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Gender Inequality, Social Capital, and Economic Growth in Turkey

CAMA Working Paper 57/2022
September 2022

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Keywords

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JEL Classification

J16, O41

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ISSN 2206-0332

Gender Inequality, Social Capital, and Economic Growth in Turkey*

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First complete version: September 15^{th}, 2022
This version: September 24^{th}, 2022

Abstract

Although sociologists have already recognised the gender aspect of social capital, to date it has not yet been systematically investigated in an endogenous growth model. In pursuing this objective theoretically, we draw on Agénor and Canuto (2015) that has offered a three-period (childhood, adulthood, and old age) gender-based Overlapping Generations (OLG) framework, but we explore a different mechanism through which social capital may explain gender equality and prospects for economic growth in Turkey. This paper contributes in several ways to understanding the pivotal role of social capital in the process of economic development. First, social capital gives individuals a great sense of community and feelings of pleasure, and therefore we consider social capital as a possible driving factor of labour productivity. Second, in our model setting, survival rate for adults is determined by the average social capital level of men and women because individuals who are less socially integrated are more likely to have high mortality rates than people with strong ties to their community. Third, we elucidate an important,

*The financial support from the British Council under the Newton Fund: Researcher Links Programme (Grant Number: RL TG 261697662) is gratefully acknowledged. We are grateful to seminar participants at the Department of Economics, University of Girona and Research Centre for Policy Design, Tohoku University for helpful comments on an earlier version of this paper.

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but understudied, trade-off between time allocated by women to market work and social capital-enhancing activities, and show that these two components of time allocation have opposite effects on intra-household bargaining power.

Keywords: Social capital; Three-period gender-based OLG model; Turkey
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1 Introduction

"Equality is not just the right thing to do. It's smart economics. How can an economy achieve full potential if it ignores, sidelines, or fails to invest in half its population" - Robert B. Zoellick (the Former President of the World Bank Group, Op-Ed: Empowering Women Power Nations, September 19, 2011)

Turkey has, in recent years, made remarkable progress in reducing poverty and tackling income inequality. Although Turkey has launced successful nation-wide campaigns and gender-sensitive programmes, and therefore has made tremendous progress in access to education at all levels and closing the gender gap in education, it still lags behind many countries in different aspects of gender equality.[1] This paper adds to the existing, but scant, growth literature that contributes in several ways to understanding the pivotal role of social capital in the process of economic development (e.g., Routledge and von Amsberg, 2003; Chou, 2006; Growiec and Growiec, 2012; Ponzetto and Troiano, 2014; Agénor and Dinh, 2015; Bofota et al., 2016; Alpaslan, 2017; Alpaslan and Yildirim, 2020). First of all, whilst sociologists (e.g., McPherson et al., 1982; Moore, 1990; O'Neill and Gidengil, 2006) have recognised the gender aspect of social capital, to date it has not yet been systematically investigated within the economics discipline, particularly in an endogenous growth model. In pursuing this objective theoretically, we draw on Agénor and Canuto (2015) that

[1] Following an 8-year basic education programme in 1997, a new education law for a 12-year compulsory education that was first implemented in 2012 and aimed particulary at keeping girls in school for a longer time, and the conditional cash transfer programme and the campaign "Hey Girls, Let's go to School" that were both initiated in 2003 may all serve as important policies that can indeed account for the achievement in closing the gender gap in education; the Ministry of Family and Social Services that has worked in cooperation with other ministries, Industry Development Organisation (KOSGEB), and Turkish Employment Agency (ISKUR) have also taken an active role in the battle against gender inequality (World Bank, 2012). Besides, these policies have been also supported by gender-sensitive campaigns, such as "Snowdrops", "Daddy, Send me to School", and "I have a daughter in Anatolia and she will be a teacher", which have been all successfully led by non-profit private entities and are still ongoing in attempting to achieve gender parity in education in Turkey (Cin and Walker, 2016; Cin, 2017).

has offered a three-period (childhood, adulthood, and old age) gender-based Overlapping Generations (OLG) framework, but we explore a different mechanism through which social capital may explain gender equality and prospects for economic growth in Turkey.

In line with the previous studies in the literature (e.g., Putnam, 1993 and 2000), social capital gives individuals a great sense of community and feelings of pleasure, and therefore we consider social capital as a possible driving factor of labour productivity. Social capital is intrinsically a sociological concept and the definitions of this term vary in the literature. Following Hanifan (1916) who first used the term "social capital", a growing body of literature has provided widely varying definitions of this term.[2] Regardless of its definition, all forms of social capital, for example *structural (institutional)* vs. *cognitive (relational)*, are, however, believed to complement one another and are essential for economic development (Chou, 2006). Given that social capital is a concept difficult to define precisely and has been therefore a matter of ongoing discussion among economists, we approach the "capital" aspect of the term "social capital" as in Routledge and von Amsberg (2003). Furthermore, a number of studies have been conducted to determine the possible effects of weak/strong social ties on mortality rates. For example, several studies for OECD countries (e.g., Mohan et al., 2005; Poortinga, 2006; Lofors and Sundquist, 2007; Sundquist and Yang, 2007; Olsen and Dahl, 2007) have documented that individuals with higher levels of social networks and/or social integration tend to live a longer and healthier life than their worse-off counterparts. Put it another way, individuals who are less socially integrated are more likely to have high mortality rates than people with strong ties to their community. In our model setting, survival rate for adults is therefore determined by the *average* social capital level of men and women.

[2] See, for instance, Jacobs (1961), Bourdieu, (1986), Coleman (1988 and 1990), Putnam (1993 and 1995), Fukuyama, (1995), Putterman (1995), Knack and Keefer, (1997), Putnam (2000), Dasgupta (2003), Durlauf and Fafchamps (2005), and Sabatini (2005).

We assume that both males and females face time constraints; however, males allocate their time mainly between market work and social capital-enhancing activities, whereas females allocate their time between market work, household chores (cooking, cleaning the house, doing laundry etc.), and child rearing due to social norms and values attached to females, which has been well-documented in the following section. In addition, women allocate their remaining time, if any exists, to social capital-enhancing activities, which is fundamental to diversifying their own social ties, and therefore to promoting their social capital level and productivity; this, however, plays a critical role in social and cognitive development of their children in early childhood, which in turn shapes their social capital accumulation and productivity at a later stage of life. By doing so, we also elucidate an important, but understudied, trade-off between time allocated by women to market work and social capital-enhancing activities, and these two components of time allocation have opposite effects on intra-household bargaining power, as shown later on in the model part. In other words, on the one hand, *all else being equal*, if women spend more time in market work at the cost of the time spent in social capital-creating activities, they would then earn higher income and contribute more to family income, and therefore have a more say on the allocation of family resources. This could, on the other hand, adversely affect not only their own social capital level, and therefore their productivity and capacity to generate more income, but also social capital of their children this is because they may have lower levels of social capital due to impoverished social networks and may not be able to pass this social capital onto children. Besides, considering the fact that women are doing the most of housework and child care, they may find it more difficult to devote time to social capital-enhancing activities. Put it differently, the more time women spend on household chores, child rearing, and market work, the less time they will spend taking part in social capital-enhancing activities. They may even find no time due to long working hours and heavy burden of domestic tasks, thereby giving up engaging in such activities though it is rewarding for themselves and their children, as discussed above.

Overall, this discussion consititutes a meaningful whole for many countries where gender stereotypes prevail but our country choice is, in particular, Turkey where social norms and gender roles are still quite dominant and discriminate against women although over the past decade discriminatory mentality or structure and its effects on life prospects for them have dramatically evolved in the country. Consequently, the gender aspect of social capital has been a long-neglected issue in the growth literature, albeit we believe that this paper is rich enough to fill this gap in the literature and provides a theoretical evidence for the persistence of gender inequality in Turkey.

The remaining part of the paper proceeds as follows: This paper first gives a brief overview of the current economic and social status of women in Turkey. In Section 3, we set up a three-period (childhood, adulthood and old age) gender-based OLG framework, which mainly allows for the gender aspect of social capital. The final section gives a brief summary and critique of the findings.

2 Background

Although significant socio-economic progress has been made over the last decade, progress toward gender equality has stalled, and therefore gender inequality has, in recent years, become a central issue for Turkey. Such that, the current economic and social status of women has heightened the need for improvements in national legislation and the principles of rights and opportunities between men and women. In recent years, Turkish authorities have therefore strengthened women's legal rights and launched gender-specific programmes in an attempt to improve women's participation in the labour market and female entrepreneurship. Nevertheless, gender inequalities still tend to persist and women's participation in the labour market has not yet reached the desired level.

Indeed, Turkey faces gender inequality across many aspects of life, such as economic participation and opportunity, educational attainment, and political empowerement; according to the global gender gap report by World Economic Forum (2022), Turkey's overall score is 0.639 on a scale and it ranks 124 out of 146 countries.[3] For example, the country has seen a large gender gap in labour force participation and has the lowest female labour force participation rate of any OECD country. It has been reported that in 2021, the labour force participation rate of Turkish women aged 15-64 is 37.3 percent in comparison with a male participation of 76.9 percent, which is well-below the OECD average of 64.8 percent.[4] Also, Turkish women are less likely than men to have a paid job in the labour market but they are more active in the informal sector. According to the latest statistics by ILO, 37.4 percent of women are employed in the informal sector.[5] Even though women are employed in the formal sector, they work very long hours and their average earnings are relatively lower than those of men. For example, the 2021 OECD statistics show that on average, women spend 40.5 hours per week on their main job when compared to the OECD average of 33.6 hours.[6] On the other hand, the rapid pace of urbanisation in Turkey has contributed to women spending more time in family and household chores, which dominates an average Turkish woman's life and also reflects the low participation rate of women in formal employment. In fact, household tasks are traditionally more likely to fall on women. OECD reports that Turkish women spend almost 4 hours per day on housework when compared to Turkish men who spend less than half an

[3] The Global Gender Gap Report was first published by the World Economic Forum in 2006. The Global Gender Gap Index is defined between 0 (the lowest possible score, inequality) and 1 (the highest possible score, equality). In 2006, the country was ranked 105^{th} in the world, with a score of 0.585.

[4] Available at https://stats.oecd.org/Index.aspx?DataSetCode=LFS_SEXAGE_I_R#, accessed on September 8^{th}, 2022.

[5] Available at https://ilostat.ilo.org/topics/informality/, accessed on September 8^{th}, 2022.

[6] Available at https://stats.oecd.org/Index.aspx?DataSetCode=AVE_HRS, accessed on September 8^{th}, 2022.

hour per day.[7] Besides, women in Turkey are not well presented at universities and in the civil service; even though they hold a position, the percentage of high-level positions to be reserved for them is somewhat lower than that of men. Despite the fact that Turkish women achieved political rights in 1934, ahead of many other countries, and its significant progress in the representation of women in the Grand National Assembly of Turkey, according to the latest gender gap report to which was referred earlier, Turkish women's participation in political life and representation or political decision-making ranks well below the global average, 112 out of 146 countries with a score of 0.123, and therefore still remains limited. All these aspects clearly show gender disparity in many spheres of life which reflects entrenched social norms and traditional gender stereotypes that the society dictates. That having been said, women's access to economic opportunities and jobs, which is believed to be the key to achieving gender equality, could increase total productive employment, thereby boosting economic growth and poverty reduction in Turkey.

3 The Model

Unless otherwise stated, we mainly draw upon Agénor and Canuto (2015) that has developed a three-period (childhood, adulthood, and old age) gender-based OLG model of endogenous growth. The model ties together the various theoretical strands in the growth literature and therefore its features will be further elaborated in the following sections: time allocation and utility, budget constraints, non-market work and market production, human capital, social capital, survival rate, bargaining power, government and market-clearing condition, and balanced growth equilibrium, respectively.

[7] Available at https://www.oecd.org/gender/data/OECD_1564_TUSupdatePortal.xlsx, accessed on September 8^{th}, 2022.

3.1 Time Allocation and Utility

Couples in adulthood produce n_t children, and parents can afford their children's consumption and any spending on schooling and health care. In additon, parents have no control over family gender allocation so they have an equal number of boys and girls. The amount of time that women spend in social capital-enhancing activities:

$$\varepsilon_t^{f,S} = 1 - \varepsilon_t^{f,P} - \varepsilon_t^{f,W} - n_t \varepsilon_t^{f,R}, \tag{1}$$

where $\varepsilon_t^{f,P}$ the time that women allocate to home production, $\varepsilon_t^{f,R} \in (0,1)$ the amount of time that mothers devote to child rearing, and therefore $n_t \varepsilon_t^{f,R}$ the total amount of time allocated to child rearing, and finally $\varepsilon_t^{f,W}$, the amount of time women spend in the market work.

However, as alluded earlier, because Turkish women bear the overwhelming brunt of household tasks and child rearing falls on their shoulder, men are assumed to spend a constant amount of time on market work, $\varepsilon^{m,W}$ and social capital-enhancing activities, $\varepsilon^{m,S}$.

Following the existing studies in the literature, the collective household utility function can be written as[8]:

$$U_t = \varkappa_t U_t^f + (1 - \varkappa_t) U_t^m, \tag{2}$$

where U^j is partner j's utility function and $\varkappa_t \in (0,1)$ is a weight that measures the wife's bargaining power in the household decision process.

For the purpose of our analysis, consumption of children is considered to be subsumed in the family's consumption.[9] However, we assume that the amount of time allocated to social capital-enhancing activities gives individuals feelings of pleasure and therefore such time is introduced as a preference into the utility function, which is

[8] See also Agénor and Alpaslan (2013) for further discussion.

[9] See also Agénor and Alpaslan (2013), Agénor and Agénor (2014), and Agénor (2017).

consistent with the ideas of Becker (1996) and Glaeser et al. (2000). The discounted utility function therefore takes the form:

$$U_t^j = \eta_C^j \ln c_t^{t-1} + \eta_Q \ln Q_t + \eta_N^j \ln n_t + \eta_E \ln(e_t^{m,C} + e_t^{f,C}) + \eta_S \ln \varepsilon_t^{f,S} + \frac{p^j}{1+\rho} \ln c_{t+1}^{t-1}, \quad (3)$$

where $j = f(female), m(male)$, c_t^{t-1} and c_{t+1}^{t-1} are the family's total consumption in adulthood and old age, respectively, Q_t the consumption and production of home goods, n_t the number of children that each couple produces, $e_t^{m,C}(e_t^{f,C})$ a unit of human capital of male children (female children), $\rho > 0$ a common discount rate, $p^j \in (0,1)$ constant probability of survival rate from adulthood to old age, η_C^j the relative preference for today's consumption, η_N^j the relative preference for the number of children, η_Q the family's relative preference for the home-produced good, and η_S the relative preference for social capital. In addition, $\eta_C^f < \eta_C^m$ which implies that women have less incentive than men to consume today but rather save more for the future[10], $\eta_N^f \leq \eta_N^m$; women have more incentive than men to have fewer children[11].

3.2 Budget Constraints

The family's budget constraints for period t and $t+1$ are given by

$$c_t^{t-1} + s_t = (1 - \theta_t^R n_t)(1-\tau) w_t^T, \quad (4)$$

$$c_{t+1}^{t-1} = (1 + r_{t+1}) s_t / p_t, \quad (5)$$

where $\tau \in (0,1)$ is the tax rate on wages, s_t savings, r_{t+1} the net rental rate of private capital.

θ_t^R is a weighted average of spending on children in total family income

$$\theta_t^R = \varkappa_t \theta^{f,R} + (1 - \varkappa_t)\theta^{m,R}, \quad (6)$$

[10] See also Thomas (1990), Quisumbing (2010), World Bank (2011), Doepke and Tertilt (2014), and Agénor (2017) for a detailed discussion.

[11] See, for instance, Prettner and Strulik (2017).

where $\theta^{f,R}$ and $\theta^{m,R}$ are male- and female-specific parameters for child spending.

In addition, p_t is a weighted average of survival rate

$$p_t = \omega p_t^m + (1-\omega)p_t^f, \tag{7}$$

where $\omega \in (0,1)$ is a relative weight of survival rate of males and females.

Finally, w_t^T is total gross wage income of the family, which can be defined as

$$w_t^T = e_t^{m,A}\varepsilon^{m,W} a_t^m w_t^m + e_t^{f,A}\varepsilon_t^{f,W} a_t^f w_t^f, \tag{8}$$

with $e_t^{m,A}(e_t^{f,A})$ a unit of human capital for males (females), $a_t^m(a_t^f)$ labour productivity of males (females), and $w_t^m(w_t^f)$ an effective market wage for males (females), per unit of time worked.

Both equations (4) and (5) yield the family's consolidated budget constraint:

$$c_t^{t-1} + \frac{p_t c_{t+1}^{t-1}}{1+r_{t+1}} = (1-\theta_t^R n_t)(1-\tau)w_t^T. \tag{9}$$

3.3 Non-Market Work and Market Production

As was pointed out in the introduction to this paper, in Turkey household tasks are traditionally more likely to fall on women, and therefore production for home use of goods is mainly composed of the amount of time that women devote to household chores[12]:

$$Q_t = (\varepsilon_t^{f,P})^{\pi^Q}, \tag{10}$$

where $\pi^Q \in (0,1)$.

Assuming constant returns to scale in private inputs and imperfect substitution between two categories of labour, the production function of individual firm i that

[12] Alternatively, in line with Agénor and Canuto (2015), home production would also be bound up with infrastructure services; this would not, however, apply to Turkey where basic infrastructure services (roads, electricity, water and sanitation, and so on) have been widely provided, we therefore disregard this issue.

produces a single nonstorable good:

$$Y_t^i = (A_t^m \varepsilon^{m,W} E_t^{m,A} N_t^{m,i})^\beta (A_t^f \varepsilon_t^{f,W} E_t^{f,A} N_t^{f,i})^\beta (K_t^{P,i})^{1-2\beta}, \tag{11}$$

where $\beta \in (0,1)$. $A_t^m \varepsilon^{m,W} E_t^{m,A} N_t^{m,i}$ and $A_t^f \varepsilon_t^{f,W} E_t^{f,A} N_t^{f,i}$ are male and female effective labour, respectively, and $K_t^{P,i}$ is private capital. For tractability, the output elasticity, β is the same for each category of labour: male and female.

A fraction $b \in (0,1)$ is, however, introduced to capture gender discrimination in the workplace; in other words, women are assumed to earn only a fraction of their marginal product. In fact, this idea has been also corroborated by previous published studies (e.g., Agénor, 2012, Chapter 5; Agénor and Agénor, 2014). Profit maximisation with respect to private inputs is then:

$$A_t^m \varepsilon^{m,W} E_t^{m,A} w_t^m = \frac{\beta Y_t^i}{N_t^{m,i}}, \quad A_t^f \varepsilon_t^{f,W} E_t^{f,A} w_t^f = b\frac{\beta Y_t^i}{N_t^{f,i}}, \quad r_t = (1-2\beta)\frac{Y_t^i}{K_t^{P,i}} - 1, \tag{12}$$

which yields

$$w_t^m = b(\frac{A_t^f \varepsilon_t^{f,W} E_t^{f,A}}{A_t^m \varepsilon^{m,W} E_t^{m,A}})w_t^f, \tag{13}$$

where an equal number of men and women in the population is assumed, that is, $N_t^{m,i} = N_t^{f,i}$.

Equation (11) then takes the form:

$$Y_t = \int_0^1 Y_t^i di = (\frac{A_t^m \varepsilon^{m,W} E_t^{m,A} N_t^m}{K_t^P})^\beta (\frac{A_t^f \varepsilon_t^{f,W} E_t^{f,A} N_t^f}{K_t^P})^\beta K_t^P, \tag{14}$$

where $K_t^P = K_t^{P,i}$ $\forall i$. And note that all the firms are identical and the number of firms is normalised to one.

3.4 Human Capital

Previous studies have reported that average government spending per child, $G_t^E / n_t 0.5 N_t$ is a determinant of human capital in childhood.[13] It is now well-established from

[13] See also Agénor and Alpaslan (2013), Agénor and Agénor (2014), Agénor and Dinh (2015), and Agénor (2017).

a variety of studies that a mother's human capital contributes to the production of human capital.[14] Also, the amount of time mothers spend in tutoring their children, $\varepsilon_t^{f,R}$ shapes human capital of children.[15] In so doing, mothers help children do their homework and develop the necessary learning skills, such as critical and creative thinking, which is vital for overcoming any challenge that they may face at any stage during school life.[16] This time is also fundamental to building a relationship of mutual trust between mother and child, and other values, which is an important factor that has considerable impact on social capital in childhood, as further discussed in the next section. However, gender discrimination in education still prevails in Turkey despite the significant progress at all levels of education, as discussed before. This is in particular evident in Eastern Turkey where gender roles are defined for males and females, and the society therefore attributes a more meaning to education of male children relative to female children (Cin and Walker, 2016; Cin, 2017). This observation is mainly due to the prevalence of child-gender discrimination and restrictions on women empowerment and participation in economic activities as a result of a reflection of social norms and cultural beliefs in such a closed society. Furthermore, the belief that sons would continue the bloodline and support parents in old age encourages parents to give much more attention to sons than daughters who are considered to contribute to the household of their husbands' parents when they are married, thereby creating an incentive for parents to allocate more rearing time to sons, as compared to daughters; this argument is, in fact, consistent with the so-called "old age security hypothesis" in the literature.[17] A fixed fraction of this time, $\chi^R \in (0, 1)$ is therefore allocated to male children and $1 - \chi^R$ to female ones due to a bias in

[14]See also Agénor (2011), Agénor (2012, Chapter 2), and Agénor and Alpaslan (2013).

[15]See also Agénor and Agénor (2014) and Agénor (2017).

[16]See, for instance, Bryant and Zick (1996) for further discussion.

[17]See, for instance, Raut (1990), Ehrlich and Lui (1991), and Morand (1999) for a more detailed discussion.

parental preferences toward male children.[18] For tractability, we assume constant returns to scale in government spending on education and a mother's human capital, human capital in childhood then takes the form:

$$e_t^{m,C} = (\frac{G_t^E}{n_t 0.5 N_t})^{\nu_1} (E_t^{f,A})^{1-\nu_1} (\chi^R \varepsilon_t^{f,R})^{\nu_2}, \tag{15}$$

$$e_t^{f,C} = (\frac{G_t^E}{n_t 0.5 N_t})^{\nu_1} (E_t^{f,A})^{1-\nu_1} [(1-\chi^R)\varepsilon_t^{f,R}]^{\nu_2}, \tag{16}$$

where $\nu_1 > 0$ and $\nu_2 \in (0,1)$.

Consequently, human capital in the second period of life is a function of human capital in childhood:

$$e_{t+1}^{j,A} = e_t^{j,C}, \tag{17}$$

where $j = f, m$.

Equations (15)-(17) yield:

$$\frac{e_{t+1}^{m,A}}{e_{t+1}^{f,A}} = \frac{e_t^{m,C}}{e_t^{f,C}} = (\frac{\chi^R}{1-\chi^R})^{\nu_2}. \tag{18}$$

The result in Equation (18) is in line with Agénor (2017) and shows that if mothers care more about education of male children, their human capital will be then relatively higher than that of female children.

Human capital is an underlying factor for social capital accumulation because not only does it help individuals improve and practice their civic skills and cognitive abilities that could encourage more associational involvement, but it also lowers the opportunity costs of engaging in civic activities (OECD, 2010). We will, therefore, move on now to consider social capital.

[18] See, for instance, Lundberg (2005) for further discussion on this point.

3.5 Social Capital

Social capital, which takes time to accumulate and depreciates over time as in human capital, has been commonly considered to be an important asset individuals can invest in and it is associated with the process of economic development (Alpaslan, 2017).[19] Several factors are, however, known to affect social capital in childhood. Recent studies (e.g., Agénor and Dinh, 2015; Alpaslan, 2017; Alpaslan and Yildirim, 2020) have shown that social capital is facilitated by average government spending on social capital-creating activities, G_t^S, which is, however, subject to congestion by the private capital stock, K_t^P[20]. This type of government spending is characterised by policy and programme interventions and/or initiatives, for instance, building more children's play areas and facilities that bring communities together, support for charities that allow for all kinds of civic cooperation, that could be socially beneficial and respond to societal needs to form and maintain social infrastructure.[21] Also, it has been suggested that social capital-creating activities in all its aspects can be done by both males and females; however, women who develop a different sort of social capital linked to non-market based organisations are often considered to play a more active role than men in building social ties and informal networks, and they have been therefore thought of as a key factor in the creation of social capital (Elson, 2002). Finally, the amount of time mothers spend with their children and responding to their daily basis needs will help children develop "attachment" security. This is especially true at times when children have strong negative emotions that need to be tolerated

[19] It has been established that there are three levels of social capital: *micro-level* social capital that develops as a result of the relationship between immediate family members and close friends/neighbours (*bonding* social capital) or between more distant friends and colleagues (*bridging* social capital); *meso-level* social capital refers to cooperation and coordination that may be *vertical* or *horizontal* within and among firms, and finally *macro-level* social capital involves "formalised institutional relationships and structures" that are considered to contribute to community well-being and to shape social infrastructure (Chou, 2006).

[20] The number of adults alive in period t is equal to the number of children per family born in $t-1$ (n_{t-1}) times the number of families in the previous period ($0.5N_{t-1}$).

[21] See, for instance, Scrivens and Smith (2013) for a detailed discussion.

or managed effectively and/or when life throws them a curveball, particularly in the early stages of childhood. In fact, in Bowlby's (1958) seminal work "attachment theory", the important role of parent-child attachment in children's development is discussed at great length, yet considering mothers are typically responsible for child rearing, which is the case in many countries including Turkey, they are identified as "psychic organisers".[22] In our model framework, a fixed fraction of this time, $\chi^R \in (0,1)$ is, however, allocated to male children and $1-\chi^R$ to female ones due to a bias in parental preferences toward male children, as discussed earlier. Social capital in childhood is then:

$$k_t^{m,C} = (\frac{G_t^S}{K_t^P})^{\kappa_1}(K_t^{f,A})^{\kappa_2}(\chi^R \varepsilon_t^{f,R})^{\kappa_3}, \tag{19}$$

$$k_t^{f,C} = (\frac{G_t^S}{K_t^P})^{\kappa_1}(K_t^{f,A})^{\kappa_2}[(1-\chi^R)\varepsilon_t^{f,R}]^{\kappa_3}, \tag{20}$$

where $\kappa_1 > 0$ and $\kappa_{2,3} \in (0,1)$.

Social capital in childhood and women's relative level of human capital exert a positive effect upon social capital in adulthood; however, social capital in the second period of life, $t+1$, is also determined by the amount of time both males and females allocate to creating and sustaining a strong social fabric that holds a community together through, for instance, self-help groups/organisations and good neighbourness:[23]

$$k_{t+1}^{m,A} = k_t^{m,C}(\frac{E_t^{f,A}}{E_t^{m,A}})^{\lambda_1}(\varepsilon^{m,S})^{\lambda_2}, \tag{21}$$

$$k_{t+1}^{f,A} = k_t^{f,C}(\frac{E_t^{f,A}}{E_t^{m,A}})^{\lambda_1}(\varepsilon_t^{f,S})^{\lambda_2}, \tag{22}$$

[22] See also Bowlby (1969 and 1988) for further discussion.

[23] Another example of social capital-creating activities is parental involvement in parent-teacher associations, which is believed to have a critical role in educational outcomes. Indeed, Grootaert et al. (2002) provide a solid evidence of the importance of parental involvement in such associations for Burkina Faso. However, this issue lies beyond the scope of this study and therefore has not been incorporated into our OLG framework.

where $\lambda_1 > 0$ and $\lambda_2 \in (0, 1)$.

In line with the evidence that has been reported earlier, social capital contributes to labour productivity but it is assumed to be subject to decreasing marginal returns:

$$a_{t+1}^j = (k_{t+1}^{j,A})^{\kappa_P}, \tag{23}$$

where $\kappa_P \in (0, 1)$.

3.6 Survival Rate

As was mentioned in the introduction, individuals who are less socially integrated are more likely to have high mortality rates than people with strong ties to their community; we therefore assume that survival rate from adulthood to old age depends on the *average* social capital of men and women:

$$p_t^j = p_M^j + \bar{p}^j \left(\frac{K_t^{j,A}}{1 + K_t^{j,A}}\right)^{\nu_S}, \tag{24}$$

where p_M^j is a minimum value, $\bar{p}^j$ is a shift parameter, $p_0^j = p_M^j$, $\lim_{K_t^{j,A} \to \infty} p_t^j = p_M + \bar{p}^j < 1$, $j = f, m$, and $\nu_S > 0$.

3.7 Bargaining Power

In reviewing the literature (e.g., Doss, 1996; Agarwal, 1997; Frankenberg and Thomas, 2003; Anderson and Eswaran, 2009; Angel-Urdinola and Wodon, 2010; Quisumbing, 2010; Doss, 2013), different variables, such as asset ownership, access to credit, and income-earning opportunities etc. have been found to be related to a woman's bargaining power within the household. We, however, consider the wage ratio as a determinant of the women's relative bargaining power:

$$\varkappa_t = \left(\frac{w_t^f}{w_t^m}\right)^{\mu_B}, \tag{25}$$

which can be rewritten using equation (13):

$$\varkappa_t = [b(\frac{A_t^m \varepsilon^{m,W} E_t^{m,A}}{A_t^f \varepsilon_t^{f,W} E_t^{f,A}})]^{\mu_B}, \tag{26}$$

where $\mu_B \geq 0$ measures the sensitivity of the endogenous component of bargaining power to the relative wage ratio.

Or explicitly, using equations (18) and (21)-(23), equation (26) takes the form:

$$\varkappa_t = [b(\frac{\varepsilon^{m,S}}{\varepsilon_t^{f,S}})^{\lambda_2}(\frac{\chi^R}{1-\chi^R})^{\kappa_3\kappa_P+\nu_2}(\frac{\varepsilon^{m,W}}{\varepsilon_t^{f,W}})]^{\mu_B}. \tag{27}$$

As can be seen from equation (27), the women's bargaining power can vary depending on relative levels of time allocation (by men and women) to social capital-enhancing activities and market work, both of which have, however, the opposite effect on the bargaining power, and the ratio of a fixed fraction of time allocation (by mothers) to sons to the remaining fixed fraction of time to daughters.

3.8 Government and Market-Clearing Condition

Assuming that the government levies a tax only on wage incomes of adult workers, its balanced budget is:

$$G_t = \sum G_t^h = \tau(w_t^m A_t^m \varepsilon^{m,W} E_t^{m,A} N_t^m + w_t^f A_t^f \varepsilon_t^{f,W} E_t^{f,A} N_t^f), \quad h = E, S, O \tag{28}$$

where education, G_t^E; social capital-enhancing activities, G_t^S and other items, G_t^O.

Shares of public spending are assumed to be constant fractions of government revenues:

$$G_t^h = \upsilon_h \tau(w_t^m A_t^m \varepsilon^{m,W} E_t^{m,A} N_t^m + w_t^f A_t^f \varepsilon_t^{f,W} E_t^{f,A} N_t^f), \quad h = E, S, O \tag{29}$$

where $\upsilon_h \in (0, 1)$ for all h.

Equations (28) and (29) give

$$\sum_h \upsilon_h = 1. \tag{30}$$

Or alternatively,

$$\upsilon_E + \upsilon_S + \upsilon_O = 1, \tag{31}$$

where full depreciation is assumed.

The asset-market clearing condition requires that

$$K_{t+1}^P = 0.5(N_t^m + N_t^f)s_t = N_t^f s_t, \tag{32}$$

where s_t is savings per family, $0.5(N_t^m + N_t^f)$ is the number of families, and $N_t^f = N_t^m$.

3.9 Balanced Growth Equilibrium

3.9.1 Definition and Solution of the Model

Definition 1: A *competitive equilibrium* in this economy is a sequence of prices $\{w_t^m, w_t^f, r_{t+1}\}_{t=0}^{\infty}$, allocations $\{c_t^{t-1}, c_{t+1}^{t-1}, s_{t+1}, \varepsilon_t^{f,S}, \varepsilon_t^{f,P}, \varepsilon_t^{f,R}\}_{t=0}^{\infty}$, physical capital stock $\{K_{t+1}^P\}_{t=0}^{\infty}$, human capital stocks $\{e_t^{m,C}, e_t^{f,C}, e_{t+1}^{m,A}, e_{t+1}^{f,A}\}_{t=0}^{\infty}$, social capital stocks $\{k_t^{m,C}, k_t^{f,C}, k_{t+1}^{m,A}, k_{t+1}^{f,A}\}_{t=0}^{\infty}$, a constant tax rate, and constant spending shares such that, given initial stock $K_0^P > 0$, $e_0^{m,A}, e_0^{f,A} > 0$ and $k_0^{m,A}, k_0^{f,A} > 0$, families maximise utility subject to their time and budget constraints, firms maximise profits, markets clear, and the government budget is balanced. In equilibrium, $e_t^{j,A} = E_t^{j,A}$, $k_t^{j,A} = K_t^{j,A}$, and $a_t^j = A_t^j$, for $j = f, m$.

Definition 2: A *balanced growth equilibrium* is a competitive equilibrium in which c_t^{t-1}, c_{t+1}^{t-1}, s_{t+1}, K_{t+1}^P, $e_t^{m,C}$, $e_t^{f,C}$, $e_{t+1}^{m,A}$, $e_{t+1}^{f,A}$, $k_t^{m,C}$, $k_t^{f,C}$, $k_{t+1}^{m,A}$, $k_{t+1}^{f,A}$ and Y_t grow at the constant, endogenous rate γ_Y, the rate of return on private capital r_{t+1} is constant, women's time allocation, $\varepsilon_t^{f,S}$, $\varepsilon_t^{f,P}$, $\varepsilon_t^{f,R}$, and bargaining power, $\varkappa_t$, are all constant.

From the solutions in Appendix A, we can see that

$$\varepsilon_t^{f,P} = \frac{\eta_Q \pi^Q (1-\sigma_t)}{\eta_C + (1-\sigma_t)(\eta_Q \pi^Q + \eta_S + \eta_E 2\nu_2)}, \tag{33}$$

$$\varepsilon_t^{f,S} = \eta_S (1-\sigma_t)\eta_C^{-1}, \tag{34}$$

$$\varepsilon_t^{f,R} = \frac{[1 - \frac{\eta_E 2\nu_2}{\eta_N} + \frac{\eta_C}{\eta_N(1-\sigma_t)}]\theta_t^R \eta_E 2\nu_2 (1-\sigma_t)(1-\varepsilon_t^{f,P})}{\eta_C(1-\eta_E 2\nu_2/\eta_N)[1 + (1-\sigma_t)\eta_C^{-1}(\eta_Q \pi^Q + \eta_S + \eta_E 2\nu_2)]}, \tag{35}$$

$$n_t = \frac{(1-\eta_E 2\nu_2/\eta_N)}{[1 - \frac{\eta_E 2\nu_2}{\eta_N} + \frac{\eta_C}{\eta_N(1-\sigma_t)}]\theta_t^R}, \tag{36}$$

where

$$\sigma_t = \frac{p_t}{(1+\rho)\eta_C + p_t} < 1, \tag{37}$$

together with the definition of a weighted average of survival rate, which can be recalled from equation (7),

$$p_t = \omega p_t^m + (1-\omega) p_t^f, \tag{38}$$

and recall

$$\eta_h = \varkappa_t \eta_h^f + (1-\varkappa_t)\eta_h^m = \eta_h^m + (\eta_h^f - \eta_h^m)\varkappa_t, \quad h = C, N \tag{39}$$

$$\theta_t^R = \varkappa_t \theta^{f,R} + (1-\varkappa_t)\theta^{m,R}. \tag{40}$$

From equations (35) and (36), we have

$$n_t \varepsilon_t^{f,R} = \frac{\eta_E 2\nu_2 (1-\sigma_t)(1-\varepsilon_t^{f,P})}{\eta_C[1 + (1-\sigma_t)\eta_C^{-1}(\eta_Q \pi^Q + \eta_S + \eta_E 2\nu_2)]}. \tag{41}$$

Let us recall from the time constraint equation (1)

$$\varepsilon_t^{f,S} = 1 - \varepsilon_t^{f,P} - \varepsilon_t^{f,W} - n_t \varepsilon_t^{f,R}. \tag{42}$$

As can be seen from Appendix A, we have a nonlinear system of two first-difference equations as follows

$$k_{t+1}^{f,A} = \Gamma_4 (k_t^{f,A})^{2\beta\kappa_1 + \kappa_2} (x_t^f)^{-2\beta\kappa_1} (\varepsilon_t^{f,W})^{\beta\kappa_1} (\varepsilon_t^{f,S})^{\lambda_2(1-\beta\kappa_P\kappa_1)} (\varepsilon_t^{f,R})^{\kappa_3}, \tag{43}$$

$$x_{t+1}^f = \Gamma_3 \sigma_t (1-\theta_t^R n_t) n_t^{-(1-\nu_1)} (x_t^f)^{(1-2\beta)(1-\nu_1)} (k_t^{f,A})^{\beta\kappa_P(1-\nu_1)} (\varepsilon_t^{f,W})^{\beta(1-\nu_1)} (\varepsilon_t^{f,S})^{-\beta\nu_2\kappa_P(1-\nu_1)} (\varepsilon_t^{f,R})^{-\nu_2}, \tag{44}$$

where $x_t^f = K_t^P / e_t^{f,A} N_t^f$ is defined as the private capital-female effective labour ratio, and

$$\Gamma_4 = \{\Gamma_1[\upsilon_S \tau(1+b)\beta]\}^{\kappa_1} (\chi^R)^{-\nu_2\lambda_1}(1-\chi^R)^{\nu_2\lambda_1+\kappa_3},$$

$$\Gamma_3 = \Gamma_2 \Gamma_1^{1-\nu_1},$$

$$\Gamma_2 = [\frac{b\beta\Phi}{(1-\chi^R)^{\nu_2} 0.5}][\upsilon_E \tau(1+b)\beta]^{-\nu_1},$$

$$\Gamma_1 = (\frac{\chi^R}{1-\chi^R})^{\beta(\nu_2+\kappa_3\kappa_P)}(\varepsilon^{m,W})^{\beta},$$

$$\Phi = (1-\tau)(b^{-1}+1).$$

The steady-state solutions (denoted by superscript "~" over each variable below) of equations (43) and (44), as well as the steady-state growth rate, as also shown in Appendix A, are given by:

$$\tilde{k}^{f,A} = \left\{\Gamma_4 (\tilde{x}^f)^{-2\beta\kappa_1} (\tilde{\varepsilon}^{f,W})^{\beta\kappa_1} (\tilde{\varepsilon}^{f,S})^{\lambda_2(1-\beta\kappa_P\kappa_1)} (\tilde{\varepsilon}^{f,R})^{\kappa_3}\right\}^{1/\Pi_1}, \tag{45}$$

$$\tilde{x}^f = \left\{\Gamma_3 \tilde{\sigma}(1-\tilde{\theta}^R \tilde{n})\tilde{n}^{-(1-\nu_1)} (\tilde{k}^{f,A})^{\beta\kappa_P(1-\nu_1)} (\tilde{\varepsilon}^{f,W})^{\beta(1-\nu_1)} (\tilde{\varepsilon}^{f,S})^{-\beta\nu_2\kappa_P(1-\nu_1)} (\tilde{\varepsilon}^{f,R})^{-\nu_2}\right\}^{1/\Pi_2}, \tag{46}$$

$$1+\gamma_Y = \Gamma_1 (\tilde{\varepsilon}^{f,W})^{\beta} (\tilde{\varepsilon}^{f,S})^{-\beta\nu_2\kappa_P} \frac{\beta\tilde{\sigma}(1-\tilde{\theta}^R \tilde{n})}{[(1-\tau)(1+b)]^{-1}} (\tilde{k}^{f,A})^{2\beta\kappa_P} (\tilde{x}^f)^{-2\beta}, \tag{47}$$

where

$$\Pi_1 = 1-(2\beta\kappa_1+\kappa_2),$$

$$\Pi_2 = 1-(1-2\beta)(1-\nu_1) > 0.$$

3.9.2 Stability of the Model

In order to assess if the dynamic system is stable, we first take the natural logs of the system of nonlinear difference equations and then write them in a 2 by 2 square matrix form. As can be seen from the solutions in Appendix B, the stability condition for the dynamic system holds, that is, $\Pi_1 = 1-(2\beta\kappa_1+\kappa_2) > 0$ where $2\beta\kappa_1+\kappa_2 < 1$, which can also be verified if the steady-state solution of the model is calibrated, as discussed in the next section.

4 Concluding Remarks

In this paper, the gender aspect of social capital has been studied in a three-period gender-based OLG model of endogenous growth by Agénor and Canuto (2015); however, we explored a different mechanism through which social capital may explain gender equality and prospects for economic growth in Turkey. This paper makes several noteworthy contributions to the existing growth literature.

First, social capital is considered as a possible driving factor of labour productivity because in line with the previous studies in the literature (e.g., Putnam, 1993 and 2000), social capital gives individuals a great sense of community and feelings of pleasure.

Second, unlike the previous studies in the literature, in our model setting, survival rate for adults is determined by the average social capital level of men and women because individuals with higher levels of social networks and/or social integration tend to live a longer and healthier life than their worse-off counterparts.

Third, we elucidate an important, but understudied, trade-off between time allocated by women to market work and social capital-enhancing activities, and show that these two components of time allocation have opposite effects on intra-household bargaining power. In other words, on the one hand, all else being equal, if women spend more time in market work at the cost of the time spent in social capital-creating activities, they would then earn higher income and contribute more to family income, and therefore have a more say on the allocation of family resources. This could, on the other hand, adversely affect not only their own social capital level, and therefore their productivity and capacity to generate more income, but also social capital of their children this is because they may have lower levels of social capital due to impoverished social networks and may not be able to pass this social capital onto children. In addition, considering the fact that women are doing the most of housework and child care, they may find it more difficult to devote time to social capital-enhancing activities. Put it differently, the more time women spend on household chores, child rearing, and market work, the less time they will spend taking part in social capital-enhancing activities. They may even find no time due to long working hours and heavy burden of domestic tasks, thereby giving up engaging in such activities though it is rewarding for themselves and their children.

In terms of directions for future research, a calibration exercise could also help us verify the stability of our theoretical model and provide an in-depth analysis of long-run impacts of gender-sensitive policies on economic growth in Turkey.

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Appendix A: Dynamic System and Steady-State Growth

Let us first consider the family's optimisation problem. Rearranging equation (3) in the form of a weighted sum of the two individual utility functions as in (2) yields

$$U_t = [\varkappa_t \eta_C^f + (1-\varkappa_t)\eta_C^m] \ln c_t^{t-1} + \eta_Q \ln Q_t + [\varkappa_t \eta_N^f + (1-\varkappa_t)\eta_N^m] \ln n_t \tag{A1}$$

$$+\eta_E \ln(e_t^{m,C} + e_t^{f,C}) + \eta_S \varepsilon_t^{f,S} + \frac{[\omega p_t^f + (1-\omega)p_t^m]}{1+\rho} \ln c_{t+1}^{t-1}.$$

We use the following expressions:

$$\eta_h = \varkappa_t \eta_h^f + (1-\varkappa_t)\eta_h^m = \eta_h^m + (\eta_h^f - \eta_h^m)\varkappa_t, \quad h = C, N$$

$$p_t = \omega p_t^f + (1-\omega)p_t^m = p_t^m + (p_t^f - p_t^m)\omega,$$

where $\eta_C^f < \eta_C^m$, $\eta_N^f < \eta_N^m$, as noted earlier in the text, and therefore

$$\frac{d\eta_C}{d\varkappa_t}, \frac{d\eta_N}{d\varkappa_t} < 0.$$

From equations (10), (15), and (16), the collective household utility function (A1) is then

$$U = \eta_C \ln c_t^{t-1} + \eta_Q \pi^Q \ln \varepsilon_t^{f,P} + \eta_N \ln n_t \tag{A2}$$

$$+\eta_E \left[\ln \left\{ (\frac{G_t^E}{n_t 0.5 N_t})^{\nu_1} (E_t^{f,A})^{1-\nu_1} (\chi^R \varepsilon_t^{f,R})^{\nu_2} \right\} + \ln \left\{ (\frac{G_t^E}{n_t 0.5 N_t})^{\nu_1} (E_t^{f,A})^{1-\nu_1} [(1-\chi^R)\varepsilon_t^{f,R}]^{\nu_2} \right\} \right]$$

$$+\eta_S \varepsilon_t^{f,S} + \frac{p}{1+\rho} \ln c_{t+1}^{t-1}.$$

Equation (13) can be rewritten for convenience

$$A_t^m E_t^{m,A} \varepsilon^{m,W} w_t^m = b^{-1} A_t^f E_t^{f,A} \varepsilon_t^{f,W} w_t^f, \tag{A3}$$

which can be substituted in (8) to give, noting that $e_t^{j,A} = E_t^{j,A}$ for $j = f, m$ in the equilibrium

$$w_t^T = a_t^m e_t^{m,A} \varepsilon^{m,W} w_t^m + a_t^f e_t^{f,A} \varepsilon_t^{f,W} w_t^f = (b^{-1}+1) a_t^f e_t^{f,A} \varepsilon_t^{f,W} w_t^f. \tag{A4}$$

Equations (1) and (A4) can be substituted in the budget constraint (9) to give

$$\frac{(1-\theta_t^R n_t)}{[(1-\tau)(b^{-1}+1)]^{-1}} a_t^f e_t^f (1 - \varepsilon_t^{f,P} - \varepsilon_t^{f,S} - \varepsilon_t^{f,R} n_t) w_t^f \tag{A5}$$

$$-c_t^{t-1} - \frac{c_{t+1}^{t-1}}{1+r_{t+1}} = 0.$$

Families maximise (A2) subject to (A5), with respect to c_t^{t-1}, c_{t+1}^{t-1}, $\varepsilon_t^{f,P}$, $\varepsilon_t^{f,R}$, $\varepsilon_t^{f,S}$, and n_t, together with $\varepsilon_t^{f,W}$ which is residually solved from (1). First-order conditions then yield the standard Euler equation

$$\eta_C \frac{c_{t+1}^{t-1}}{c_t^{t-1}} = \frac{1+r_{t+1}}{1+\rho}, \tag{A6}$$

together with

$$\frac{\eta_Q \pi^Q}{\varepsilon_t^{f,P}} = \frac{\eta_C(1-\theta_t^R n_t)}{c_t^{t-1}} \Phi a_t^f e_t^{f,A} w_t^f, \tag{A7}$$

$$\frac{\eta_E 2\nu_2}{\varepsilon_t^{f,R}} = \frac{\eta_C(1-\theta_t^R n_t)}{c_t^{t-1}} \Phi a_t^f e_t^{f,A} w_t^f n_t, \tag{A8}$$

$$\frac{\eta_S}{\varepsilon_t^{f,S}} = \frac{\eta_C(1-\theta_t^R n_t)}{c_t^{t-1}} \Phi a_t^f e_t^{f,A} w_t^f, \tag{A9}$$

$$\frac{\eta_N}{n_t} = \frac{\eta_C}{c_t^{t-1}} \Phi a_t^f e_t^{f,A} w_t^f [\theta_t^R \varepsilon_t^{f,W} + (1-\theta_t^R n_t)\varepsilon_t^{f,R}], \tag{A10}$$

where $\Phi = (1-\tau)(b^{-1}+1)$.

Substituting (A6) in the intertemporal budget constraint (A5) yields

$$c_t^{t-1} = [\frac{(1+\rho)\eta_C}{1+(1+\rho)\eta_C + p_t}](1-\theta_t^R n_t)\Phi a_t^f e_t^{f,A} \varepsilon_t^{f,W} w_t^f, \tag{A11}$$

which can be substituted into (4) to yield

$$s_t = \sigma_t (1-\theta_t^R n_t)\Phi a_t^f e_t^{f,A} \varepsilon_t^{f,W} w_t^f, \tag{A12}$$

where σ_t is the marginal propensity to save

$$\sigma_t = \frac{p_t}{(1+\rho)\eta_C + p_t} < 1. \tag{A13}$$

Substituting equation (A11) for c_t^{t-1} in (A7), (A8), and (A9) yields

$$\frac{\eta_Q \pi^Q}{\varepsilon_t^{f,P}} = \frac{\eta_C}{(1-\sigma_t)\varepsilon_t^{f,W}},$$

$$\frac{\eta_E 2\nu_2}{\varepsilon_t^{f,R}} = \frac{\eta_C n_t}{(1-\sigma_t)\varepsilon_t^{f,W}},$$
$$\frac{\eta_S}{\varepsilon_t^{f,S}} = \frac{\eta_C}{(1-\sigma_t)\varepsilon_t^{f,W}},$$

or equivalently

$$\varepsilon_t^{f,P} = \eta_Q \pi^Q (1-\sigma_t)\eta_C^{-1}\varepsilon_t^{f,W}, \tag{A14}$$
$$n_t\varepsilon_t^{f,R} = \eta_E 2\nu_2 (1-\sigma_t)\eta_C^{-1}\varepsilon_t^{f,W}, \tag{A15}$$
$$\varepsilon_t^{f,S} = \eta_S (1-\sigma_t)\eta_C^{-1}, \tag{A16}$$

From the time constraint equation (1), together with (A15) and (A16) to eliminate $n_t\varepsilon_t^{f,R}$ and $\varepsilon_t^{f,S}$,

$$\varepsilon_t^{f,W} = 1 - \varepsilon_t^{f,P} - \eta_S(1-\sigma_t)\eta_C^{-1}\varepsilon_t^{f,W} - \eta_E 2\nu_2(1-\sigma_t)\eta_C^{-1}\varepsilon_t^{f,W},$$

or equivalently

$$\varepsilon_t^{f,W} = \frac{1-\varepsilon_t^{f,P}}{1+(1-\sigma_t)\eta_C^{-1}(\eta_S + \eta_E 2\nu_2)}, \tag{A17}$$

which can be substituted in (A14) to give

$$\varepsilon_t^{f,P} = \frac{\eta_Q \pi^Q (1-\sigma_t)}{\eta_C + (1-\sigma_t)(\eta_Q\pi^Q + \eta_S + \eta_E 2\nu_2)}. \tag{A18}$$

Equation (A8) can be divided by equation (A10) to obtain n_t

$$\frac{\eta_E 2\nu_2 n_t}{\eta_N \varepsilon_t^{f,R}} = \frac{(1-\theta_t^R n_t)n_t}{\theta_t^R\varepsilon_t^{f,W} + (1-\theta_t^R n_t)\varepsilon_t^{f,R}},$$

or equivalently

$$\frac{\eta_E 2\nu_2}{\eta_N \varepsilon_t^{f,R}} = \frac{(1-\theta_t^R n_t)}{\theta_t^R\varepsilon_t^{f,W} + (1-\theta_t^R n_t)\varepsilon_t^{f,R}},$$

which can be rearranged to give

$$\frac{\eta_E 2\nu_2 \theta_t^R}{\eta_N}\left(\frac{\varepsilon_t^{f,W}}{\varepsilon_t^{f,R}}\right) = \left(1 - \frac{\eta_E 2\nu_2}{\eta_N}\right)(1-\theta_t^R n_t). \tag{A19}$$

From (A15), we have

$$\frac{\varepsilon_t^{f,W}}{\varepsilon_t^{f,R}} = \frac{\eta_C n_t}{\eta_E 2\kappa_2 (1-\sigma_t)},$$

which can be substituted in (A19)

$$\left\{\frac{\eta_C}{\eta_N(1-\sigma_t)} + (1 - \frac{\eta_E 2\nu_2}{\eta_N})\right\}\theta_t^R n_t = 1 - \frac{\eta_E 2\nu_2}{\eta_N},$$

or equivalently

$$n_t = \frac{(1-\eta_E 2\nu_2/\eta_N)}{[1 - \frac{\eta_E 2\nu_2}{\eta_N} + \frac{\eta_C}{\eta_N(1-\sigma_t)}]\theta_t^R}, \tag{A20}$$

where $(1-\eta_E 2\nu_2/\eta_N) > 0$ and therefore $(1-\eta_E 2\nu_2/\eta_N) + [\eta_C/\eta_N(1-\sigma_t)] > 0$ so that $n_t > 0$.

Equations (A17) and (A20) can be both substituted into equation (A15) to yield

$$\frac{(1-\eta_E 2\nu_2/\eta_N)}{[1 - \frac{\eta_E 2\nu_2}{\eta_N} + \frac{\eta_C}{\eta_N(1-\sigma_t)}]\theta_t^R}\varepsilon_t^{f,R} = \frac{\eta_E 2\nu_2(1-\sigma_t)\eta_C^{-1}(1-\varepsilon_t^{f,P})}{1+(1-\sigma_t)\eta_C^{-1}(\eta_Q\pi^Q + \eta_S + \eta_E 2\nu_2)},$$

which can be rearranged to give

$$\varepsilon_t^{f,R} = \frac{[1 - \frac{\eta_E 2\nu_2}{\eta_N} + \frac{\eta_C}{\eta_N(1-\sigma_t)}]\theta_t^R \eta_E 2\nu_2(1-\sigma_t)\eta_C^{-1}(1-\varepsilon_t^{f,P})}{(1-\eta_E 2\nu_2/\eta_N)[1+(1-\sigma_t)\eta_C^{-1}(\eta_Q\pi^Q + \eta_S + \eta_E 2\nu_2)]},$$

or equivalently

$$\varepsilon_t^{f,R} = \frac{[1 - \frac{\eta_E 2\nu_2}{\eta_N} + \frac{\eta_C}{\eta_N(1-\sigma_t)}]\theta_t^R \eta_E 2\nu_2(1-\sigma_t)(1-\varepsilon_t^{f,P})}{\eta_C(1-\eta_E 2\nu_2/\eta_N)[1+(1-\sigma_t)\eta_C^{-1}(\eta_Q\pi^Q + \eta_S + \eta_E 2\nu_2)]}. \tag{A21}$$

Substituting (A12) in (32) yields

$$K_{t+1}^P = N_t^f s_t = N_t^f \Phi\sigma_t(1-\theta_t^R n_t) a_t^f e_t^{f,A} \varepsilon_t^{f,W} w_t^f, \tag{A22}$$

Substituting for w_t^f from (12) in (A22) and rearranging this, noting that in equilibrium $e_t^{f,A} = E_t^{f,A}$ and $a_t^f = A_t^f$, yields

$$\frac{K_{t+1}^P}{K_t^P} = b\beta\Phi\sigma_t(1-\theta_t^R n_t)(\frac{Y_t}{K_t^P}). \tag{A23}$$

Equation (29) can be repeated here

$$G_t^h = \upsilon_h\tau(w_t^m A_t^m \varepsilon^{m,W} E_t^{m,A} N_t^m + w_t^f A_t^f \varepsilon_t^{f,W} E_t^{f,A} N_t^f),$$

which can be rewritten, using (A3) and noting that $N_t^m = N_t^f$, and in equilibrium $e_t^{j,A} = E_t^{j,A}$ and $a_t^j = A_t^j$ for $j = f, m$.

$$G_t^h = \upsilon_h \tau (b^{-1} + 1) a_t^f e_t^{f,A} \varepsilon_t^{f,W} w_t^f N_t^f. \tag{A24}$$

From equation (12), we can substitute w_t^f in (A24)

$$G_t^h = \upsilon_h \tau (1 + b) \beta Y_t. \tag{A25}$$

We repeat equation (14) here for convenience

$$\frac{Y_t}{K_t^P} = (\frac{E_t^{m,A} N_t^m}{K_t^P})^\beta (\frac{E_t^{f,A} N_t^f}{K_t^P})^\beta (\varepsilon^{m,W})^\beta (\varepsilon_t^{f,W})^\beta (A_t^m)^\beta (A_t^f)^\beta,$$

which can be rearranged to yield

$$\frac{Y_t}{K_t^P} = (\frac{1}{x_t^m})^\beta (\frac{1}{x_t^f})^\beta (\varepsilon^{m,W})^\beta (\varepsilon_t^{f,W})^\beta (A_t^m)^\beta (A_t^f)^\beta, \tag{A26}$$

where $x_t^j = K_t^P / e_t^{j,A} N_t^j$ is defined as the private capital-effective labour ratio for each gender, $j = f, m$.

From equation (18), we have

$$\frac{e_t^{m,A}}{e_t^{f,A}} = (\frac{\chi^R}{1 - \chi^R})^{\nu_2}. \tag{A27}$$

Private capital-male effective labour ratio, noting that $N_t^f = N_t^m$, is

$$x_t^m = \frac{K_t^P}{e_t^{m,A} N_t^m} = \frac{K_t^P}{e_t^{m,A} N_t^f} = \frac{K_t^P}{e_t^{f,A} N_t^f} (\frac{e_t^{f,A}}{e_t^{m,A}}),$$

which can be rearranged to give, using equation (A27),

$$x_t^m = x_t^f (\frac{1 - \chi^R}{\chi^R})^{\nu_2}. \tag{A28}$$

From equations (19)-(23), we also have

$$a_t^m = a_t^f [(\frac{\chi^R}{1 - \chi^R})^{\kappa_3} (\frac{\varepsilon^{m,S}}{\varepsilon_t^{f,S}})^{\lambda_2}]^{\kappa_P}. \tag{A29}$$

Substituting both equations (A28) and (A29) in (A26) yields

$$\frac{Y_t}{K_t^P} = \Gamma_1(\varepsilon_t^{f,W})^{\beta}(\varepsilon_t^{f,S})^{-\beta\lambda_2\kappa_P}(\frac{a_t^f}{x_t^f})^{2\beta}, \tag{A30}$$

where

$$\Gamma_1 = (\frac{\chi^R}{1-\chi^R})^{\beta(\nu_2+\kappa_3\kappa_P)}(\varepsilon^{m,W})^{\beta}.$$

Equation (A25) for $h = E$ can be rewritten in the form

$$\frac{G_t^h}{N_t} = \upsilon_h\tau(1+b)\beta(\frac{Y_t}{N_t}),$$

which can be substituted, together with (16), in (17) for $j = f$ to give

$$e_{t+1}^{f,A} = [\frac{\upsilon_E\tau(1+b)\beta}{n_t}]^{\nu_1}(\frac{Y_t}{0.5N_t})^{\nu_1}(E_t^{f,A})^{1-\nu_1}[(1-\chi^R)\varepsilon_t^{f,R}]^{\nu_2}. \tag{A31}$$

Using equations (A23) and (A31), the private capital-female effective labour ratio takes the form

$$x_{t+1}^f = \frac{K_{t+1}^P}{e_{t+1}^{f,A}N_{t+1}^f} = \Gamma_2\sigma_t(1-\theta_t^R n_t)(\frac{Y_t}{e_t^{f,A}0.5N_t})^{1-\nu_1}n_t^{-(1-\nu_1)}(\varepsilon_t^{f,R})^{-\nu_2}, \tag{A32}$$

where $e_t^{f,A} = E_t^{f,A}$ and $N_{t+1}^f = 0.5N_{t+1} = n_t 0.5N_t$, and

$$\Gamma_2 = [\frac{b\beta\Phi}{(1-\chi^R)^{\nu_2}0.5}][\upsilon_E\tau(1+b)\beta]^{-\nu_1}.$$

By definition, we have

$$\frac{Y_t}{e_t^{f,A}0.5N_t} = (\frac{Y_t}{K_t^P})x_t^f, \tag{A33}$$

Substituting (A30) in (A33) yields

$$\frac{Y_t}{e_t^{f,A}0.5N_t} = \Gamma_1(\varepsilon_t^{f,W})^{\beta}(\varepsilon_t^{f,S})^{-\beta\lambda_2\kappa_P}(a_t^f)^{\beta}(x_t^f)^{1-2\beta}.$$

which can be substituted, together with (23), in (A32) to give

$$x_{t+1}^f = \Gamma_3\sigma_t(1-\theta_t^R n_t)n_t^{-(1-\nu_1)}(k_t^{f,A})^{\beta\kappa_P(1-\nu_1)}(x_t^f)^{(1-2\beta)(1-\nu_1)}(\varepsilon_t^{f,W})^{\beta(1-\nu_1)}(\varepsilon_t^{f,S})^{-\beta\nu_2\kappa_P(1-\nu_1)}(\varepsilon_t^{f,R})^{-\nu_2}, \tag{A34}$$

where

$$\Gamma_3 = \Gamma_2 \Gamma_1^{1-\nu_1}.$$

Substituting (20) and (A27), noting that in equilibrium $e_t^{f,A} = E_t^{f,A}$, in (22) yields

$$k_{t+1}^{f,A} = (\frac{G_t^S}{K_t^P})^{\kappa_1} (K_t^{f,A})^{\kappa_2} [(1-\chi^R)\varepsilon_t^{f,R}]^{\kappa_3} (\frac{\chi^R}{1-\chi^R})^{-\nu_2\lambda_1} (\varepsilon_t^{f,S})^{\lambda_2}. \tag{A35}$$

Both sides of equation (A25) can be divided by K_t^P and rewritten for $h = S$ to yield

$$\frac{G_t^S}{K_t^P} = \upsilon_S \tau (1+b)\beta (\frac{Y_t}{K_t^P}),$$

which can be substituted in (A35) to give

$$k_{t+1}^{f,A} = [\upsilon_S \tau (1+b)\beta]^{\kappa_1} (\frac{Y_t}{K_t^P})^{\kappa_1} (K_t^{f,A})^{\kappa_2} [(1-\chi^R)\varepsilon_t^{f,R}]^{\kappa_3} (\frac{\chi^R}{1-\chi^R})^{-\nu_2\lambda_1} (\varepsilon_t^{f,S})^{\lambda_2}. \tag{A36}$$

Finally, equation (A30), together with (23), can be substituted in (A36) to yield

$$k_{t+1}^{f,A} = \{\Gamma_1[\upsilon_S \tau (1+b)\beta]\}^{\kappa_1} \, (\varepsilon_t^{f,W})^{\beta\kappa_1} (\varepsilon_t^{f,S})^{-\beta\lambda_2\kappa_P\kappa_1} (k_t^{f,A})^{2\beta\kappa_1} (x_t^f)^{-2\beta\kappa_1} (K_t^{f,A})^{\kappa_2}$$
$$[(1-\chi^R)\varepsilon_t^{f,R}]^{\kappa_3} (\frac{\chi^R}{1-\chi^R})^{-\nu_2\lambda_1} (\varepsilon_t^{f,S})^{\lambda_2}, \tag{A37}$$

which can be rearranged to give, noting that in equilibrium $k_t^{f,A} = K_t^{f,A}$,

$$k_{t+1}^{f,A} = \Gamma_4 (k_t^{f,A})^{2\beta\kappa_1+\kappa_2} (x_t^f)^{-2\beta\kappa_1} (\varepsilon_t^{f,W})^{\beta\kappa_1} (\varepsilon_t^{f,S})^{\lambda_2(1-\beta\kappa_P\kappa_1)} (\varepsilon_t^{f,R})^{\kappa_3}, \tag{A38}$$

where

$$\Gamma_4 = \{\Gamma_1[\upsilon_S \tau (1+b)\beta]\}^{\kappa_1} \, (\chi^R)^{-\nu_2\lambda_1} (1-\chi^R)^{\nu_2\lambda_1+\kappa_3}.$$

In addition, from equations (A34) and (A38), we have steady-state solutions for $\tilde{x}^f$ and $\tilde{k}^{f,A}$ which are both obtained when $\Delta k_{t+1}^{f,A} = \Delta x_{t+1}^f = 0$:

$$\tilde{k}^{f,A} = \left\{\Gamma_4 (\tilde{x}^f)^{-2\beta\kappa_1} (\tilde{\varepsilon}^{f,W})^{\beta\kappa_1} (\tilde{\varepsilon}^{f,S})^{\lambda_2(1-\beta\kappa_P\kappa_1)} (\tilde{\varepsilon}^{f,R})^{\kappa_3}\right\}^{1/\Pi_1}, \tag{A39}$$

$$\tilde{x}^f = \left\{\Gamma_3 \tilde{\sigma} (1-\tilde{\theta}^R \tilde{n}) \tilde{n}^{-(1-\nu_1)} (\tilde{k}^{f,A})^{\beta\kappa_P(1-\nu_1)} (\tilde{\varepsilon}^{f,W})^{\beta(1-\nu_1)} (\tilde{\varepsilon}^{f,S})^{-\beta\nu_2\kappa_P(1-\nu_1)} (\tilde{\varepsilon}^{f,R})^{-\nu_2}\right\}^{1/\Pi_2}, \tag{A40}$$

where

$$\Pi_1 = 1 - (2\beta\kappa_1 + \kappa_2),$$

$$\Pi_2 = 1 - (1 - 2\beta)(1 - \nu_1) > 0.$$

Equation (A30) can be rewritten for period $t+1$

$$Y_{t+1} = \Gamma_1(\varepsilon_{t+1}^{f,W})^{\beta}(\varepsilon_{t+1}^{f,S})^{-\beta\nu_2\kappa_P}(\frac{a_{t+1}^f}{x_{t+1}^f})^{2\beta}K_{t+1}^P. \tag{A41}$$

And then equation (A23) can be substituted in (A41) to yield

$$\frac{Y_{t+1}}{Y_t} = \Gamma_1(\varepsilon_{t+1}^{f,W})^{\beta}(\varepsilon_{t+1}^{f,S})^{-\beta\nu_2\kappa_P}(\frac{a_{t+1}^f}{x_{t+1}^f})^{2\beta}b\beta\Phi\sigma_t(1 - \theta_t^R n_t),$$

where $\Phi = (1 - \tau)(b^{-1} + 1)$.

As a final step, we substitute out for Φ, together with equation (23),

$$\frac{Y_{t+1}}{Y_t} = \Gamma_1(\varepsilon_{t+1}^{f,W})^{\beta}(\varepsilon_{t+1}^{f,S})^{-\beta\nu_2\kappa_P}\frac{\beta\tilde{\sigma}(1 - \tilde{\theta}^R\tilde{n})}{[(1-\tau)(1+b)]^{-1}}(k_{t+1}^{f,A})^{2\beta\kappa_P}(x_{t+1}^f)^{-2\beta},$$

which in the steady-state (denoted by superscript "$\sim$" over each variable) turns to

$$1 + \gamma_Y = \Gamma_1(\tilde{\varepsilon}^{f,W})^{\beta}(\tilde{\varepsilon}^{f,S})^{-\beta\nu_2\kappa_P}\frac{\beta\tilde{\sigma}(1 - \tilde{\theta}^R\tilde{n})}{[(1-\tau)(1+b)]^{-1}}(\tilde{k}^{f,A})^{2\beta\kappa_P}(\tilde{x}^f)^{-2\beta}. \tag{A42}$$

Appendix B: Stability of the Model

Following Azariadis (1993) and Galor (2006), we can verify whether or not the stability condition holds. From equations (A34) and (A38), we have a simultaneous system of nonlinear first-order difference equations, a logarithmic form of which can be written in a 2 by 2 square matrix form as follows, and let us call this matrix A:

$$\begin{bmatrix} \hat{k}^{f,A}_{t+1} \\ \hat{x}^{f}_{t+1} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \hat{k}^{f,A}_{t} \\ \hat{x}^{f}_{t} \end{bmatrix}, \tag{B1}$$

where

$$a_{11} = 2\beta\kappa_1 + \kappa_2 > 0,$$

$$a_{12} = -2\beta\kappa_1 < 0,$$

$$a_{21} = \beta\kappa_P(1-\nu_1) > 0,$$

$$a_{22} = (1-2\beta)(1-\nu_1) > 0.$$

The determinant of matrix A

$$\det(A) = a_{11}a_{22} - a_{12}a_{21} = (2\beta\kappa_1+\kappa_2)(1-2\beta)(1-\nu_1) + \beta\kappa_P(1-\nu_1)2\beta\kappa_1 > 0, \tag{B2}$$

whereas its trace is the sum of the diagonal elements

$$tr(A) = a_{11} + a_{22} = (2\beta\kappa_1 + \kappa_2) + (1-2\beta)(1-\nu_1) > 0. \tag{B3}$$

Let the scalar factor λ be the eigenvalue or characteristic root of matrix A, and the eigenvalues of this matrix are values of λ that satisfy the following equation:

$$\mid A - \lambda I \mid = 0,$$

where I is the 2 by 2 identity matrix, as shown below.

The characteristic polynomial of matrix A

$$\left| \begin{bmatrix} 2\beta\kappa_1 + \kappa_2 & -2\beta\kappa_1 \\ \beta\kappa_P(1-\nu_1) & (1-2\beta)(1-\nu_1) \end{bmatrix} - \lambda \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \right| = \begin{vmatrix} 2\beta\kappa_1 + \kappa_2 - \lambda & -2\beta\kappa_1 \\ \beta\kappa_P(1-\nu_1) & (1-2\beta)(1-\nu_1) - \lambda \end{vmatrix},$$

which can be re-arranged to give

$$\mid A - \lambda I \mid = (2\beta\kappa_1+\kappa_2)(1-2\beta)(1-\nu_1) + \beta\kappa_P(1-\nu_1)2\beta\kappa_1 - \left[(2\beta\kappa_1 + \kappa_2) + (1-2\beta)(1-\nu_1)\right]\lambda + \lambda^2, \tag{B4}$$

Using (B2) and (B3), equation (B4) can be written in a form:

$$| A - \lambda I |= \lambda^2 - \lambda tr(A) + \det(A). \tag{B5}$$

In addition, given that matrix A is a 2 by 2 matrix of complex numbers with eigenvalues λ_1 and λ_2, its trace is also the sum of all eigenvalues,

$$tr(A) = \sum_{i=1}^{2} \lambda_i = \lambda_1 + \lambda_2,$$

whereas the determinant of the matrix is the product of all its eigenvalues

$$\det(A) = \prod_{i=1}^{2} \lambda_i = \lambda_1 \lambda_2,$$

which ensures that as can be seen from (B2) and (B3), $\det(A) > 0$, implying that eigenvalues have the same sign, and $tr(A) > 0$, eigenvalues are both positive.

From (B5), the characteristic polynomial is therefore

$$p(-1) = 1 + tr(A) + \det(A) > 0.$$

However,

$$p(1) = 1 - tr(A) + \det(A) = 1 - [(2\beta\kappa_1 + \kappa_2) + (1 - 2\beta)(1 - \nu_1)]$$
$$+ [(2\beta\kappa_1 + \kappa_2)(1 - 2\beta)(1 - \nu_1) + \beta\kappa_P(1 - \nu_1)2\beta\kappa_1],$$

which can be re-arranged to give

$$p(1) = (1 - 2\beta\kappa_1 - \kappa_2)[1 - (1 - 2\beta)(1 - \nu_1)] + \beta\kappa_P(1 - \nu_1)2\beta\kappa_1.$$

If $1 - 2\beta\kappa_1 - \kappa_2 = \Pi_1 > 0$ where $a_{11} = 2\beta\kappa_1 + \kappa_2 < 1$, $p(1)$ will always hold because we know that $1 - (1 - 2\beta)(1 - \nu_1) = \Pi_2 > 0$, as alluded earlier, where $a_{22} = (1 - 2\beta)(1 - \nu_1) < 1$. Taken together, the steady-state is a sink.[24]

[24] See Azariadis (1993) for a detailed discussion.