet individual needs, support voluntary choices, and remove population reduction as a legitimate objective – evolved

in direct opposition to China's approach. Yet compulsory approaches themselves are better left unmentioned and unexamined, disqualified from the science of measurement applied to family planning programs elsewhere through 'impact evaluation' studies. The materials herein constitute, for better or worse, just such a study.

Third, perhaps the biggest stakeholder of all – the Chinese government – recently shifted strategies amidst a changing landscape of concerns. Official documents had first headlined the estimate of 400 million averted births in 2006, the timing of which suggests a defensive response to the advocacy noted above. The bureaucratic agency entrusted to implement this campaign, suddenly facing extinction and supported up by the central government that created it, cited this figure to argue that its efforts had been successful and should be continued. After 2016, however, with one-child limits ending, birth rates plummeting, and a pro-natal reorientation underway, that statistic quietly disappeared from official pronouncements, now an unwelcome reminder that China's ultra-low fertility was the premature result of its own policy choices.

Although these institutional narratives obstruct progress in the basic science of measurement in this area, there are glimmers of hope. Given the risks of addressing the impact of China's Malthusian campaign in public (and perhaps because of them), this great debate has taken refuge in the private spaces of college classrooms and graduate seminars where audiences seem more open to learning. Hopefully, the materials herein have shown how this debate is best resolved through clarifying language. To avoid confusion going forward, when one is concerned specifically with *one-child limit*s or the outcomes thereof, that term is appropriately used to narrow attention on this singular policy feature. The phrase *one-child policy,* given its inherent linguistic ambiguities, is better reserved for the broader *program* ushered in along with one-child limits. And once our purview extends to enforcements of all regulations, what we need most is a name for the full half century program inspired by Malthus.

With these considerations in mind, findings from literature that have conflated one-child limits with the broader Malthusian campaign may need to be reconsidered. Here, for instance, are just a few questions on the relevance of population change for China's economic rise: To what extent did Malthusian compulsion, which began a decade before major market reforms in the late 1970s, force an economy-boosting 'demographic dividend' by reducing the proportion of child dependents? In the absence of this campaign, how different would the number, average size, and composition of China's households be? Given that the migration of inexpensive rural labor to urban areas was a major engine driving advances in national prosperity, did tighter birth quotas in urban areas lube that process by creating a shortage of labor that rural migrants could fill? And how much higher might the current standard of living now be owing to such factors?

Whatever we discover about role of demography in China's economic growth, the program-related reduction of its population is itself critical knowledge for China's policymakers and those who would advise them. Ultra-low birth rates in China arrived at least two decades earlier than would be expected, with current fertility comparable to that of Singapore, a highly developed city state. Other countries with very low fertility have experimented with pro-natal measures, with limited if any demographic result. Although China's government may be more willing than others to use compulsion to promote pro-natal goals, might the hurdles it faces be higher owing to the zeal and longevity of the prior anti-natal program?

As we peer further into the future, one may also wonder whether China will decide to emphasize once again the massive numerical impact of its Malthusian intervention. The uncharted territory ahead is dominated by two unprecedented forces– climate change and artificial intelligence. To the extent that larger populations account for greater carbon footprints, may China re-promote these massive numbers as evidence that it did its part to mitigate the world's ill effects (e.g., Doyle 2007)? And with advances in technology threatening to make many people economically redundant, will the government thank the citizens who made sacrifices and tout its own foresight in preventing what might have other been far worse unemployment? In light of increased competition between authoritarian and plural systems around the world, might it present these examples to justify why individual rights are sometimes appropriately suspended for the benefit of the nation?

Given its intersection with so many critical issues facing the world today and tomorrow, there is likely no topic bigger than this in all of international demography (with equal relevance for sinologists). The mountain of questions it raises is worth climbing and with clear eyes, not simply because it is there but because that is where so many answers may be found.

REFERENCES

Aird, J. S. (1990). Slaughter of the innocents: Coercive birth control in China. Washington, DC: American Enterprise Institute Press.

Attane, I. (2022). China's new three-child policy: What effects can we expect? Population and Society January. Number 596. (INED – French Institute for Demographic Studies). https://www.ined.fr/fichier/s_rubrique/32387/596.a.fertility.birth.rate.china.en.pdf

Babiarz, K., Ma, P., Song, S., Miller, G. (2019) Population sex imbalance in China before the One-Child Policy, Demographic Research, 40, 319-358

Babiarz, K., Ma, P., Song, S., Miller, G. (2018, revised 2020) The Limits and Consequences of Population Policy: Evidence from China's Wan Xi Shao Campaign, National Bureau of Economic Research, Working Paper 25130.

Banister, J. (1987). China's changing population. Stanford, CA: Stanford University Press.

Cai, Y. & Wang, F. (2021). The social and sociological consequences of China's one-child policy. Annual Review of Sociology, 47, 587-606.

Catholic News Agency (CNA). 2015. China replaces one-child policy with two-child policy. October 29. https://www.catholicnewsagency.com/news/32898/china-replaces-one-child-policy-with-two-child-policy

中国共产党中央委员会 (Central Committee of the CCP), 中华人民共和国国务院 (State Council). "Decision by the Central Committee of the Chinese Communist Party and the State Council on Improving Birth Policies to Promote Long-Term, Balanced Population Development [中共中央 国务院关于优化生育政策促进人口长期均衡发展的决定]". CSIS Interpret: China, original work published in Xinhua News Agency [新华社], June 26, 2021.

Chagnon, Napolean A. 2013. Nobles Savages: My life among two dangerous tribes – the Yanomamo and the Anthropologists. Simon and Schuster. New York.

Chen, Y., Huang, Y. (2020). The power of the government: China's Family Planning Leading Group and the fertility decline of the 1970s. Demographic Research, 42, 985-1038.

Chen, Y., and Fang, H. M. (2021). The long-term consequences of China's "Later, Longer, Fewer" campaign in old age. Journal of Development Economics. 151.

Chen, Y., Li, H., Meng, L. (2013). Prenatal Sex Selection and Missing Girls in China: Evidence from the Diffusion of Diagnostic Ultrasound. Journal of Human Resources, 48, 36-70.

Congressional-Executive Commission on China (CECC). (2016). Prepared statement of Nicholas Eberstadt. In China's new ''two–child policy'' and the continuation of massive crimes against women and children: Hearing before the Congressional-Executive Commission on China, One Hundred Fourteenth Congress, First Session, December 3, 2015 (pp. 32–35). Washington, DC: U.S. Government Publishing Office. Retrieved from https://chrissmith.house.gov/uploadedfiles/2015.12.03_chinas_new_two_child_policy_and_the_continuation_of_massive_crimes_against_women_and_children.pdf

CNBC. (2021). China Scraps Fines for Families Violating Childbirth Limits. https://www.cnbc.com/2021/07/21/china-scraps-fines-for-families-violating-childbirth-limits.html

Desai, S. (2021). Why China's About Turn Shows Restrictive Population Policies Don't Work. The Indian EXPRESS. June 5. https://indianexpress.com/article/opinion/columns/why-chinas-about-turn-shows-restrictive-population-policy-doesnt-work-7344583/

Doyle, A. (2007). China says one-child policy helps protect climate. Reuters. August 30. https://www.reuters.com/article/idUSL30472039/

Dreger, Alice. (2015). Galileo's Middle Finger: Heretics, Activists, and One Scholar's Search for Justice. Penguin Books.

Du, Q. (2023). Third-child ratio rises among China's 2022 newborns, showing effect of policy. Global Times. https://www.globaltimes.cn/page/202310/1299773.shtml

Ebenstein, A. (2010). The "Missing Girls" of China and the Unintended Consequences of the One Child Policy. Journal of Human Resources Jan 2010, 45 (1) 87-115; DOI: 10.3368/jhr.45.1.87

Eberstadt, N. (2019). China's Changing Family Structure: Dimensions and Implications. American Enterprise Institute.

Eberstadt, N., and A. Verdery (2023). China's Revolution in Family Structure. American Enterprise Institute.

Eggleston, K., Oi, J., Rozelle, S., Sun, A., Walder, A., & Zhou, X. (2013). Will Demographic Change Slow China's Rise? *The Journal of Asian Studies*, 72(3), 505-518. doi:10.1017/S0021911813000557

Fukuyama, F. (1989). The End of History? *The National Interest*, *16*, 3–18. http://www.jstor.org/stable/24027184

Gietel-Basten S, Han X, Cheng Y. (2019). Assessing the impact of the "one-child policy" in China: a synthetic control approach. *PLOS ONE* 14(11):e0220170.

Goodkind, D. (1992). Estimates of averted Chinese births, 1971–1990: Comparisons of fertility decline, family planning policy, and development in six Confucian societies (Research School of Social Sciences Working Papers in Demography No. 38). Canberra, Australia: Australian National University.

Goodkind, D. (1995). Vietnam's one-or-two child policy in action. Population and Development Review, 21, 85–113.

Goodkind, D. (2011). Child underreporting, fertility, and sex ratio imbalance in China. Demography, 48, 291–316.

Goodkind, D. (2015). The claim that China's fertility restrictions contributed to the use of prenatal sex selection: A sceptical reappraisal. Population Studies, 69, 263–279.

Goodkind, D. (2017). The astonishing population averted by China's birth restrictions: Estimates, nightmares, and reprogrammed ambitions. Demography, 54, 1375–1399.

Goodkind D. (2018). If science had come first: A billion-person fable for the ages (A reply to comments). Demography 55, 743–768. pmid:29623609

Goodkind, D. (2019). Formal Comment on: Assessing the impact of the "one-child policy" in China: a synthetic control approach. PLOS ONE.

Goodkind, D. (2023). The Preeminent Impact of Two-Child Limits Throughout China's Great Malthusian

Campaign (1970-2021). Hybrid brownbag seminar hosted by the Population Division of the Department of Economic and Social Affairs. United Nations. January18.

Goodkind, D. (2024). Inside a Demographic Forbidden Zone: On the Transformative Impact of China's Great Malthusian Campaign (1970-2021). Population Association of Singapore. Commentary. March 28. PAS Blog — Population Association of Singapore (sgpopulation.org)

Greenhalgh, S., & Winckler, E. (2005). Governing China's population: From Leninist to neoliberal biopolitics. Stanford, CA: Stanford University Press.

Greenhalgh, S. (2001). Fresh Winds in Beijing: Chinese Feminists Speak Out on the One-Child Policy and Women's Lives, Signs, 26, 847-886.

Greenhalgh. S. (2018). Why Does the End of the One-Child Policy Matter? (p 183-190) The China Questions. Harvard University Press.

Gu, B., Wang, F., Guo, Z., & Zhang, E. (2007). China's local and national fertility policies at the end of the twentieth century. Population and Development Review, 33, 129–147.

Gu, B., and Wang, F. (2009). An Experiment of Eight Million People (Chinese Edition).

The Guardian, 2022. Chinese government attempts to boost birth rate with new policies. August 17. https://www.theguardian.com/world/2022/aug/17/chinese-government-birth-rate-policies-abortions-population

Guilmoto, C. Z. (2009). The Sex Ratio Transition in Asia. *Population and Development Review*, *35*(3), 519–549. http://www.jstor.org/stable/25593663

Guilmoto, C. (2013). Sex Imbalances at Birth in Armenia. UNFPA. https://armenia.unfpa.org/en/publications/%E2%80%9Csex-imbalances-birth-armenia-demographic-evidence-and-analysis%E2%80%9D-report

Hesketh, T., Li, L., & Zhu, W. (2005). The effect of China's one-child family policy after 25 years. New England Journal of Medicine, 353, 1171–1176.

Hvistendahl, 2017, Science Magazine "Analysis of China's One-child policy sparks uproar"

Jiang Q, Yu Q, Yang S, Sánchez-Barricarte JJ. (2017). CHANGES IN SEX RATIO AT BIRTH IN CHINA: A DECOMPOSITION BY BIRTH ORDER. J Biosoc Sci. 2017 Nov;49(6):826-841. doi: 10.1017/S0021932016000547. Epub 2016 Nov 11. PMID: 27834160; PMCID: PMC5533650.

Johansson S, Nygren O. 1991. The missing girls of China: a new demographic account. *Popul. Dev. Rev.* 17:35– 51

Johnson, K. A. (2016). China's hidden children: Abandonment, adoption, and the human costs of the one-child policy. Chicago, IL: University of Chicago Press.

Lavely, W., & Freedman, R. (1990). The origins of the Chinese fertility decline. Demography, 27, 357–367.

Li, L., Becker, S., Tsui, A., Ahmed, S. (2006). Three methods of estimating births averted nationally by contraception. Population Studies, 62, 191-210.

Liang, Z. (1979, December). Dui woguo jinhou jishinian renkou fazhan zhanlüe de jidian yijian [Several opinions on China's population development strategy in the next few decades]. Paper presented at the

Population Conference, Chengdu City, China.

Liang, Z. (1985, July). Guanyu wanhun wanyu jia jiange shengyu shidian de jidian shuoming [Explanations of the "late marriage, late childbearing plus spacing" birth experiment]. Speech at the Plenary Meeting of Cadres on making arrangements for the implementation of the "late marriage and late childbearing plus spacing" birth experiment in Yicheng County, Shanxi, China.

Loh C, Remick EJ. (2015). China's Skewed Sex Ratio and the One-Child Policy. The China Quarterly. 222:295-319. doi:10.1017/S0305741015000375

Malthus, T. (1965). An essay on the principle of population. New York, NY: August Kelley. (Original work published 1798).

Merli, M. G., & Smith, H. L. (2002). Has the Chinese family planning policy been successful in changing fertility preferences? Demography, 39, 557–572.

Merli, M. G., Raftery, A. (2000). Are births underreported in rural China? Manipulation of statistical records in response to China's population policies. *Demography* 1 February 2000; 37 (1): 109–126. doi: https://doi.org/10.2307/2648100

Minzner, Carl, Daniel Goodkind, Stuart Gietel-Basten and Zak Dychtwald, (2023). China's Demographic Challenges. Interpret: China -- Center for Strategic and International Studies, November 28. https://interpret.csis.org/chinas-demographic-challenges/.

Ngo, A.P. (2020) Effects of Vietnam's two-child policy on fertility, son preference, and female labor supply. J Popul Econ 33, 751–794. https://doi.org/10.1007/s00148-019-00766-1

One Child Nation. 2019. Amazon Studios. https://www.youtube.com/watch?v=gMcJVoLwyD0

People's Daily Online. (2011, October 27). 400 million births prevented by one-child policy. China Society. Retrieved from http://en.people.cn/90882/7629166.html

Pielke, R. A. (2007). The Honest Broker: Making Sense of Science in Policy and Politics. Cambridge University Press.

Scharping, T. (2003). Birth control in China 1949–2000: Population policy and demographic development. London, UK: Routledge.

Sen, A. (1999). Development as Freedom. New York, NY: Alfred A. Knopf.

Short, S. E., & Zhai, F. Y. (1998). Looking Locally at China's One-Child Policy. Studies in Family Planning, 29(4), 373-387.

Tien, H. Y. (1991). China's strategic demographic initiative. New York, NY: Praeger.

United Nations, Population Division ((UNPD). (2024). World Population Prospects 2024. Department of Economic and Social Affairs. https://population.un.org/wpp/

Wang, F., Cai, Y., & Gu, B. (2013). Population, policy, and politics: How will history judge China's one-child policy? Population and Development Review, 38(Suppl. 1), 115–129.

Wang, F. (2018). Tweet from @fwanguci on April 8 (" … #Demography and @PopAssocAmerica need to take action to retract a scientifically flawed and dishonest paper …").

Wang, F., Cai, Y., Shen, K., Geitel-Basten, S. (2018). Is demography just a numerical exercise? Numbers, Politics, and Legacies of China's One-Child Policy. 55 (2): 693–719.

Wang, H. W., Verdery, A. M., Margolis, R. (2024). Sibling Availability, Sibling Sorting, and Subjective Health Among Chinese Adults. Demography. 61 (3): 797–827.

Wei, Y., & Zhang, L. (2014). Reexamination of the Yicheng two-child policy. China Journal, 72, 98–120.

White, T. (2006). China's longest campaign: Birth planning in the People's Republic, 1949–2005. Ithaca, NY: Cornell University Press.

Whyte, M. K., Wang, F., & Cai, Y. (2015). Challenging myths about China's one-child policy. China Journal, 74, 144–159.

Whyte, M. K. (2019/2024). China's One-Child Policy. Oxford Bibliographies. Current version: https://scholar.harvard.edu/files/martinwhyte/files/chinas_one_child_policy_-_childhood_studies_-_oxford_bibliographies.pdf

Xinhua. (1991). Decision on stepping up family planning work. Translated in Foreign Broadcast Information Services (FBIS: CHI-91-119, pp. 33–36).

Xinhua. (2006, March 21). Family planning policy helps prevents 400 million births. Retrieved from http://news.xinhuanet.com/english/2006-03/21/content_4328179.htm

Xinhua. (2013, December 28). China formally allows more couple to have second child. Retrieved from http://news.xinhuanet.com/english/china/2013-12/28/c_133002754.htm

Xinhua. (2015, October 29). China to allow two children for all couples. Retrieved from http://news.xinhuanet.com/english/2015-10/29/c_134763645.htm

Xinhua. (2021, June 26). Decision by the Central Committee of the Chinese Communist Party and the State Council on Improving Birth Policies to Promote Long-Term and Balanced Population Development.

Xu, L., Yang, F., Sun, J, Nicholas, S., Wang, J. (2019). Evaluating family planning organizations under China's two-child policy in Shandong Province. Int J Environ Res Public Health. Jun 14;16(12):2121. doi: 10.3390/ijerph16122121. PMID: 31208009; PMCID: PMC6616470.

Zeng, Y., Tu, P., Gu, B. C., Xu, Y., Li, B. H., & Li, Y. P. (1993). Causes and implications of the recent increase in the reported sex ratio at birth in China. Population and Development Review, 19, 283–302.

Zeng Y. (2007). Options of fertility policy transition in China. Popul Dev Rev. 33,215–46.

Zeng Y, Hesketh T. (2016). The effects of China's universal two-child policy. Lancet. 2016 Oct 15;388(10054):1930-1938.

Zhang, J. (2017). The evolution of China's one-child policy and its effects on family outcomes. Journal of Economic Perspectives, 31(1), 141–160.

Zhang, C., Sobotka, T. (2021). Drastic changes in fertility level and timing in response to marriage and fertility policies: evidence from Shandong province, China. *China popul. dev. stud.* **5**, 191–214 (2021). https://doi.org/10.1007/s42379-021-00089-3

Figure 1. China's Fertility Before and During the Great Malthusian Campaign (1970-2021) and Its Main Sub-eras

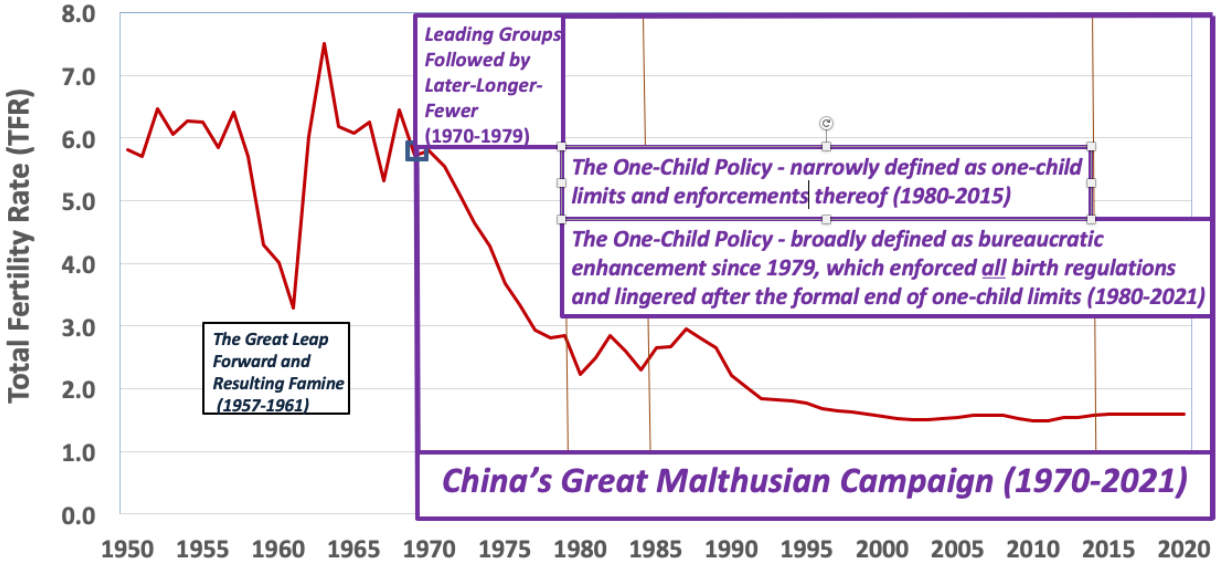


Table 1. Replicating of Goodkind 2017 Tables 2&3

	Goodkind 2017 Table 2 (P1384)								Goodkind 2017 Table 3 (P1388)						
		China's Projected Population Based on Fertility Decline in:				Cumulative Averted Population				China's Projected Population Based on Fertility Decline in:			Cumulative Averted Population Due to		
	year	China	Vietnam	16-country	India	Vietnam	untry Compi	india	Year	China	16-country	China, 1980 from 16-Country	Overall	LLF	One-child
Goodkind (2017)	1970	814	814	814	814	—	—	—	1970	814	814	—	0	0	0
	1975	908	921	925	930	14	17	22	1975	908	925	—	17	17	0
	1980	975	1035	1048	1068	60	73	94	1980	975	1048	1048	73	73	0
	1985	1044	1147	1177	1224	103	133	180	1985	1044	1177	1117	133	72	60
	1990	1136	1257	1309	1389	121	173	253	1990	1136	1309	1208	173	72	100
	1995	1201	1356	1437	1557	155	236	356	1995	1201	1437	1276	236	75	161
	2000	1251	1449	1556	1737	198	305	486	2000	1251	1556	1340	305	89	216
	2005	1285	1542	1666	1924	257	381	639	2005	1285	1666	1393	381	108	274
	2010	1318	1631	1772	2112	313	455	794	2010	1318	1772	1437	455	119	336
	2015	1349	1711	1869	2289	362	520	940	2015	1349	1869	1471	520	122	397
	2020	1375	1778	1952	2454	402	577	1079	2020	1375	1952	1501	577	126	451
	2025	1383	1833	2023	2615	450	639	1231	2025	1383	2023	1517	639	133	506
	2030	1374	1876	2078	2765	503	705	1392	2030	1374	2078	1516	705	142	562
	2035	1354	1908	2120	2900	553	765	1546	2035	1354	2120	1503	765	148	617
	2040	1329	1925	2147	3015	596	817	1685	2040	1329	2147	1480	817	150	667
	2045	1298	1929	2159	3108	631	861	1811	2045	1298	2159	1447	861	150	712
	2050	1258	1919	2156	3182	662	899	1924	2050	1258	2156	1405	899	148	751
	2055	1212	1899	2139	3233	687	927	2021	2055	1212	2139	1356	927	143	784
	2060	1165	1870	2110	3260	705	945	2095	2060	1165	2110	1303	945	138	807
Replication	1970	814	814	814	814				1970	814	814		0	0	0
	1975	908	921	925	930	14	17	22	1975	908	925		17	17	0
	1980	975	1035	1048	1068	60	73	94	1980	975	1048	1048	73	73	0
	1985	1044	1147	1177	1224	103	133	180	1985	1044	1177	1117	133	72	60
	1990	1135	1257	1308	1388	121	173	253	1990	1135	1308	1208	173	72	101
	1995	1201	1356	1437	1557	155	236	356	1995	1201	1437	1275	236	75	162
	2000	1251	1449	1556	1736	198	305	486	2000	1251	1556	1339	305	89	216
	2005	1284	1542	1666	1924	257	381	639	2005	1284	1666	1392	381	108	273
	2010	1318	1631	1772	2112	313	455	795	2010	1318	1772	1436	455	119	336
	2015	1349	1711	1869	2289	362	520	940	2015	1349	1869	1471	520	122	398
	2020	1376	1779	1953	2456	403	577	1080	2020	1376	1953	1501	577	126	452
	2025	1384	1834	2024	2617	450	640	1233	2025	1384	2024	1517	640	133	507
	2030	1375	1878	2080	2769	504	706	1395	2030	1375	2080	1517	706	142	563
	2035	1356	1910	2122	2905	554	767	1550	2035	1356	2122	1504	767	149	618
	2040	1331	1928	2150	3020	597	819	1689	2040	1331	2150	1481	819	150	669
	2045	1299	1932	2162	3114	633	863	1815	2045	1299	2162	1449	863	150	713
	2050	1259	1922	2160	3188	663	900	1929	2050	1259	2160	1407	900	148	753
	2055	1214	1902	2143	3241	688	929	2027	2055	1214	2143	1357	929	144	786
	2060	1167	1873	2114	3268	706	947	2101	2060	1167	2114	1305	947	138	810
Difference (Replication - Goodkind)	1970	0	0	0	0				0	0	0		0	0	0
	1975	0	0	0	0	0	0	0	0	0	0		0	0	0
	1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1990	-1	0	-1	-1	0	0	0	0	-1	-1	0	0	0	1
	1995	0	0	0	0	0	0	0	0	0	0	-1	0	0	1
	2000	0	0	0	-1	0	0	0	0	0	0	-1	0	0	0
	2005	-1	0	0	0	0	0	0	0	-1	0	-1	0	0	-1
	2010	0	0	0	0	0	0	1	0	0	0	-1	0	0	0
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2020	1	1	1	2	1	0	1	0	1	1	0	0	0	1
	2025	1	1	1	2	0	1	2	0	1	1	0	1	0	1
	2030	1	2	2	4	1	1	3	0	1	2	1	1	0	1
	2035	2	2	2	5	1	2	4	0	2	2	1	2	1	1
	2040	2	3	3	5	1	2	4	0	2	3	1	2	0	2
	2045	1	3	3	6	2	2	4	0	1	3	2	2	0	1
	2050	1	3	4	6	1	1	5	0	1	4	2	1	0	2
	2055	2	3	4	8	1	2	6	0	2	4	1	2	1	2
	2060	2	3	4	8	1	2	6	0	2	4	2	2	0	3

Note: Replications use the US Census Bureau's RUP software with projection inputs provided by Goodkind in an Excel file following our data request and 5-year sex ratios at birth provided in Goodkind (2017) Appendix Table 4.

FIGURE 2

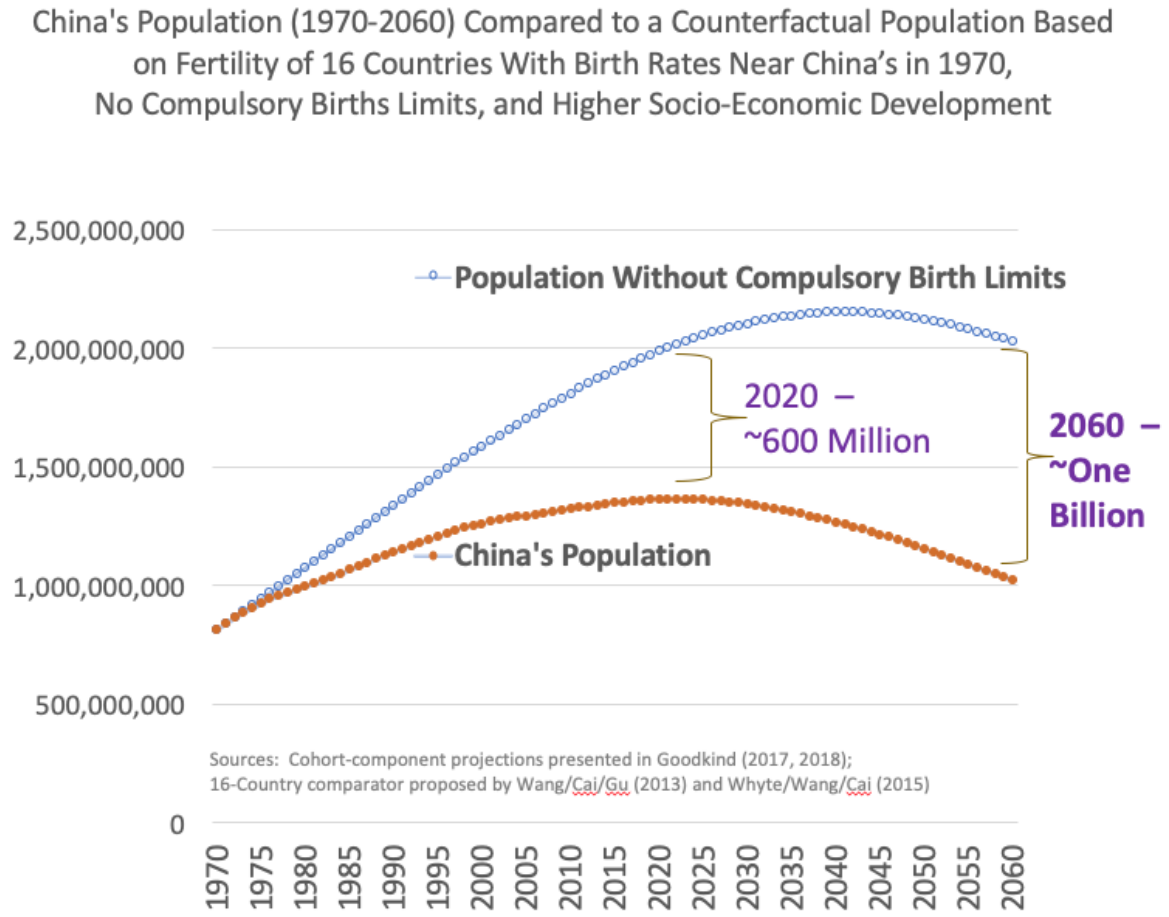

China's Population (1970-2060) Compared to a Counterfactual Population Based on Fertility of 16 Countries With Birth Rates Near China's in 1970, No Compulsory Births Limits, and Higher Socio-Economic Development
2,500,000,000
2,000,000,000
1,500,000,000
1,000,000,000
500,000,000
0
Population Without Compulsory Birth Limits
China's Population
2020 – ~600 Million
2060 – ~One Billion
Sources: Cohort-component projections presented in Goodkind (2017, 2018);
16-Country comparator proposed by Wang/Cai/Gu (2013) and Whyte/Wang/Cai (2015)
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060

FIGURE 3 – Human Development Index (HDI) in China compared to other countries in the 16-country comparator (Wang et al., 2013; Whyte et al., 2015) for which HDI was available, 1990 (alphabetical order)

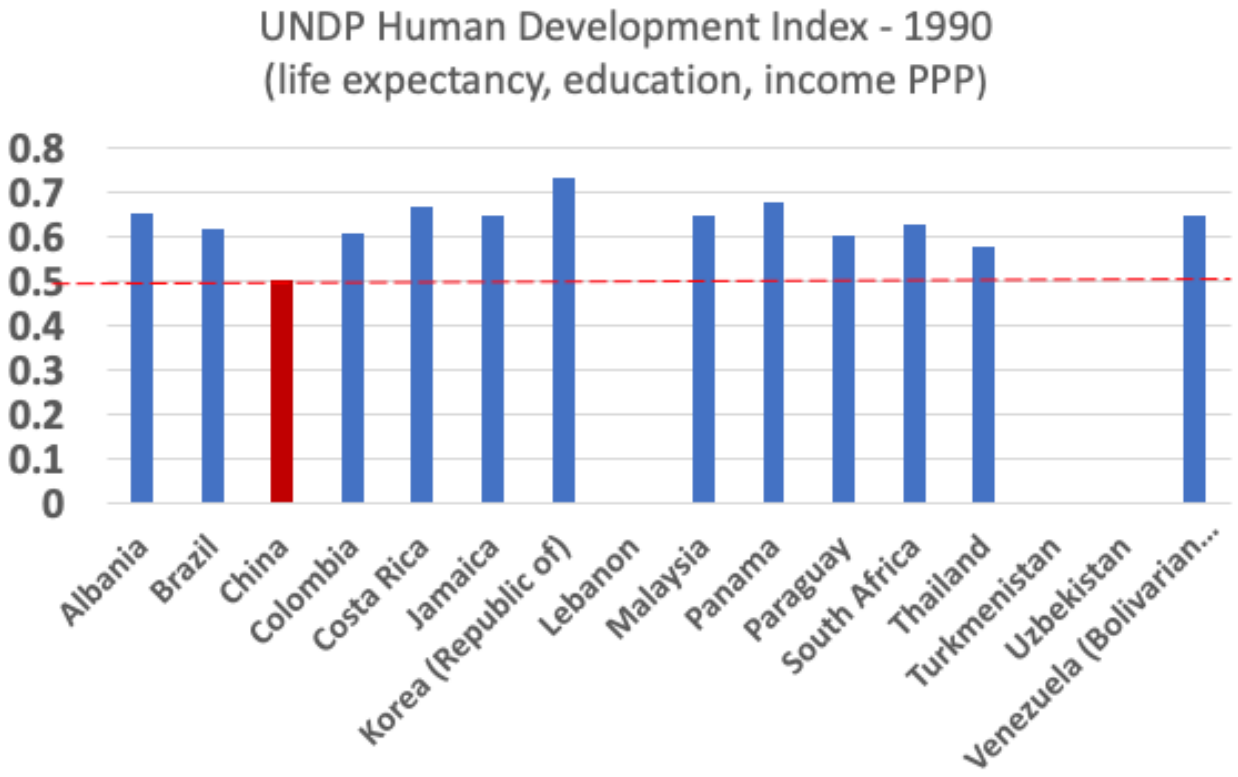


Table 2. China's Population Reduction *as of 2021* Owing to Its Malthusian Campaign (1970-2021) :
Decomposition Across Sub-Eras, Birth Limits, and Generations Based on a Presumed Wide Range of Policy-Created One-Child Families
(numbers in millions)

											Percent of Population	
	The Leading Group	All Birth Limits			One child limits			Two-three child imits			Reduction Owing to	
	& Later-Longer Fewer	1st	2nd+		1st	2nd+		1st	2nd+		One	Two-Three
	1970-1980	Generation[3]	Generation[4]		Generation	Generation		Generation	Generation		Child Limits	Child Limits
	134	**73**	61	=	**0**	**0**	+	**73**	61		0%	100%
	134	**73**	61	=	**0**	**0**	+	**73**	61		0%	100%
	134	**73**	61	=	**0**	**0**	+	**73**	61		0%	100%
	+	+	+		+	+		+	+			
	One-Child Era Forward	1st	2nd+		1st	2nd+		1st	2nd+			
	1980-2021	Generation	Generation		Generation[5]	Generation[6]		Generation	Generation			
presumed	475	**286**	189	=	**150**	*99*	+	*136*	*90*		52%	48%
range shown	475	**286**	189	=	**100**	*66*	+	*186*	*123*		35%	65%
in middle box	475	**286**	189	=	**50**	*33*	+	*236*	*156*		17%	83%
	=	=	=		=	=		=	=			
	China Malthusian											
	Campaign	1st	2nd+		1st	2nd+		1st	2nd+			
	1970-2021[1]	Generation[2]	Generation[2]		Generation	Generation		Generation	Generation			
presumed	**609**	**359**	250	=	**150**	*99*	+	*209*	*151*		41%	59%
range shown	**609**	**359**	250	=	**100**	*66*	+	*259*	*184*		27%	73%
in middle box	**609**	**359**	250	=	**50**	*33*	+	*309*	*217*		14%	86%

Guide

[1]China's population reduction was 609 million (Goodkind, 2018, Table 1; based on 16-country comparator - Wang et al. 2013; Whyte et al. 2015)

[2]Division of 609 into first and latter generations (based on Goodkind, 2017, Figure 3; Goodkind, 2018, Figure 4)

[3]First generation during Later-Longer-Fewer era was 73 million (Goodkind 2018, Table 1; see also a higher estimate of 85 million by Geitel- Basten et al., 2019)

[4]Second generation after the Later-Longer-Fewer Era - assumes avrg TFR of 1.65, 1970s SRB = 100/206, and 5% of original cohort averted in *3rd* Gen.

[5]Number of all one-child housedholds in one-child era reported to be 150 million (Wang et al., 2013) and 200 million (Greenhalgh 2018) - see text

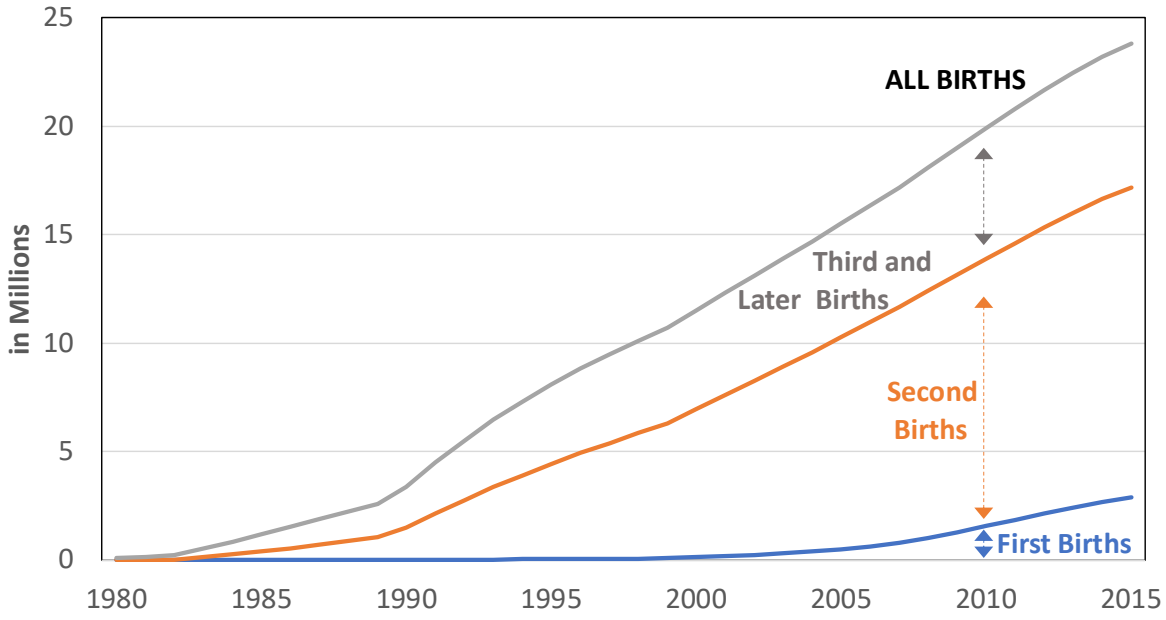
[6]Second generation after one-child era due to all birth limits (a derived estimate) assumed to apply to both one and higher-order limits

All other calculations derived arithmatically from colored cells. Note that calculated estimated for years after 2021 will grow.

TABLE 3. Estimated Shares of Missing Female Births by Birth Order in China, 1980-2021

Year	Births in China* (in millions)	Sex Ratio All Births*	Missing Female Births	Sex Ratios By Birth Order** First	Second	Third+	Percent Births by Birth Order** First	Second	Third+	Missing Female Births (millions) First	Second	Third+
1980	21.7	107.1	0.11	105.6	105.2	109.4	0.47	0.25	0.28	0.000	0.000	0.093
1981	22.5	107.3	0.13	105.6	105.2	109.4	0.47	0.25	0.28	0.000	0.000	0.097
1982	24.4	107.5	0.17	105.6	105.2	109.4	0.47	0.25	0.28	0.000	0.000	0.105
1983	21.7	107.8	0.18	105.5	112.0	115.0	0.47	0.26	0.27	0.000	0.151	0.231
1984	22.9	108.1	0.22	105.5	112.0	115.0	0.47	0.27	0.26	0.000	0.164	0.235
1985	24.1	108.6	0.28	105.5	112.0	115.0	0.48	0.28	0.25	0.000	0.178	0.237
1986	26.0	109.1	0.36	105.5	112.0	115.0	0.48	0.28	0.24	0.000	0.197	0.244
1987	27.6	109.7	0.46	105.5	112.0	115.0	0.48	0.29	0.23	0.000	0.214	0.246
1988	26.4	110.4	0.52	105.5	112.0	115.0	0.49	0.30	0.21	0.000	0.210	0.224
1989	27.2	111.1	0.62	105.5	112.0	115.0	0.49	0.31	0.20	0.000	0.222	0.219
1990	28.1	111.8	0.73	105.2	121.0	126.6	0.49	0.31	0.19	0.000	0.563	0.464
1991	22.6	112.5	0.65	106.2	136.0	143.0	0.51	0.31	0.18	0.011	0.836	0.584
1992	21.1	113.2	0.67	106.2	136.0	143.0	0.53	0.30	0.17	0.010	0.765	0.502
1993	20.2	113.9	0.70	106.2	136.0	143.0	0.55	0.30	0.15	0.010	0.721	0.443
1994	19.5	114.6	0.74	106.2	136.0	143.0	0.57	0.29	0.14	0.010	0.684	0.391
1995	19.0	115.2	0.77	106.2	136.0	143.0	0.59	0.29	0.13	0.010	0.654	0.344
1996	18.3	115.7	0.78	106.2	136.0	143.0	0.61	0.28	0.11	0.010	0.619	0.296
1997	17.7	116.2	0.79	106.2	136.0	143.0	0.62	0.28	0.10	0.010	0.587	0.252
1998	17.2	116.6	0.79	106.2	136.0	143.0	0.64	0.27	0.09	0.010	0.560	0.212
1999	16.9	116.9	0.80	106.2	136.0	143.0	0.66	0.27	0.07	0.010	0.539	0.175
2000	17.6	117.2	0.85	107.1	151.9	159.4	0.68	0.26	0.06	0.060	0.788	0.201
2001	16.6	117.4	0.82	107.4	150.2	158.1	0.67	0.27	0.06	0.069	0.752	0.183
2002	16.4	117.6	0.82	107.6	148.4	156.8	0.66	0.28	0.06	0.080	0.748	0.174
2003	16.2	117.7	0.82	107.9	146.7	155.5	0.65	0.29	0.06	0.090	0.743	0.166
2004	16.5	117.8	0.84	108.1	144.9	154.2	0.64	0.31	0.05	0.102	0.754	0.162
2005	16.6	117.8	0.85	108.4	143.2	152.9	0.63	0.32	0.05	0.114	0.758	0.157
2006	16.9	117.8	0.86	109.5	140.6	154.0	0.63	0.32	0.06	0.165	0.723	0.169
2007	17.2	117.7	0.87	110.5	138.0	155.1	0.63	0.31	0.06	0.218	0.688	0.183
2008	17.7	117.5	0.88	111.6	135.5	156.2	0.63	0.31	0.06	0.275	0.657	0.199
2009	18.0	117.4	0.89	112.6	132.9	157.3	0.62	0.31	0.06	0.331	0.615	0.214
2010	17.9	117.1	0.86	113.7	130.3	158.4	0.62	0.31	0.07	0.379	0.557	0.224
2011	17.8	116.8	0.84	113.6	128.2	151.7	0.61	0.33	0.07	0.361	0.537	0.203
2012	19.2	116.4	0.87	113.4	126.2	145.0	0.59	0.34	0.07	0.372	0.556	0.195
2013	18.3	116.0	0.80	113.3	124.1	138.4	0.57	0.36	0.07	0.338	0.501	0.160
2014	18.8	115.5	0.78	113.1	122.1	131.7	0.56	0.37	0.07	0.330	0.480	0.136
2015	17.5	115.0	0.69	113.0	120.0	125.0	0.54	0.39	0.07	0.293	0.410	0.098
2016	18.3	114.5	0.69	113.0	117.4	126.6	0.53	0.40	0.07	0.300	0.362	0.117
2017	18.3	113.3	0.59	113.1	114.7	128.2	0.51	0.41	0.08	0.293	0.287	0.132
2018	15.4	113.9	0.54	113.1	112.1	129.7	0.50	0.42	0.08	0.240	0.174	0.124
2019	14.6	113.9	0.51	113.2	109.4	131.3	0.48	0.43	0.09	0.223	0.097	0.132
2020	11.8	111.2	0.28	113.2	106.8	132.9	0.47	0.44	0.09	0.177	0.019	0.119
2021	10.5	110.4	0.21	113.2	106.8	132.9	0.44	0.41	0.15	0.147	0.016	0.165
1980-2015	724.3		23.8	Missing females by birth order: summed					**1980-2015**	2.9	14.3	6.6
2016-2021	88.9		2.8	and raked back to match totals implied by					2016-2021	1.2	0.9	0.7
1980-2021	813.1		26.6	overall sex ratios at birth (in millions)					1980-2021	4.1	15.2	7.3
Sources:							Percent distributions		**1980-2015**	12.1%	60.0%	27.9%
*UN World Population Prospects 2024							of missing females		2016-2021	44.2%	30.6%	25.3%
**Birth order data for key years (interpolations in between) :							by birth order		1980-2021	15.5%	56.9%	27.6%
1982, 1990, 2000, 2005, 2010 - Jiang et al. (2017)												
2015 - Attane (2022)												
2020 - Published Census Results												
2021 - Du (2023)												

Figure 4. China's Missing Female Births by Birth Order in the Era of One-Child Limits, Cumulated 1980-2015



Note - For details on calculations, see text.
Sources - see Table 3.