Below Replacement Fertility and Other Post-Transitional Aspects:
Are There Microeconomic and Economic Growth Implications?

Eduardo L.G. Rios-Neto – Universidade Federal de Ouro Preto (UFOP) and Cedeplar/UFMG

The classic demographic transition regarding micro-level fertility determination and economic growth is central to the economic demography field. Other micro-level economic models are being developed to explain the post-transitional context in developed and middle-income countries. The question remains whether these post-transitional micro-level demographic aspects bear macroeconomic growth implications. This paper will briefly review the micro-macro context of economic demography in the demographic transition to prepare for evaluating this context in the post-demographic transition period. The final paper will add evidence.

- The Demographic Transition: Fertility Decline

In "A Treatise on the Family," Becker (1981) suggests that his theory improves the Malthusian formulation regarding fertility. In broad terms, the improvement is related to a change between a positive income effect in the birth rate (Malthus´ preventive check) and the proposed negative income effect advocated by Becker due to the trade-off between child quantity and quality. Notice that Malthus´ preventive check was a macro-level formulation related to norms and the marriage pattern, while Becker´s formulation had a micro foundation towards the demand for children. In any case, the change in the income effect signal matters in defining the improvement.

Economists care about the micro-fertility transition because it affects their economic growth models. The Malthusian model posits that population growth is self-equilibrating in the absence of technological changes or increases in resource availability. According to the model, any rise in available resources would be offset by a corresponding increase in population size associated with the positive income-fertility relationship, leaving the standard of living unchanged over time. The modern era employs constant-returns-to-scale technology with labor and capital inputs. Initially, only Malthus technology was employed due to a small stock of usable knowledge, rendering the Solow production process unprofitable. As usable knowledge grows, allocating labor and capital to Solow´s technology becomes profitable. This transition diminishes the influence of population growth on per capita income growth, leading to improved living standards. Ultimately, the economy transitions to a standard Solow growth model, exhibiting features of modern industrial economies. This transition is discussed in several papers, such as Becker et al. (1990), Galor and Weil (2000), and Hansen and Prescott (2002).

The demographic transition is a pivotal element in modern growth theories. It marks the shift from a Malthusian regime, characterized by high fertility and mortality rates, to a regime of sustained economic growth with low fertility and mortality rates. This transition is driven by technological progress and human capital accumulation. The relationship between income and population growth changes as the demographic transition progresses. Initially, higher income leads to higher population growth (Malthusian regime), but eventually, higher income results in lower population growth due to increased investments in human capital and reduced fertility rates (modern growth regime). Both Galor and Weil's (2000) and Becker et al.'s (1990) models emphasize the crucial role of human capital in economic development and the transition from stagnant to sustained growth. In Galor and Weil (2000), the transition from the Malthusian regime to the modern growth regime is driven by technological progress, which enhances the returns on human capital investment and induces a demographic transition. Similarly, Becker et al. (1990) propose that as the stock of human capital increases, the rates of return on human

capital rise, leading to multiple steady states. These steady states include a Malthusian equilibrium, with high fertility and low human capital, and a developed equilibrium, with low fertility and high human capital. Both models also incorporate endogenous fertility, recognizing economic incentives and returns on investment in human capital influence decisions regarding family size.

Galor (2012) thoroughly reviews the demographic transition, identifying key factors such as technological progress, increased income, and improved public health as primary drivers of the transition from high to low fertility and mortality rates. He argues that the demographic transition is crucial for accumulating human capital. Galor (2011) provides a unified framework for growth theory that summarizes the crucial role of the demographic transition in this critical area of economic theory.

- Economists, below replacement fertility and post-transitional aspects

When the demographic transition has been completed in a country, fertility is at or below the replacement level; the main question is to speculate about the extent to which economists remain interested in demography. An apparent positive answer is associated with the mostly negative consequences of low fertility: population aging with a growing dependency ratio, issues regarding aging and productivity, aging and government expenditures, international migration with implications for growth and government expenditures, etc. The question we intend to answer here is the one associated with the facts related to the post-transition demographic dynamics: low fertility, postponement of childbearing, childlessness, cohabitation, diverse family arrangements, diversity in gender identities, etc.

Doepke et al. (2023) discuss how these changes are partly driven by advancements in female education and employment opportunities, leading to more egalitarian household gender roles. Their analysis shows that spending patterns shift as women gain more control over household resources and decision-making, particularly toward investments in children's human capital. They analyze the post-transition demographic dynamics, introducing key concepts. Fertility decisions now include two aspects: extensive and intensive margins—an extensive margin regards childlessness, which means the decision to have children or not, while the intensive margin regards how many children you will have if you decide to have children. Increasing childlessness is now linked to changes in social and economic factors. Women's education has become a key variable with changing signals compared to those expected in the classic demographic transition.

Culture plays a significant role in family arrangements and cultural norms. They are pivotal in shaping fertility decisions. In countries like South Korea, where there is a strong cultural emphasis on education and social status, fertility rates are among the lowest in the world. Kim et al. (2024) discuss how status externalities in education contribute to low birth rates in Korea, where parents' competition over educational outcomes for their children leads to high costs associated with child-rearing, thus discouraging larger families. The cultural context, particularly in East Asian countries, reinforces traditional gender roles that further complicate the balancing act between career and family life.

Voluntary and involuntary childlessness is a growing phenomenon in many developed countries, influenced by socio-economic factors and cultural norms. The concept of voluntary childlessness, particularly in highly educated women, is driven by the high opportunity costs associated with having children. Siuda (2024) provides a dynamic model of fertility that explores how economic conditions and the timing of fertility decisions contribute to childlessness. As women delay childbearing to pursue higher education and career opportunities, the likelihood of remaining childless increases, particularly as fecundity declines with age. The empirical findings in the paper show that in Germany, voluntary childlessness accounts for a significant

portion of overall childlessness, influenced by the postponement of childbearing due to career aspirations. In Germany, the trend of delayed childbearing and increasing childlessness is prevalent. The paper indicates that these trends are strongly associated with higher levels of female education and labor market participation. Childlessness increases due to the opportunity costs of childbearing, combined with social policies that may not fully support work-family balance.

Another dimension of childlessness is suggested by Baudin et al. (2018) to add a new aspect associated with two essential types of childlessness: “opportunity-driven” and “poverty-driven.” Opportunity-driven arises due to high opportunity costs among highly educated women who forgo having children. Poverty-driven affects low-educated women, and it is caused by economic hardships associated with malnutrition, lack of healthcare, and poor living conditions. These two types of childlessness may explain the U-shaped relationship between childlessness and education, with low education being poverty-driven and high education being opportunity-driven. A similar dichotomy is presented in the analysis of the postponement of childbearing in Europe by d’Albis et al. (2017). Birth postponement is common in Europe, with an increase in the mean age at first birth between 1970 and 2010. While there is a positive gradient between education and age at first birth, this gradient has declined in recent cohorts. Economic uncertainty is another factor affecting the timing of childbearing, but results are ambiguous (unemployment delays childbearing in some studies but not in others).

Bar et al. (2017) try to explain the reversal of the classic negative income fertility pattern to a U-shaped pattern with an emphasis on unequal societies where there is the possibility of “marketization,” which is defined as the process of outsourcing home production tasks such as childcare, thus influencing fertility among higher-income women. Hazan et al. (2021) follow the “marketization” line along with the extensive and intensive margins of fertility discussed above. In the US case, using the CPS survey from 1980 to 2000, the authors found the convergence of fertility with closing the fertility gap between low and high-educated women. The reduction in childcare costs explains 11,9% of the increase in the number of children ever born among highly educated women. The analysis of “marketization” on the extensive margin shows a decline in childlessness rates among women with advanced degrees. The decrease in childcare costs relative to wages can account for 16.1% of the decline in childlessness. The analysis in the intensive margin indicates an increase in the number of children among mothers with advanced degrees over time. The reduction in childcare costs explains 6.6% of the rise. The U-shape hypothesis here is different from the one associated with childlessness and described in the previous paragraph. Bailey et al. (2014) compare the post-1960 fertility decline with earlier declines in the 20th century in the US to evaluate the validity of the “second demographic transition,” marked by fertility below replacement levels, and changes in family structures, delayed marriage, increased cohabitation. The empirical evidence is mixed. Low fertility well below the replacement level is not found in the US; evidence shows a significant convergence around having two children and reduced childlessness post-1960. Non-marital cohabitation increased, leading to the decoupling of marriage and motherhood, and higher education levels led to delayed household formation and motherhood. A bimodal pattern of age at first birth among more recent cohorts of women suggests a differential role of education in the postponement of childbearing. Non-marital cohabitation and childbearing also rise after 1960. These findings align with the second demographic transition. The US case is marked by growing economic inequality among children and delays in marriage and motherhood associated with class-based differences in children's resources and opportunities.

- Economic consequences of below-replacement fertility and post-transition

The economic growth literature stresses the role of factors (capital, labor, and human capital) and the total factor productivity (TFP). In the post-transition period, most of the growth literature refers to gender issues and rising female labor force participation, and the other trends are less emphasized. Fluchtmann et al. (2024) analyze how past trends in gender equality impacted economic growth and its future potential. The impact of gender equality is evaluated in terms of increased labor force participation and higher productivity using growth accounting (to measure past contributions) and the OECD Long-Term Model (to make projections). Previous literature on gender equality and economic growth stressed the positive impacts of increased female labor force participation and the role of barriers to women´s full economic potential. Women´s employment rates increased by 11 percentage points between 2000 and 2022, reducing the gender employment gap from 18 to 11 percentage points. Decomposing GDP´s per capita growth, female employment added 0.37 percentage points to annual growth, and men´s employment added 0.14 percentage points. The working-age share of the population led to -0.16 percentage points and labor productivity to 1.73 percentage points. Gender equality significantly contributes to economic growth, and substantial gains will be made from closing gender gaps by 2060. In the context of a substantial increase in Female Labor Force Participation (FLFP) in the late 20th century, Baerlocher et al. (2021) examined the channels through which increased FLFP affects national development. FLFP may raise a nation´s living standard through higher labor input and aggregate output, increased capital per capita, and improved total factor productivity. They found a positive and statistically significant effect of FLFP growth on economic growth, a positive effect but not a statistically significant effect of initial FLFP, and no evidence of secondary effects through education or population growth.

Doepke et al. (2023) and Doepke and Tertilt (2016) suggest several implications for economic growth derived from the demographic transformations post-transition associated with female empowerment. The authors analyze how shifts in gender roles, family dynamics, and fertility patterns can influence economic outcomes. There are four critical implications. First, female empowerment impacts human capital investment, as women´s gain of control over household resources increases the allocation of children´s education and health. This is relevant in economies where human capital is a significant driver of economic growth. Second, increased female empowerment may reduce overall household savings as more resources flow to the immediate consumption of children. Reduced savings might lead to lower capital accumulation, slowing growth in those economies that rely heavily on physical capital investments. Third, declining fertility and increased female labor force participation directly affect economic growth. Lower fertility rates for a long time will lead to a declining working-age population. Immediately after the fertility decline, the demographic dividend may be observed. Still, higher participation from the female labor force may offset this impact. Fourth, the capital composition of the countries' economies (more dependent on human capital or physical capital) makes the economic consequences of the demographic trends different. While low fertility leads to challenges like population aging and shifts in government expenditures, the broader implications of post-transition dynamics, such as delayed childbearing, increased female labor participation, and evolving gender roles, are also significant. Doepke et al. (2023) discuss how these shifts, driven by female empowerment and changing family dynamics, influence economic outcomes, particularly in human capital investment and savings patterns. If assessing the role of FLFP on economic growth is well documented, the impact of gender and other post-transition demographic trends in total factor productivity (TFP) or technological progress at large is still due.

Jones (2023) provides an outlook on long-term economic growth. Using a stylized model, income per capita is directly linked to the total number of ideas, which depends on the number of researchers, proportional to a country's population size. Some recent stylized facts in advanced economies are the slowing pace of total factor productivity (TFP), stagnating educational attainment, the need for more researchers to sustain the same level of innovation, and slowing population growth.

Population growth becomes the dominant factor in the long run, implying that slowing or negative population growth could severely slow economic growth. These factors could be counteracted by the role of emerging economies (China and India), the global circulation of talents (including the participation of women and minorities in innovation), and artificial intelligence (AI) that may substitute for human researchers. As global population growth starts to decline, the circulation of talent is challenged. Jones (2022a) shows that the observation of negative population growth leads to a stagnation in the stock of knowledge and living standards, which is named the "Empty Planet" by the author. In an alternative model with endogenous population growth, multi-equilibrium outcomes are generated, one of which is still the "Empty Planet." Optimal population strategies may create an escape from an "Empty Planet" with timely population growth and human capital accumulation strategies that would generate an "Expanding Cosmos" steady state.

- Final Remarks

Post-transitional demographic outcomes bear potential economic implications that must be better understood. The role of factor accumulation in economic growth is reaching a limit with a ceiling in educational attainment and the possible exhaustion of increased female labor force participation. Changes in TFP due to gender equality and other post-transitional demographic outcomes are a possibility far from being proved. The general decline in population growth and eventual decrease in population size announces a possible future of economic stagnation. This could be counteracted by artificial intelligence and automatization, but the potential modeling of these aspects interacting with the population dynamics is part of the future agenda.

References:

Baerlocher, Diogo, Parente, Stephen L., and Rios-Neto, Eduardo. 2021. "Female Labor Force Participation and Economic Growth: Accounting for the Gender Bonus." ***Journal: Economics Letters***, Elsevier, B.V.

Bailey, Martha, Melanie Guldi, and Brad J. Heshbein. 2014. "Is there a case for the 'Second Demographic Transition'? Three distinctive features of the post-1960 US fertility decline." In Leah Platt Boustan, Carola Frydman, and Robert A. Margo, editors. ***Human Capital History: The American Record***, University of Chicago Press.

Bar, Michael, Moshe Hazan, Oksana Leukhina, David Weiss and Hosny Zoabi. 2017. "Inequality and the changing role of differential fertility," ***discussion paper N. 17.03, The Maurice Falk Institute for Economic Research in Israel Ltd.*** The Hebrew University, August.

Baudin, T., David de la Croix, and P. Gobbi. (2018). "Endogenous Childlessness and Stages of Development." ***Journal of the European Economic Association***, 00(0), 1-59. https://doi.org/10.1093/jeea/jvy042

Baudin, T., David de la Croix, and P. Gobbi. (2018). "Endogenous Childlessness and Stages of Development." ***Journal of the European Economic Association***, 00(0), 1-59. https://doi.org/10.1093/jeea/jvy042

Becker, G. 1981. "The demand for children". In: Becker, G. ***A Treatise on the Family***. Cap.5, p. 93-112. Boston: Harvard University Press.

Becker, G.S., Murphy, K.M., Tamura, R. 1990 “Human Capital, Fertility and Economic Growth”. ***Journal of Political Economy*** 98: S12–S37

d’Albis, Hippolyte, Angela Greulich, and Grégory Ponthière. 2017. “Education, Labour, and the Demographic Consequences of Birth Postponement in Europe.” ***Demographic Research***, Volume 36, Article 23.

Doepke, Matthias and Tertilt, Michèle. 2016. “Families in Macroeconomics”. *IZA DP* No. 9802, March.

Doepke, Matthias, Hannusch, Anne, Kindermann, Fabian, and Tertilt, Michèle. 2022. "The Economics of Fertility: A New Era." IZA DP No. 15224, April.

Doepke, Matthias, Hannusch, Anne, Kindermann, Fabian, and Tertilt, Michèle. 2023. "The Economics of Fertility: A New Era". Chapter in ***Handbook of the Economics of the Family***, Vol. 1, 151-254, edited by Shelly Lundberg and Alessandra Voena, Elsevier B.V., March.

Fluchtmann, Jonas, Keese, Mark, and Adema, Willem. 2024. “Gender Equality and Economic Growth: Past Progress and Future Potential.” ***OECD Social, Employment and Migration Working Papers***, No. 304, March.

Galor, Oded and Weil, David N. 2000. "From Malthusian Stagnation to Demographic Transition.” ***American Economic Review,*** V. 90 (4), pp. 806-828.

Galor, Oded. 2011. ***Unified Growth Theory***. Princeton University Press.

Galor, Oded. 2012. “The Demographic Transition: Causes and Consequences.” ***Cliometrica*** (Berl). 2012 Jan; 6(1): 1–28.

Hansen, Gary D. and Prescott, Edward C. 2002. “Malthus to Solow.” ***American Economic Review***, 92, 1205-1217.

Hazan, Moshe, David Weiss, and Hosny Zoabi. 2021. “Marketization and the fertility of highly educated women along the extensive and intensive margins.” ***Discussion Paper***, No. 12-2021, The Pinchas Sapir Center for Development, Tel Aviv University.

Kim, Seongeun, Tertilt, Michèle, and Yum, Minchul. 2024. “Status Externalities in Education and Low Birth Rates in Korea,” ***The American Economic Review***, Vol. 114 (6), 1576-1611, June 2024.

Jones, Charles I. 2022a. “The End of Economic Growth? Unintended Consequences of a Declining Population?” ***American Economic Review.***

Jones, Charles I. 2023. “The Outlook for Long-Term Economic Growth”. ***NBER Working Paper***, No. 31648, August.

Siuda, F. (2024). “Childlessness and Inter-Temporal Fertility Choice.” Vienna University of Economics and Business, ***IFO Institute***, Vienna.