THE EFFECTS OF PUBLIC SOCIAL INFRASTRUCTURE AND GENDER EQUALITY ON OUTPUT AND EMPLOYMENT: THE CASE OF SOUTH KOREA

Cem Oyvat, University of Greenwich
Özelm Onaran, University of Greenwich

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*Corresponding author email: c.oyvat@greenwich.ac.uk

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The Care Work and the Economy (CWE-GAM) Project strives to reduce gender gaps in economic outcomes and enhance gender equality by illuminating and properly valuing the broader economic and social contributions of caregivers and integrating care in macroeconomic policymaking toolkits. We work to provide policymakers, scholars, researchers and advocacy groups with gender-aware data, empirical evidence, and analytical tools needed to promote creative, gender-sensitive macroeconomic and social policy solutions. In this era of demographic shifts and economic change, innovative policy solutions to chronic public underinvestment in care provisioning and infrastructures and the constraints that care work places on women's life and employment choices are needed more than ever. Sustainable development requires gender-sensitive policy tools that integrate emerging understandings of care work and its connection with labor supply, and economic and welfare outcomes.

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THE AUTHOR TEAM

CEM OYVAT

Cem Oyvat is Lecturer in economics at the University of Greenwich. He received his PhD in Economics from University of Massachusetts – Amherst in 2014 with dissertation titled "Essays on the Evolution of Inequality". His research interests include development economics, macroeconomics, international economics, income distribution and political economy.

ÖZLEM ONARAN

Özlem Onaran is Professor of Economics at the University of Greenwich since 2012 and the director of the Greenwich Political Economy Research Centre. She is currently directing a project for the ESRC Rebuilding Macroeconomics Network on inequalities in income, wealth and gender and macroeconomic performance. She has directed research projects for the UN International Labour Organisation, UNCTAD, the Institute for New Economic Thinking, the Foundation of European Progressive Studies, New Economics Foundation and Unions21. She is a member of the Scientific Committee of the Foundation of European Progressive Studies, of the Scientific Advisory Board of the Hans Boeckler Foundation, of the Policy Advisory Group of the Women's Budget Group and of the Coordinating Committee of the Research Network Macroeconomics and Macroeconomic Policies. She has more than 70 articles in books and leading peer-reviewed journals on issues of inequality, wage-led growth, employment, fiscal policy and gender. Before joining the University of Greenwich in 2012, Özlem has worked at several universities including the University of Westminster, the University of Applied Science Berlin, Vienna University of Economics and Business, and Istanbul Technical University.

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1. INTRODUCTION

This paper aims to analyse the effects of public spending in education, childcare, health and social care and gender pay gap in South Korea on aggregate output and employment of men and women based on a Post-Kaleckian feminist macroeconomic model. According to the Global Gender Gap Index of the World Economic Forum (2018), South Korea is one of the lowest-ranked countries in the world in terms of "Economic Participation and Opportunity" (124th out of 149 countries) as of 2018. Global Gender Gap Index also shows that South Korea ranks 88th in terms of female labour force participation and 121st in terms of gender wage equality for similar work. The average wages of women in South Korea are on average 36.7% lower than average male wages (as of 2012, own calculations based on World Klems (2014) database). These statistics reflect that there is a significant economic gender gap in South Korea despite the fact that the country is now classified as a high-income economy. Moreover, the underdeveloped care infrastructure and reliance on unpaid care labour of women is posing serious demographic and social sustainability challenges in an aging society.

Empirical research on the effects of public spending show a strong positive effect of public spending in social care and education on female employment as well as total employment (Antonopoulos et al., 2010; Ilkkaracan, Kim and Kaya, 2015; Ilkkaracan and Kim, 2018; De Henau et al., 2016; Onaran, Oyvat and Fotopoulou, 2019). These employment effects have further effects on the economy and the wellbeing of the society, as microeconomic studies show that a larger share of women's income compared to that of men's is spent on the needs of the household (Blumberg, 1991; Antonopoulos et al, 2010; Pahl, 2000) and an increase in women's income leads to increased spending on children's education and wellbeing (Vogler and Pahl, 1994; Lundberg, Pollak and Wales, 1997; Cappellini, Marilli and Parsons, 2014). These have further demand and supply side effects on output, productivity and employment (Onaran, Oyvat and Fotopoulou, 2019; Seguino, 2017).

With respect to the effect of gender equality on output, there are potentially both positive effects on consumption and investment, and negative effects on net exports and investment due to both demand and supply side effects; and the effects differ in the short and medium-run and crucially depend on the structure of the economy (Onaran, Oyvat and Fotopoulou, 2019; Braunstein, Bouhia and Seguino, 2018; Seguino, 2010, 2012, 2017; Braunstein, Stavaren, Tavani, 2011). In the case of South Korea, Seguino (1997) finds that higher gender pay gap increases the exports in manufacturing by lowering unit labour costs of export goods. Seguino (2000) estimates that gender pay gaps positively contributed to the economic growth in nine Asian economies including South Korea during the period from 1975-95. In contrast, Onaran, Oyvat and Fotopoulou (2019) find that gender equality leads to higher output in the UK in both the short and the medium-run. Empirical research based on post-Kaleckian models on the impact of the share of wages in national income indicates that a higher wage share leads to higher output in the case of South Korea (Onaran and

Stockhammer, 2005; Onaran and Galanis, 2014; Oyvat, Elgin and Öztunalı, 2020); however, these studies do not analyse the effects of gender distribution of wage income.

We introduce a post-Kaleckian feminist model to analyse the effects of public social expenditure and gender gaps on output and employment building on Onaran, Oyvat and Fotopoulou (2019), and extending it with an endogenous labour supply and wage bargaining model. Empirically, we use a structural vector autoregression (SVAR) analysis to estimate the impact of an increase in social infrastructure spending, female and male wages and closing the gender pay gap on aggregate output and employment of men and women in South Korea based on data provided by World Klems (2014) for the period from 1970-2012. Our results show that social infrastructure spending has a positive effect on aggregate non-agricultural output both in the short-run and medium-run in South Korea and it contributes to closing the gender employment gap in the short-run through generating substantial employment for women. Moreover, an increase in the wages of women stimulate aggregate demand in the medium-run, and South Korea is overall female wage-led/gender equality-led in the medium-run. However, the effects of higher wages and gender equality are economically small in comparison to the strong effects of social infrastructure spending. The results point at the importance of using more than one policy tool combining wage and fiscal policies to create a substantial increase in decent jobs for both men and women with decent wages and higher equality.

Section two discusses social expenditures, and labour markets and the growth regime in South Korea. Section three presents the post-Kaleckian feminist demand-led theoretical growth model. Section four analyses theoretically the effects of an increase in public social expenditure through increasing employment or closing the gender pay gap via increasing the wages of women in the social sector. Section five presents the data and estimation results and the final section concludes.

2. SOCIAL EXPENDITURES, LABOUR MARKETS AND GENDER EQUALITY IN SOUTH KOREA

2.1 SOCIAL EXPENDITURES, LABOUR MARKETS AND GENDER EQUALITY IN SOUTH KOREA

South Korea is often referred to as an important case of “East Asian miracle” due to its high growth rates in the post-1960s period (World Bank, 1993; 1994). In 1960 South Korea had a lower income per capita than today's lower and lower-middle-income countries such as Cameroon, Bolivia, Haiti and Democratic Republic of the Congo, and in 1995 became a high-income country according to the World Bank classification (World Bank, 2019b). As can be seen in Table 1, in 1970 South Korea was poorer than Argentina, Brazil, Mexico, South Africa, or Turkey and significantly surpassed them since the late 1980s.

The high growth rates in South Korea are explained by several channels. Until the 1990s, the South Korean state implemented developmental policies including export subsidies, subsidised credit, targeted tariffs and quotas in selected industries (Amsden, 1989; Chang, 1993; Chang, Andreoni and Kuan, 2013), which contributed to the rapid structural transformation from light to heavy and chemical industries and hence to the rise of South Korea. These policies are based on five-year plans of South Korea's Economic Planning Board[1]. Unlike the import-substitution industrialisation in the Latin American countries, the South Korean industrial strategy focused on export promotion (Dornbusch and Park, 1987). Indeed, the state support for the South Korean enterprises was strictly conditional on the export performance of the enterprises (Kang, 2002; Chang, 1993) and the state support for enterprises that could not satisfy the performance criteria either stopped or was reduced.

Table 1: GDP per capita, secondary school enrolment, and infant mortality rate in South Korea and selected middle-income countries (1970-2012)

	GDP per capita (USD constant, 2010)					
	1970	1974	1980	1989	2000	2012
South Korea	1815	2509	3700	7785	15105	23124
Argentina	7084	7741	7908	6497	8224	10650
Brazil	4704	6623	8349	8390	8803	11746
Mexico	5524	6288	8017	7549	9254	9691
South Africa	6244	6602	6722	6226	5938	7500
Turkey	4221	4744	4987	6309	8238	12039
	Secondary school enrolment (%, net)					
	1970	1974	1980	1989	2000	2012
South Korea	-	45.6	68.6	84.6	92.6	96.4
Argentina	-	40.5	-	-	78.5	85.9
Brazil	-	-	-	-	-	76.4
Mexico	-	-	-	45.9	56.1	71.8
South Africa	-	-	-	-	58.9	-
Turkey	-	24.2	-	43.2	64.5	81.2
	Infant mortality rate (per 1,000 live births)					
	1970	1974	1980	1989	2000	2012
South Korea	47.1	38.0	29.4	14.4	6.4	3.3
Argentina	59.0	54.7	37.0	25.5	17.5	11.8
Brazil	101.8	92.5	76.6	54.6	30.4	15.4
Mexico	76.9	67.6	54.9	37.5	22.2	14.1
South Africa	-	89.3	66.9	47.0	49.0	35.3
Turkey	127.1	113.0	90.1	58.2	30.9	13.1

[1] However, South Korea experienced a significant dismantling of financial regulations and industrial policy in the 1990s, which led to the economic crisis in 1997-98 (Chang, Park and Yoo, 1998; Crotty and Lee, 2005).

Source: World Bank (2019a)
Note: Net secondary school enrolment rate is "the ratio of children of official school age who are enrolled in school to the population of the corresponding official school age" according to the World Bank's (2019a) definition.

During this period, the South Korean policy-makers supported the formation of an oligopolistic structure in the country through state-initiated and state-subsidised mergers, entry barriers in different industries, preferential subsidies and access to credit[2] by *chaebol*s (Chang, 1993). The South Korean policy-makers aimed at obtaining the minimum efficient scale of production and reducing the possibility of excessive price competition through forming an oligopolistic structure.

In the 1990s and after the 1997-98 economic crisis, the developmental state policies providing support on strategic industries significantly weakened; however, they continued at a lower key (Chang, Andreoni and Kuan, 2013). South Korean policy-makers continued to support bio-tech, nano-tech and green-tech industries through R&D funding, credit guarantees and public funding for training. Following the crisis in 1997-1998, the entry of non-chaebol firms to the industries which used to be dominated by chaebols significantly increased, because the government lowered barriers to entry for domestic non-chaebol and foreign firms, reduced the chaebol firms' preferential access to finance, and introduced new anti-trust regulations (Aghion, Guriev and Jo, 2019).

In addition to interventionist developmental policies, the effect of "human capital" on the industrialisation of South Korea is also highlighted substantially. World Bank (1993) and Birdsall, Ross and Sabot (1995) estimate that high enrolment rates in South Korea significantly contributed to the growth rates in 1960-1985. Dornbusch and Park (1987) point that unlike many emerging economies South Korea suffered little from shortages of skilled and educated labour. Similarly, Amsden (1989) argues that South Korea had a surplus of middle and high skilled workers in some periods, and highlights that "the relationship between education and industrialization in Korea can be said to have obeyed a kind of Say's Law, the supply of educated personnel creating its own demand," i.e. the supply of high-skilled workers pushed the growth of skilled jobs.

Table 1 shows that the level of education was significantly higher in South Korea than today's large emerging economies. Although GDP per capita in South Korea was one-third of Argentina's in 1974, net secondary school enrolment rate in South Korea was larger than that in Argentina. Net secondary school enrolment rate in South Korea in 1980 was larger than that in Mexico, South Africa and Turkey in 2000, although South Korea was poorer than all three countries in 1980. The average years of schooling were also larger in South Korea than that in Brazil and Turkey in 1974 (Oyvat, 2014).

[2] The banking system in South Korea was nationalised by the Park Chung-Hee regime and was entirely public until 1982 (Chang, 1993).

The educational success of South Korea was partially an outcome of high public education expenditure as a share of GDP (Amsden, 1989; Birdsall, Ross and Sabot, 1995) compared to countries like Mexico and Turkey[3], but it was also due to the relatively equal distribution of education expenditure (Oyvat, 2014). As an outcome of this, the average education Gini coefficient (for population over 15, measured by years of schooling) was 0.25 in South Korea as opposed to 0.47 in Turkey, 0.46 in Brazil, 0.40 in Mexico, and 0.37 in South Africa between 1970 and 2010[4].

In addition, income inequality in South Korea was lower than most other developing economies, partly as an outcome of South Korea's successful progressive land reforms in 1945-1954 (Griffin, Khan and Ickowitz, 2002; Oyvat, 2016). This allowed South Korean households to further privately spend in education and healthcare (Birdsall, Ross and Sabot, 1995).

Table 1 also shows that the infant mortality rate in South Korea was significantly lower than Argentina, Brazil, Mexico, South Africa, and Turkey from 1970-2012, which indicates better access to healthcare. In South Korea, the share of public healthcare expenditure in GDP steadily increased from 0.27% in 1970 to 1.32% in 1994, and even more remarkably to 3.74% in 2012 and to 4.41% in 2016[5]. The share of private household expenditure in total healthcare expenditure declined from 43.6% in 2000 to 35.0% in 2012 (World Bank, 2019) following this growth in public healthcare expenditure.

The Korean government implemented policies that would promote childcare in post-1980. Following the introduction of the Early Childhood Education Promotion Act in 1982, the number of kindergartens increased from 2,958 in 1981 to 8,294 in 2007 (Peng, 2011). Following the Child Care Act of 1991, the total number of childcare centres increased from 1,919 to 29,823 between 1990 and 2007. As an outcome, the number of children enrolled in childcare centres increased by more than 20 times in 1990-2017 (Peng, 2012). Moreover, the South Korean government introduced free pre-school education for all 5-year old children in 1997 (Peng, 2011). In addition following the 2004 Early Childhood Education and the 2005 Child Care Acts targeting expansion and development of early childcare education and care, the government increased its early childcare budget by five times between 2002 and 2006.

South Korea has also introduced a new mandatory long-term care insurance (LTCI) system in 2008 targeting elderly care (Peng, 2012; Jeon and Kwon, 2017). In South Korea, the share of population aged 64 and over in total population increased from 5.0% in 1990 to 11.1% in 2010 and is projected to rise to 23.4% in 2030 and to 37.4% in 2050 (Rhee, Done and Anderson, 2015). The reform in elderly care aimed to address the rapidly rising needs

[3] Between 1981-1995 and 2001-2009, the share of public education expenditures in GDP in South Korea was respectively 1.7 and 1.3 percentage points higher than that in Turkey (Oyvat, 2014). In 1970 the share of basic (primary and secondary) public education expenditures in GNP in South Korea was 3.1%, and 1.6% in Mexico; in 1985 this ratio increased to 3.8% in South Korea and to 2.0% in Mexico (Birdsall, Ross and Sabot, 1995).

[4] Authors' calculations based on Benaabdelaali, Hanchane and Kamal (2012).

[5] Authors' calculations based on OECD (2019).

of the aging population. LTCI provides benefits to households both for institutional as well as home-based care.

The reforms targeting child and elderly care were aimed to reduce the care burden of women in South Korea (Peng, 2012) and contribute to increasing female employment, which we will discuss in Section 2.2.

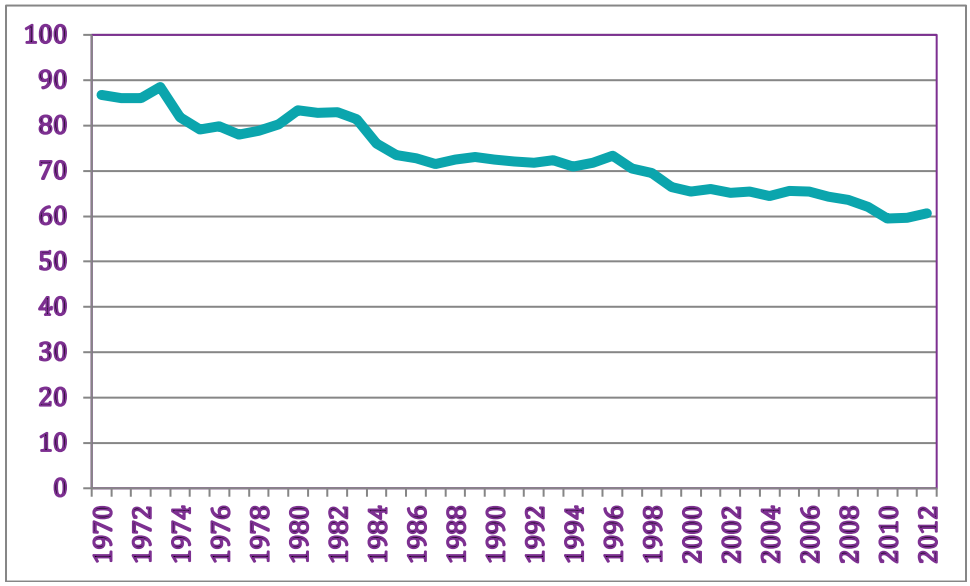
2.2 LABOUR MARKETS, INCOME DISTRIBUTION AND GENDER INEQUALITY IN SOUTH KOREA

South Korea has distributional characteristics comparable to those of European countries, e.g. Gini coefficient has remained around 0.30 (Oyvat, 2014), which is low compared to developing economies. This is seemingly counterintuitive, since income redistribution policies in Korea have been very limited until the 1990s (Amsden, 1989). Moreover, the oligopolistic structure was supported by the state as discussed in Section 2.1, which could potentially lead to a high-profit share. In addition, trade union activities were extremely restricted until the end of the military regime in 1987 (Kang, 2002).

The low-income inequality in South Korea is partially an outcome of the successful progressive land reform in 1945-1954 (Griffin, Khan and Ickowitz, 2002; Oyvat, 2016). According to Amsden (1989), this land reform led to a more egalitarian rural sector and a sharp increase in agricultural productivity, which also reduced rural-urban migration. As a result, the pressure on manufacturing wages, which could have been much higher in the incidence of high rural poverty was reduced. Moreover, although trade union activities were restricted, labour laws were rigid prior to 1990s, which along with high growth rates led to employment rates near full employment for men (Peng, 2011).

Despite these developments, the wage share (adjusted for self-employment) steadily declined between 1970-2012, as can be seen in Figure 1. In 1987, South Korea experienced democratization, which led to a significant increase in the number of trade unions and strikes. As an outcome, the adjusted wage share temporarily increased from 71.5% in 1987 to 73.1% in 1989. Following the economic crisis of 1997/98, the wage share declined from 70.5% in 1997 to 65.4% in 2000. The post-crisis reforms deregulated the labour market (Yang, 2006), which might have contributed to the decline in the wage share. Following the Global Economic Crisis in 2008-09, the wage share declined further from 63.6% in 2008 to 59.5% in 2010.

Figure 1: Adjusted wage share in South Korea (% GDP at current factor cost, 1970-2012)



Source: European Commission AMECO (2019)

The labour market in South Korea has been subject to gender segregation both across and within industries. Table 2 shows the share of women in hours of work in different sectors. The social sector includes education, childcare, healthcare, and social care, the rest of the economy includes all other non-agricultural sectors.

Table 2: The share of female employment in employment (%, period averages, 1970 – 2012)

	1970-79	1980-1987	1988-1997	1998-2007	2008-2012	1970-2012
Total non-agricultural	31.68	30.35	28.00	30.33	32.63	30.37
Education, health, social work	32.71	36.92	47.42	58.25	63.19	45.41
Rest of the economy (in the non-agricultural sector)	31.61	29.96	26.70	27.71	28.42	28.88
Sectors with the largest share of female employment (other than education, health, social work)						
Food, beverages, tobacco,	64.25	59.73	53.62	47.10	43.68	54.56

textiles, leather and footwear						
Electrical and optical equipment	42.49	38.84	33.26	30.00	23.06	34.50
Financial intermediation	31.72	32.78	28.48	29.36	30.12	30.43
Sectors with the smallest share of female employment						
Basic metal and fabricated metal; other non-metallic minerals	15.96	17.20	17.43	15.46	14.17	16.21
Construction; electricity, water and gas supply	7.30	9.68	11.32	13.25	11.79	10.58
Mining and quarrying	5.18	6.20	7.01	7.89	8.67	6.83

Source: Author's calculations based on World Klems (2014)
Note: The shares in each sector are based on hourly employment.

As can be seen in Table 2 the share of women in employment in the social sector has been greater than in the rest of the economy during the period from 1970- 2012, and the social sector is the most female-dominated industry compared to any other sector in the post 1997-98 period. This hints that public investment in the social sector would increase the share of female employment in South Korea. Secondly, some of the sectors are almost entirely male-dominated with female employment shares lower than 10-20%. Thirdly, the sectors "food, beverages, tobacco, textiles, leather and footwear" and "electrical and optical equipment" had very high female employment shares in 1970-1997; however, the female employment share has been steadily decreasing in these industries. Fourthly, the share of female employment increased in the post 1997-98 in all sector groups. This increase coincided with increases in spending in childcare and eldercare and maternity leave policies implemented in 2001, 2005 and 2006 that extended paid maternity leave from 60 days to 90 days, and increased the public financial support for and the duration of parental leave to three years (Peng, 2011).

The occupational gender segregation and gender wage gaps within the industries have also been significant. Seguino (1997) shows that the earnings ratio between female and male workers was between 40% to 60% in the key female-dominated industries like textiles, wearing apparel and electronics and in a male-dominated industry like transport during 1977-1990. Table 3 also shows that male wages/ female wages) in both the social sector

and the rest of the economy were around 1.69 during 1970-2012, and although the ratio has been decreasing in time, it remains high.

Finally, job insecurity increased significantly specifically for women in the 2000s since the crisis. The share of part-time employment in total employment increased from 13.9% in 2000 to 22.3% in 2012 (ILO, 2019). The increase in part-time employment is more limited among men but nevertheless, the share of part-time in total male employment increased from %7.6 in 2000 to %10.9 in 2012.

Table 3: Male wages/female wages (period average)

	1970 - 1979	1980 - 1987	1988 - 1997	1998 - 2007	2008 - 2012	1970 - 2012
The rest of the economy	1.95	1.84	1.69	1.47	1.38	1.69
Education, health, social work	1.74	1.75	1.71	1.61	1.61	1.69

Source: Authors' calculations based on World Klems (2014)
Notes: The average wages are hourly wage rates. The average wage income also includes the income of the self-employed in the non-agricultural sector.

3. A FEMINIST POST-KALECKIAN MODEL WITH PUBLIC AND PRIVATE SOCIAL EXPENDITURE, PAID AND UNPAID LABOUR

In this section, we present a feminist post-Kaleckian theoretical model that forms the basis of our analysis of the effects of gender inequalities in pay and employment and social infrastructure investment. The model builds on Onaran, Oyvat and Fotopoulou (2019), and extends it with an endogenous labour supply and wage bargaining model. We also extend the theoretical models by Braunstein, Stavaren and Tavani (2011) and Seguino (2010, 2012), incorporating both demand and supply side analysis within post-Kaleckian theoretical models, albeit without an empirical analysis. The theoretical model is a general model, allowing for both positive and negative effects of gender equality on the demand side depending on the structural features of the economy and incorporates the positive effects on the supply side.

The model introduces two types of workers, female and male, which are respectively demonstrated by scripts F and M. We disaggregate profit share into its components: output, female and male wage rates, and female and male paid employment. The profits are earned by the capitalists, who are genderless for simplicity in our model.

The model has three sectors, public social sector, which consists of the expenditure of the government in education, childcare, healthcare, and social care (demonstrated with script H), the rest of the market economy (demonstrated with script N), and the unpaid care sector. The public spending in the social sector is defined as investment in social infrastructure in line with the feminist economics literature (Elson, 2016, 2017; Women's Budget Group, 2015). İlkkaracan (2013) defines this as purple investment. We also introduce household's spending on marketized social services. Both public and household's social expenditure have short-run demand effects and influence labour productivity in the medium-run. Appendix 1 presents the list of the variables in the model.

Aggregate output (Y_t) is the sum of total male wage bill (WB_t^M), total female wage bill (WB_t^F) and profits (R_t).

$$Y_t = WB_t^M + WB_t^F + R_t \quad (1)$$

The total wage bill for female workers (WB_t^F) is a function of female wages in the social sector (w_t^{HF}), female employment in the social sector (E_t^{HF}), female wages in the rest of the economy (w_t^{NF}), and female employment in the rest of the economy (E_t^{NF}):

$$WB_t^F = w_t^{HF} E_t^{HF} + w_t^{NF} E_t^{NF} \quad (2)$$

Similarly, the total wage bill for male workers (WB_t^M) is a function of male wages in the social sector (w_t^{HM}), male employment in the social sector (E_t^{HM}), male wages in the rest of the economy (w_t^{NM}), and male employment in the rest of the economy (E_t^{NM}):

$$WB_t^M = w_t^{HM} E_t^{HM} + w_t^{NM} E_t^{NM} \quad (3)$$

The data for South Korea show that average hourly male wage rates are significantly higher than average hourly female wage rate (own calculations based on World Klems (2014) discussed in more detail in Section 5). For the from period of 1970- 2012, the average hourly male wages in the non-agricultural sector in South Korea are on average 62% higher than the average hourly female wages (based on period average), although the gender pay gap declined during this period. The gender pay gap is larger in N during 1970-1985 and is larger in H during 1991-2012.

In South Korea, there is also significant occupational/sectoral segregation with women constituting the majority in the social sector in the post-1998 period and are substantially underrepresented in the rest of the economy during the whole period of 1970-2012. During the period from 1977-2012, the share of women in hours of work in the social sector is larger and increased through time, which indicates that occupational/sectoral segregation increased. As of 2012, the share of women in hours of work in N and H in South Korea are respectively 30.5% and 68.0% (own calculations based on World Klems (2014) database presented in more detail in Section 4).

We define gender wage gaps (α_t) in H and N as below:

$$\alpha_t^N = \frac{w_t^{NM}}{w_t^{NF}}, \quad \alpha_t^H = \frac{w_t^{HM}}{w_t^{HF}} \tag{4}$$

In South Korea $\alpha_t^N > 1$ and $\alpha_t^H > 1$ (own calculations based on World Klems data discussed in Section 5) similar to a variety of other emerging as well as developed economies (Onaran, Oyvat, and Fotopoulou, 2019).

The aggregate output in the market economy (GDP, excluding unpaid activities) is

$$Y_t = C_t^N + C_t^H + I_t + G_t^H + G_t^C + I_t^G + X_t - M_t \tag{5}$$

where C_t^H is households' social expenditure[6], C_t^N is consumption in the rest of the economy, I_t is private investment expenditure, G_t^H is government's social infrastructure expenditure , G_t^C is government's consumption expenditure, I_t^G is public investment other than investment in the social sector[7], X_t is exports of goods and services and M_t is imports of goods and services. The public social expenditure is a fiscal policy decision targeted as a share of aggregate output (κ_t^H), and constitutes the public social sector output (Y_t^H). The rest of the GDP is the market output in the rest of the economy (Y_t^N):

$$Y_t^H = G_t^H = \kappa_t^H Y_t \tag{6}$$

$$Y_t^N = Y_t - G_t^H = Y_t(1 - \kappa_t^H) \tag{7}$$

The share of government's consumption expenditure (G_t^C) and public investment other than social infrastructure investment in the social sector (I_t^G) are also determined by the government as a share of aggregate output and are respectively κ_t^C and κ_t^G:

$$G_t^C = \kappa_t^C Y_t \tag{8}$$

$$I_t^G = \kappa_t^G Y_t \tag{9}$$

Employment in N is output over labour productivity in N (T_t^N):

[6] While theoretically household consumption of social services amounts to investment in human infrastructure as well and affects productivity in our model, as discussed below, we preserved the term "consumption" for this category consistent with the definitions in national accounts.

[7] Government's social infrastructure expenditures are classified as current spending on labour services in the national accounts. The physical infrastructure associated with providing social infrastructure such as schools and hospitals are counted as physical infrastructure. Hence part of I_t^G also contributes to social infrastructure. However, our classification is important for a gendered analysis of the employment impact of different fiscal policy decisions as G_t^H is very female labour intensive while construction, just as most other parts of I_t^G is male labour intensive.

$$E_t^N = \frac{Y_t^N}{T_t^N} = \frac{(1-\kappa_t^H)\,Y_t}{T_t^N} \tag{10}$$

The share of female employment in N is exogenous and institutionally and socially determined to lead to occupational segregation, and is demonstrated by β_t^N. The male workers in N constitute $(1-\beta_t^N)$ of the sector[8]:

$$E_t^{NF} = \frac{(1-\kappa_t^H)\,Y_t}{T_t^N}\beta_t^N = \frac{Y_t^N}{T_t^N}\beta_t^N \tag{11}$$

$$E_t^{NM} = \frac{(1-\kappa_t^H)\,Y_t}{T_t^N}(1-\beta_t^N) = \frac{Y_t^N}{T_t^N}(1-\beta_t^N) \tag{12}$$

The number of male workers is greater than the number of female workers in N for all the years reported; hence, $\beta_t^N < 0.50$ in South Korea (own calculations based on World Klems (2014) presented in Section 5). Moreover, $\beta_t^N < \beta_t^H$ in all years except the few years before 1977. Therefore, we expect that a rise in the share of social sector in output to increase the share of women in total employment.

We assume that the wage paid to male and female workers in the social sector constitutes the public social expenditure and the social sector is not making profits. Any non-labour inputs used constitute part of government consumption (G^C). Following this, the public social expenditure can be written as a function of employment (E_t^H), average female wage (w_t^{FH}), average male wage (w_t^{MH}), female employment share (β_t^H) and male employment share $(1-\beta_t^H)$ in the social sector.

$$G_t^H = \kappa_t^H Y_t = \beta_t^H E_t^H w_t^{FH} + (1-\beta_t^H) E_t^H w_t^{MH} \tag{13}$$

Using equations (13) and (4), we can write the total employment (E_t^H), female employment (E_t^{HF}) and male employment (E_t^{HM}) in the social sector as a function of public social expenditure and female wages in the social sector.

$$E_t^H = \frac{G_t^H}{w_t^{FH}(\beta_t^H + \alpha_t^H - \beta_t^H\alpha_t^H)} = \frac{\kappa_t^H Y_t}{w_t^{FH}(\beta_t^H + \alpha_t^H - \beta_t^H\alpha_t^H)} \tag{14}$$

$$E_t^{HF} = \frac{\beta_t^H \kappa_t^H Y_t}{w_t^{FH}(\beta_t^H + \alpha_t^H - \beta_t^H\alpha_t^H)}, \qquad E_t^{HM} = \frac{(1-\beta_t^H)\kappa_t^H Y_t}{w_t^{FH}(\beta_t^H + \alpha_t^H - \beta_t^H\alpha_t^H)} \tag{15a,b}$$

[8] For simplicity, we abstract from the presence of trans workers and classify them as either male or female in our model.

Therefore, we can expect that a rise in the share of social sector in aggregate output increases the share of female workers in total employment.

We model the unpaid domestic care labour (U_t) within the households as

$$\log U_t = q_0 + q_G \log G_t^H + q_F \log E_t^{NF} + q_M \log E_t^{NM} \tag{16}$$

For a given demographic structure defining the care needs of a society, (q_0) the higher male and female paid employment is expected to have some negative impact on the supply of unpaid labour, since it decreases the time that could be allocated for unpaid care ($q_F < 0, q_M < 0$). Higher government expenditure in the social sector is also expected to reduce the need in households for care; therefore, it leads to lower unpaid labour ($q_G < 0$). We specify the equation in logarithms, since the impact of employment in N and public social expenditure on the time spent on unpaid domestic care might be non-linear (the negative impact might be decreasing in absolute values as it gets increasingly more difficult to decrease unpaid care at lower levels of unpaid care).

Next, we define the profits (R) in N as the income in N after wage payments.

$$\begin{aligned} R_t = Y_t^N - \ w_t^{NF} E_t^{NF} \ - w_t^{NM} \ E_t^{NM} &= Y_t^N - \ E_t^N(\beta_t^N + \alpha_t^N - \beta_t^N \alpha_t^N) w_t^{NF} \\ &= \left((1 - \kappa_t^H) Y_t - E_t^N(\beta_t^N + \alpha_t^N - \beta_t^N \alpha_t^N) w_t^{NF}\right) \end{aligned} \tag{17}$$

The profit share in N is the share of profits in output in N. Therefore, the profit share could also be written as a function of female wages and labour productivity in N:

$$\pi_t = \frac{Y_t^N - \ w_t^{NF} E_t^{NF} \ - w_t^{NM} \ E_t^{NM}}{Y_t^N} = 1 - \frac{(\beta_t^N + \alpha_t^N - \beta_t^N \alpha_t^N) w_t^{NF}}{T_t^N} \tag{18}$$

The next set of equations present the behavioural equations defining the demand side of the model. Consumption of households in goods and services other than social expenditure is a function of after-tax wage income of female and male workers in H and N and profit income of capitalists. t_t^W is the rate of tax on wages and t_t^R is the rate of tax on profits. Following previous empirical literature (e.g. Hein and Vogel, 2009; Molero-Simarro, 2011; Onaran and Galanis, 2014; Onaran and Obst, 2016) we define consumption in logarithms. The non-linearities in the relationship between sources of incomes and consumption might be an outcome of changing propensities to consume with changing incomes.

$$\begin{aligned} \log C_t^N = \ & c_0 + c_R \log[R_t(1 - \ t_t^R)] \\ & + c_{NF} \log[w_t^{NF} E_t^{NF}(1 - \ t_t^W)] + c_{HF} \log[w_t^{HF} E_t^{HF}(1 - \ t_t^W)] \\ & + c_{NM} \log[w_t^{NM} E_t^{NM}(1 - \ t_t^W)] + c_{HM} \log[w_t^{HM} E_t^{HM}(1 - \ t_t^W)] \end{aligned} \tag{19}$$

The marginal propensity to consume in N and H is assumed to be different for male and female workers, reflecting the gender pay gaps as well as differences in behaviour.

The households' social expenditure (C_t^H) is also a function of after tax profit and wage income of female and male workers in N and H, and governments' social expenditure:

$$\begin{aligned}\log C_t^H = {} & z_0 + z_G \log G_t^H \\ & + z_R \log[R_t(1 - t_t^R)] \\ & + z_F \log[w_t^{NF} E_t^{NF}(1 - t_t^W)] + z_M \left(\log[w_t^{NM} E_t^{NM}(1 - t_t^W)]\right)\end{aligned} \tag{20}$$

The marginal propensity to consume in H is different for male and female workers in N. Moon and Joung (1997) find that in South Korea income elasticity for education expenditures are significantly higher in households headed by single-mothers compared to that in two-parent households. This is consistent with the empirical literature which shows that women spend a greater share of their incomes on children's education (Onaran, Oyvat, and Fotopoulou, 2019; Seguino and Floro, 2003; Morrison, Raju and Sinha, 2007). Moon and Joung (1997) do not find a significant difference in the income elasticity of healthcare expenditures between these two types of households. Lee and Pocock (2007) estimate that a higher income for wives' relative to the household lead to higher savings for the household in South Korea. Based on these studies we predict that the marginal propensity to consume in social services is larger for female workers in N than male workers in N and the marginal propensity to consume in the rest of the goods and services is larger for male workers in N than female workers in N.

We assume that the marginal propensity to consume in H is the same for male and female workers working in the social sector in an attempt to simplify the model.[9] Following this assumption, governments' social expenditure (G_t^H) can *i)* increase households' social expenditure by providing wage income in the social sector, *ii)* decrease households' social expenditure by reducing the need for these expenditures. We assume that the demand for C_t^H is provided by the private sector in the market economy as part of the output in N, as mentioned above.

Next, private investment (I_t) is

$$logI_t = i_0 + i_1 \log Y_t + i_2 log\,[\pi_t(1 - t_t^R)] + i_3 \log\left(\frac{D}{Y}\right)_t \tag{21}$$

where D is the public debt. The private investment is expected to increase as a result of higher aggregate output ($i_1 > 0$). $\pi_t(1 - t_t^R)$ is the after-tax share of profits in N. Following Bhaduri and Marglin (1990) and Blecker (1989), we expect the profit share to have a positive direct impact on private investment ($i_2 > 0$). Last, we use the ratio of public debt to GDP, $(D/Y)_t$, to consider the possible negative crowding-out effects of rising public debt on the interest rate and thereby, private investment ($i_3 < 0$). However, this effect might be small

[9] As the majority of the workers in H are women, the impact of this simplification is not very important. The assumption helps to simplify the model by using only G_t^H to reflect the demand effect while at the same time capturing the substitution effect of public social infrastructure provision on private demand for social expenditure.

for the case of South Korea, since for the period we examine (1970-2012) the public debt to GDP in South Korea was 32.1% at its highest level (IMF, 2019). The economic recession in 1980 (Dornbusch and Park, 1987) and the economic crisis in 1997-98 that South Korea experienced were due to the indebtedness in the private sector (Palma, 2000) and household indebtedness (Crotty and Kee, 2005).

The public debt at time t (D_t) is the public debt accumulated from the public debt in the previous period (D_{t-1}) with an interest rate of r_{t-1}, plus the total government expenditure at t, minus the taxes collected from profits and wages at time t (Obst, Onaran, and Nikolaidi,2019).

$$D_t = (1 + r_{t-1})\, D_{t-1} + G_t^H + G_t^C + I_t^G - t_t^W (WB_t^F + WB_t^M) - t_t^R R_t \tag{22}$$

$$D_t = (1 + r_{t-1})\, D_{t-1} + \frac{Y_t^N(\kappa_t^H + \kappa_t^C + \kappa_t^G)}{1 - \kappa_t^H} - w_t^{NF}(\alpha_t^N E_t^{NM} + E_t^{NF}) t_t^W - w_t^{HF}(\alpha_t^H E_t^{HM} + E_t^{HF}) t_t^W - t_t^R\left(Y_t^N - w_t^{NF}(E_t^{NF} + \alpha_t^N E_t^{NM})\right) \tag{22'}$$

Exports, X are

$$logX_t = x_0 + x_1 logY_t^{World} + x_2 log\pi_t + x_3 log\varepsilon_t \tag{23}$$

The income of the trading partners (Y_t^{World}) and the depreciation in currency (x_3) increases the exports ($x_1, x_3 > 0$). A rise in the profit share is equivalent to a fall in real unit labour costs, and hence would increase the export competitiveness and hence exports of an economy ($x_2 > 0$).

Imports,M, are

$$logM_t = n_0 + n_1 logY_t^N + n_2 log\pi_t + n_3 log\varepsilon_t \tag{24}$$

Higher domestic demand in N would stimulate the demand for imported goods and services ($n_1 > 0$) and real deprecation in currency (x_3) reduces the imports ($n_3 < 0$). A rise in the profit share would decrease imports, because it would increase the competitiveness of the economy.

This is a reduced form modelling of the relative price effects on exports and imports. Domestic prices and export prices are functions of nominal unit labour costs, based on a mark-up pricing model in an imperfectly competitive economy. Exports are a function of relative prices of exports to imports, and imports are a function of domestic prices relative to import prices. As nominal unit labour costs are real unit labour costs multiplied by domestic prices, and the wage share is identical to real unit labour costs, a fall in the wage share, i.e. a rise in the profit share, leads to a fall in relative prices and improves net exports, depending on the labour intensity of exports, the pass through from labour costs to export prices and domestic prices and the price elasticity of exports and imports. To simplify the

model we do not present the price equations and relative price effects on net exports. Our claim on the impact of the profit share on net exports is also supported by the previous empirical literature. For South Korea, Onaran and Galanis (2014) find that an increase in the profit share increases exports and reduces imports.

Finally, on the supply side of the model, labour productivity is constant in the short run and changes endogenously in the medium run in the rest of the economy, as we assume technological change or adoption of new techniques take time.[10] Labour productivity in N (T_t^N) is

$$\begin{aligned}\log T_t^N = {} & h_0 + h_1 \log G_{t-1}^H + h_2 \log I_{t-1}^G + h_3 \log G_{t-1}^C \\ & + h_4 \log Y_{t-1} + h_5 \log w_{t-1}^{NF} + h_6 \log(\alpha_{t-1}^N w_{t-1}^{NF}) + h_7 \log C_{t-1}^H \\ & + h_8 \log U_{t-1} + h_9 \log T_{t-1}^N\end{aligned} \tag{25}$$

In the medium run, the labour productivity is likely to be positively influenced by lagged values of government's social infrastructure investment as well as government's consumption expenditure and other public investment ($h_1, h_2, h_3 > 0$). We also expect households' consumption expenditure in marketized social services (C^H) and domestic unpaid care labour to affect labour productivity positively ($h_7, h_8 > 0$). Nevertheless, we expect the effects of these to be realised over the medium-run, namely in the next period. Higher output also leads to higher labour productivity due to Verdoorn effect (Naastepad, 2006; Hein and Tarassow, 2010), as greater scale can lead to a more efficient allocation of sources ($h_4 > 0$). Moreover, following Marx (1867) and later the theoretical contributions and empirical findings of Naastepad (2006) and Hein and Tarassow (2010), we consider that higher female and male wages in N leads to capitalists' preference towards labour-saving technologies, which increases the labour productivity ($h_5, h_6 > 0$). The coefficients of h_5 and h_6 are also consistent with the New Keynesian efficiency wage theories (Shapiro and Stiglitz, 1984; Campbell III, 1993), which shows that higher wages provide additional incentives for workers for not shirking/putting additional effort and keeping their jobs, which would in turn increase labour productivity. Higher output and higher wages have also a lagged effect, since the change in technology and/or techniques pushed by these factors would require time. Finally, the labour productivity in the previous period is also positively related with the productivity in the current period, since part of the technology from the last period is transferred to the following period ($h_9 > 0$). The next period is a sufficiently long time period for these effects to be realised, e.g. five years or more; furthermore, the time required for these different factors to affect productivity is an empirical question; e.g. the impact of public investment in childcare may take longer than the impact of other types of government spending or higher wages. In the theoretical model, we abstract from differences in the lag structure of the effects.

[10] Increasing productivity in H is less related to the availability of technology or better skills, as the quality of these services is more important and is in many cases requires more hours of nurses, care workers, teachers per patient or student. Productivity in H is determined by the female wage rate, gender pay gap, and occupational segregation in H.

Unpaid domestic care labour, U is shared between women (U^F) and men (U^M), where β_d is the share of U^F in U, and is exogenous and institutionally and socially determined:

$$U_t^F = \beta_d U_t \quad (26)$$

$$U_t^M = (1 - \beta_d) U_t \quad (27)$$

In case of extreme gender inequality $\beta_d = 1$.

Female and male labour force participation rates (labour force as a ratio to population, N_t^F and N_t^M) are positive functions of average wages, benefits and social infrastructure and negative functions of U_t. Hence female and male labour force is

$$L_t^F = (l_{1F}(w_t^{FH} + w_t^{FN}) + l_{2F} G_t^H + l_{3F} U_t^F) N_t^F \quad (28)$$
$$L_t^M = (l_{1M}(w_t^{MH} + w_t^{MN}) + l_{2M} G_t^H + l_{3M} U_t^M) N_t^M \quad (29)$$

For simplicity we assume, N_t^F and N_t^M are exogenously determined as changes in fertility and mortality take a much longer time period than our medium-term theoretical and empirical analysis in this paper

If employment grows faster than the labour force for a particular type of worker, unemployment rate decreases, and vice versa. If demand for employment, E, for a particular type of worker is not met by an increase in labour supply due to constraints in supply, e.g. a low female labour supply due to lack of provision of public social infrastructure for care, either there will be an exogenous increase in labour supply due to migration, or gender norms and occupational segregation coefficients will change or wages will adjust. It is realistic to assume that changes in labour demand vs. labour supply can lead to changes in wages.

Similarly, a rise in wages in a particular sector, e.g. H as an outcome of higher public social infrastructure, or a faster increase in wages in the social sector compared to wages in the rest of the economy is likely to lead to higher labour supply of both men and women, leading to also changes in the sectoral segregation ratios in the social sector and the rest of the economy, as well as a change in social gender norms and the distribution of unpaid domestic labour.

The real wages for women and men in H is exogenously determined by the government. Wage rates for men and women in N sector are determined endogenously as an outcome of a bargaining process between employers and workers depending on the changes in labour demand in each sector and labour supply of men and women as well as exogenous factors determined by labour market institutions and legislation, bargaining power of men and women, social norms, and occupational segregation effected by these norms, as well as differences in personal characteristics such as education which in turn are affected by social norms. For simplicity, we assume expected prices are equal to actual prices. Hence, the real

wage rates in N are functions of employment (or unemployment rate) for men and women, spillover effects from wages in H, and a set of exogenous factors and are given by the following bargaining relations:

$$\log w_t^{NF} = p_{0F} + p_{1F}\log\left((E_t^{NF} + E_t^{HF})/L_t^F\right) + p_{2F}\log w_t^{HF} \quad (30)$$

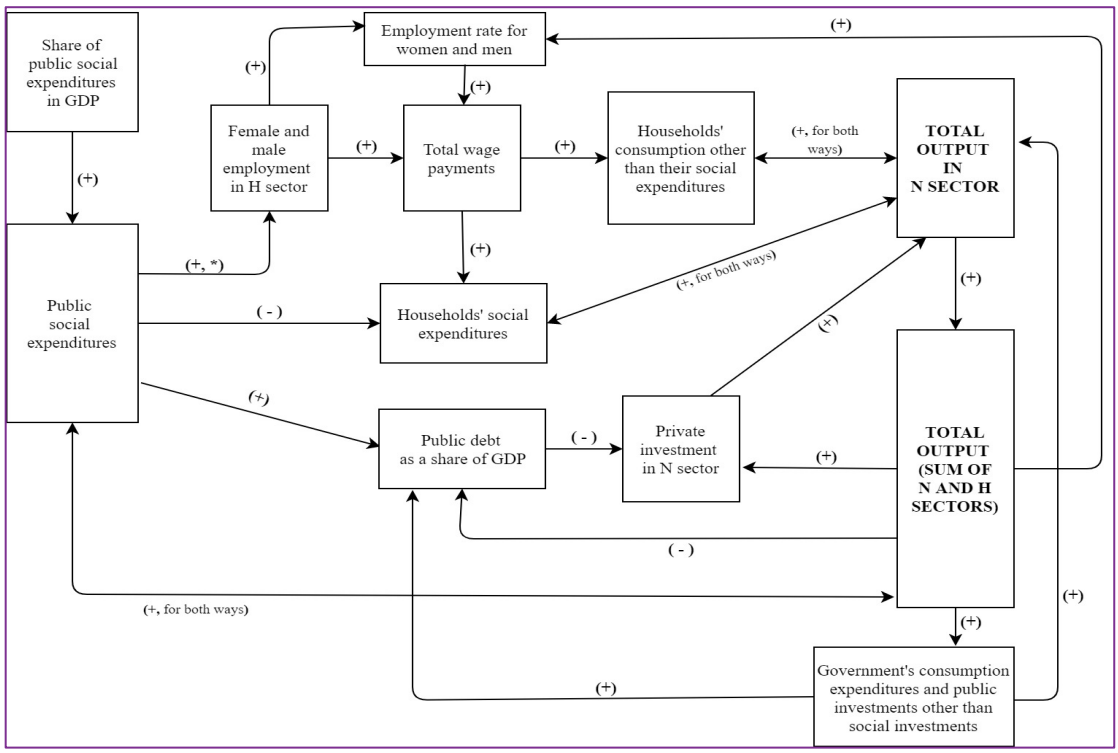
$$\log w_t^{NM} = p_{0M} + p_{1M}\log\left((E_t^{NM} + E_t^{HM})/L_t^M\right)) \; p_{2M}\log w_t^{HFM} \quad (31)$$

Consequently, gender gaps may be the result of women's disproportionate responsibility for unpaid care work, stereotypes that lead to occupational segregation, or wage gaps in favour of men leading families to select the lowest-paid adult to provide unpaid care work (Seguino, 2017).

4. THE EFFECTS OF THE PUBLIC SOCIAL INFASTRUCTURE EXPENDITURE ON OUTPUT AND EMPLOYMENT

In this section, we analyse the impact of a change in the share of public social infrastructure investment on GDP and employment in the short and medium-run based on the theoretical model. We first examine the effect of an increase in the share of public social infrastructure investment with constant wages ($w_t^{HM} = w_t^{HM*}, w_t^{HF} = w_t^{HF*}$) with an increase in female and male employment in the social sector. Next, we analyse the case where the share of public social expenditure increase due to increasing female wage rate with a constant male wage rate and closing gender pay gap with constant female and male employment in H ($E_t^{HF} = E_t^{HF*}$, $E_t^{HM} = E_t^{HM*}$).

Figure 2: The short-run impact of an increase in the share of public social infrastructure expenditure in GDP on total output

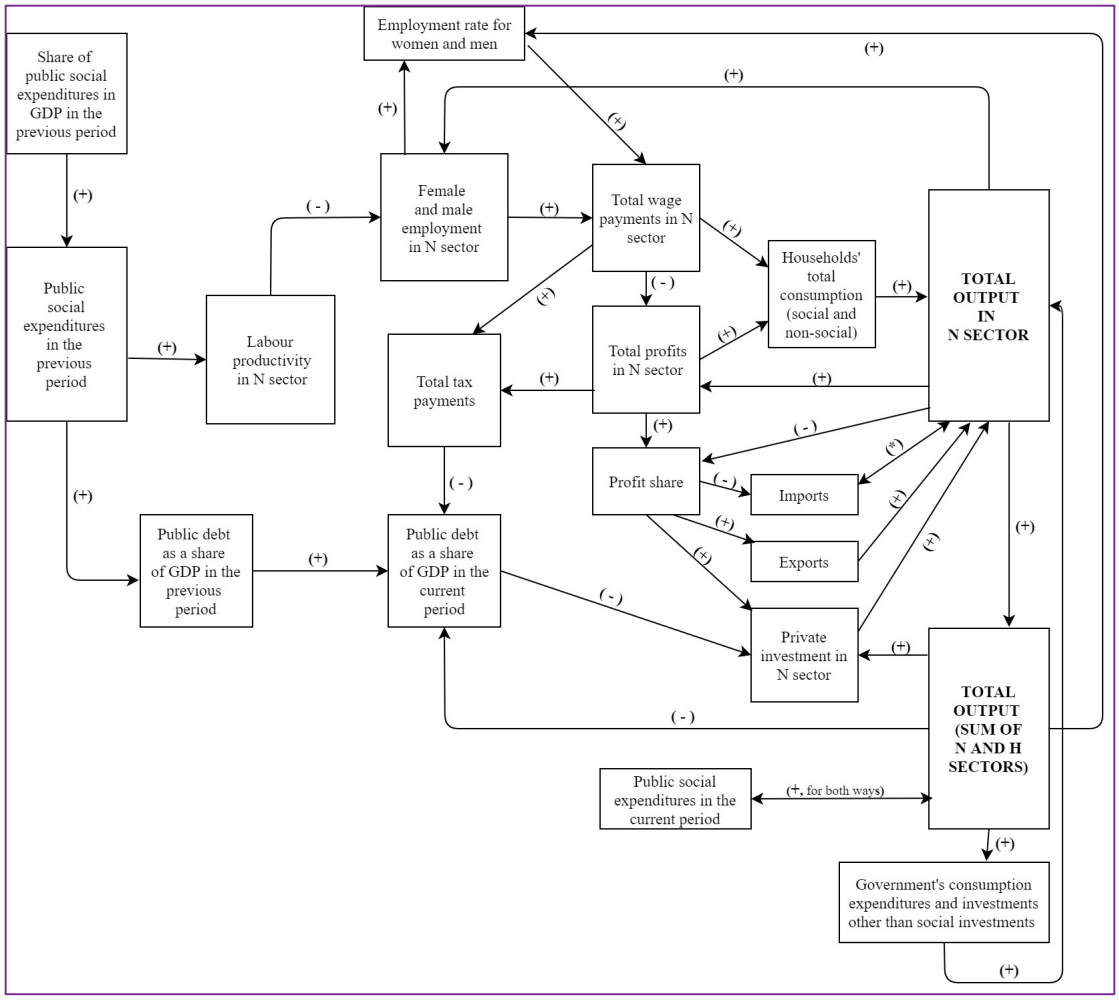


* Based on Table 2, the positive partial impact of public social expenditures is expected to be relatively larger for female employment compared to the partial impact from expenditures in N sector.

4.1 THE EFFECT OF A CHANGE IN THE SHARE OF PUBLIC SOCIAL INFASTRUCTURE INVESTMENT ON OUTPUT AND EMPLOYMENT WITH CONSTANT WAGES

We start our analysis with the short-run impact of the share of *public social infrastructure investment* in GDP (κ_t^H) on output and employment for the case in which wages in H are constant and new employment in H is generated. Details of the short-run impact on output are summarised in Figure 2.

Figure 3: The medium-run impact of an increase in the share of public social infrastructure expenditure in GDP on total output



Notes: All variables without time represent the current period.
* The impact of total output on imports is positive and the impact of imports on total output is negative.

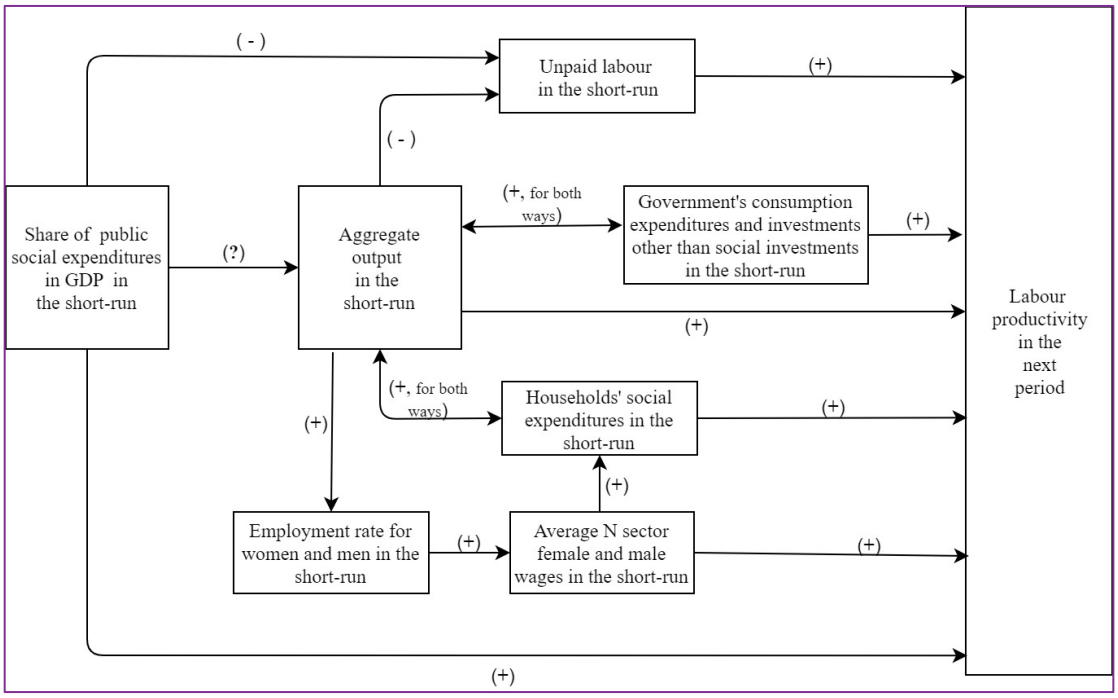
The increase in public social infrastructure investment has a direct positive effect on total output. Moreover, it generates female and male employment in H, which stimulates consumption in both social and other expenditures. Higher social public expenditure may have a negative impact on private investment in the short-run due to increasing public debt/GDP due to the crowding-out effect. However, this negative effect will be moderated

as tax revenues also increase alongside the demand stimulated by public spending, and an increase in public social expenditure/GDP also increases the denominator of the public debt/GDP ratio. Finally, if the effect of public social expenditures on aggregate output is positive, this leads to a positive effect on private investment.

Next, we discuss the medium-run effect of an increase in the share of public social infrastructure expenditure in GDP, which is summarised in Figure 3. The medium-run effects of higher public social expenditure work through its effects on labour productivity and public debt/GDP. An increase in social expenditure has a direct positive impact on labour productivity in the next period through its contributions to human capabilities as summarised in Figure 4 below. Higher social expenditure is also expected to increase output in the short-run, which affects labour productivity positively due to the Verdoorn effects. Moreover, higher output in the short-run leads to an increase in the social expenditure of households, government's consumption expenditure, and other public investments, which are all expected to increase the labour productivity in the next period. Finally, we expect higher social expenditure to reduce the unpaid care work. However, the decline in unpaid care is unlikely to have a large negative impact that would reverse the positive effects of public social expenditure on labour productivity.

The effect of public social infrastructure expenditure on labour productivity also affects employment in N in the next period, which has further effects on consumption. Moreover, for constant wages in N, higher public social expenditure leads to an increase in the profit share, which affects private investments and net exports in the next period positively.

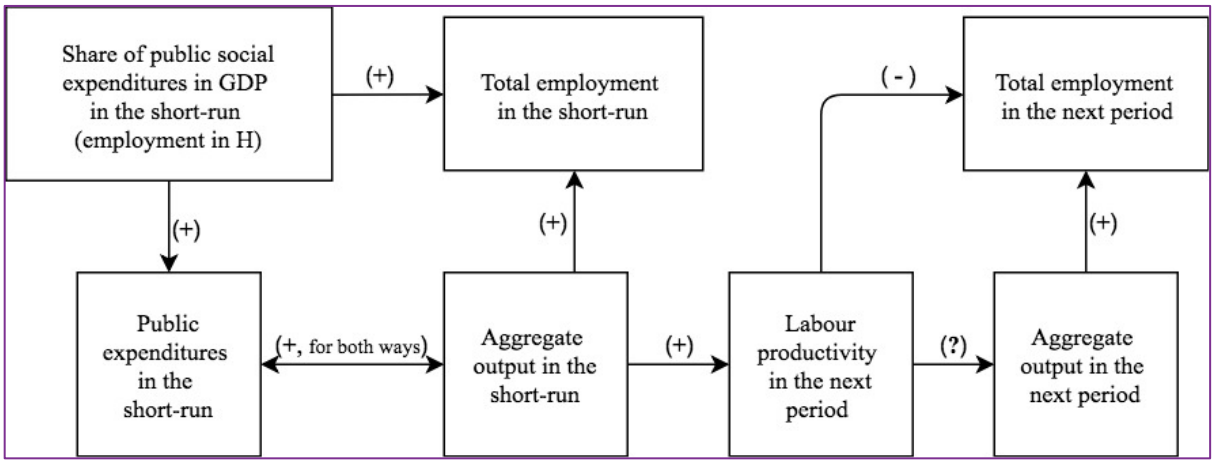
Figure 4: The summary of the impact of the share of public social infrastructure expenditure in GDP on labour productivity in the next period



An increase in public social expenditure can lead to an increase in public debt which may have a negative effect on the private investments in the next period. However, as public social expenditure also affects the labour productivity in the next period, which in turn affects the denominator of the public debt/GDP ratio, the overall effect on public debt/GDP may be eased or reversed in the next period.

A higher share of public social expenditure in GDP is expected to increase total employment in the short-run through an increase in output and its direct impact on employment in the social sector (Figure 5). In South Korea, the female employment share is on average significantly larger in H than in N (Table 2). Therefore, higher public social expenditure is expected to reduce the gender employment gap. However, the effect of public social expenditure on female and male employment in the next period depends on the magnitude of its effect on output and labour productivity in the next period. If the effect on labour productivity is smaller than its possible positive effect on output in the next period, total employment increases in the next period.

Figure 5: The summary of the impact of an increase in the share of public social infrastructure expenditure as a share of GDP on total employment in the short-run and in the next period

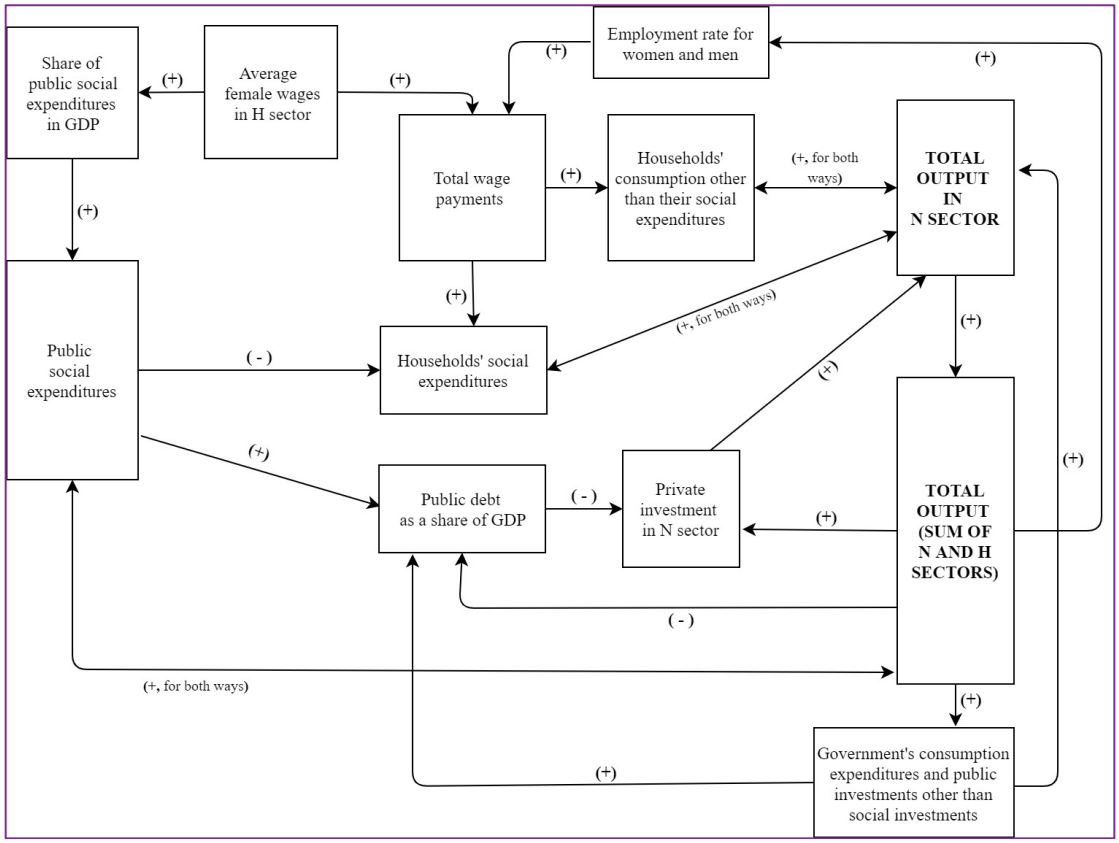


4.2. THE EFFECTS OF CLOSING THE GENDER WAGE GAP IN H ON THE OUTPUT AND EMPLOYMENT

Public social expenditure can also increase through increasing female wages in H with constant employment in H ($E_t^{HF} = E_t^{HF*}$, $E_t^{HM} = E_t^{HM*}$). As Figure 6 shows, the short-run effects of this policy on aggregate output are similar to the case where public social expenditure increases through generating employment in H. The main difference between two policies is that, in the case in which the average female wage rate in H increases, public social expenditure would only have a direct positive impact on female wage bill, whereas in the case where employment in H increases, public social expenditure has a direct positive impact on the wage bill of both female and male workers. Considering that the marginal propensity to consume in H and N is different for men and women, the magnitude of the short-run impact of these different policies on consumption in N and H and hence aggregate output will be different. Following Vogler and Pahl (1994), Lundberg, Pollak, and Wales. (1997), Cappellini, Marilli, and Parsons (2014), Onaran, Oyvat, and Fotopoulou (2019), and Seguino and Floro (2013), we expect the short-run effect of rising female wages in H to be larger on consumption in H for the same amount of an increase in public social expenditure, since the marginal propensity to consume in H is larger for female workers.

The medium-run impact of an increase in the share of public social expenditure in GDP through closing the gender pay gap in H is similar to the case described in Figure 3. An increase in the female wage rate in H affects aggregate output in the next period through productivity and public debt. The impact of closing the gender pay gap in H on productivity would be slightly different, as its short-run effect on aggregate output is different and its short-run effect on private social expenditure is slightly larger.

Figure 6: The short-run effect of the closing gender pay gap in H on total output



5. EMPIRICAL ANALYSIS

5.1 ESTIMATION METHODOLOGY

In this section, we estimate the impact of an increase in the total social infrastructure expenditure, wages and closing the gender pay gap on output and employment of men and women in South Korea using a structural vector autoregression (SVAR) analysis for the period of 1970-2012.

VAR estimations regarding the effect of functional income distribution or wages on output have been applied by Onaran and Stockhammer (2005), Stockhammer and Onaran (2004), Barbosa-Filho and Taylor (2006), Kiefer and Rada (2015), Tavani et al. (2011) and Jump and

Mendieta-Muñoz (2017). The advantage of this approach is that the interaction between the variables can be incorporated and it allows for tracing effects through an entire system rather than analysing one equation at a time. Also, it is more suitable to deal with endogeneity bias. However, using this approach requires a substantial simplification of the model since it cannot handle more than five endogenous variables (Onaran and Galanis, 2014; Onaran and Obst, 2016; Blecker, 2015).

For the purpose of the SVAR analyses, we simplify our model and reduce the number of equations defined in Section 3. We use the total social expenditure (in real terms) rather than only the public social expenditure in line with data availability. Thus, we redefine Y^H as the sum of both public social infrastructure and private household consumption in the social sector as $G^H + C^H$.

The average female and male wages used in the SVAR specification are hourly real wage rates. The other variables in the SVAR specification are total value added (in real terms), and hours of employment of men and women. Our analysis focuses on the value-added, wages and employment in the non-agricultural economy only, as a large part of the agricultural sector might be subsistence farming and highly dominated by self-employed and unpaid family workers. South Korea could be considered as a developing economy for most of the early years of our estimation period and experienced a significant structural transformation during this period (Oyvat, 2014). By focusing on the non-agricultural sector, we aim at reducing the biases due to transformation from the subsistence to the capitalist sector, considering that extra hours worked (or reported) in the subsistence sector might not contribute to extra income for the female and male self-employed.

We first estimate the SVAR model based on the following specification:

$$AX_t = A_0 + A_1 X_{t-1} + A_1 X_{t-2} + e_t \tag{32}$$

which could be written in reduced form as

$$X_t = C_0 + C_1 X_{t-1} + C_1 X_{t-2} + u_t \tag{33}$$

where

$$X_t = \begin{bmatrix} \Delta\log(Y_t^H) \\ \Delta\log(E_t^F) \\ \Delta\log(E_t^M) \\ \Delta\log(w_t^F) \\ \Delta\log(w_t^M) \\ \Delta\log(Y_t) \end{bmatrix} \tag{34}$$

X_t is a 6x1 vector of six variables consisting of the logarithmic change in the total social expenditure ($Y^H = G^H + C^H$), female employment (E^F), male employment (E^M), average

female wage rate (w^F), average male wage rate (w^M), real value-added (Y) (all in the non-agricultural sector) and e_t are structural shocks. From (32) and (33), $Au_t = e_t$ which is

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & a_{26} \\ a_{31} & 0 & 1 & 0 & 0 & a_{36} \\ 0 & a_{42} & 0 & 1 & a_{45} & 0 \\ 0 & 0 & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{pmatrix} \begin{pmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \\ u_5 \\ u_6 \end{pmatrix} = \begin{pmatrix} e_1 \\ e_2 \\ e_3 \\ e_4 \\ e_5 \\ e_6 \end{pmatrix} \quad (35)$$

We use the logarithmic differences of the variables as the Augmented Dickey Fuller tests show that our variables are non-stationary and integrated of order one. We use two lags of the variables based on Final Prediction Error (FPE) criterion. Social expenditure (Y^H) is the most exogenous variable, since the majority of social expenditure is public spending as part of a policy decision in South Korea. An increase in social expenditure generates employment in H for men and women contemporaneously. Female (male) employment has a contemporaneous effect on average female (male) wage rate due to both its effect on bargaining power as well as changes in the sectoral composition of female (male) employment in N and H. In line with equations (11), (12), and (15) in the theoretical model, aggregate non-agricultural value added (Y) has a contemporaneous effect on female and male employment. However, female and male wages have only a lagged impact on employment, which is due to changes in productivity according to the theoretical model[11]. Finally, social expenditure, employment and wage rate of men and women affect output (Y, non-agricultural value-added) contemporaneously. The rest of the interactions in the SVAR specification are through lagged effects of all the variables affecting each other.

5.2 DATA

We use data from the World Klems (2014) database for South Korea, which is available for the period of 1970-2012. The total non-agricultural output (Y) is the total real value added (in millions of Korean Won) in all sectors excluding agriculture, forestry and fishing. The total social expenditure (Y^H) is the sum of real value-added in education, health and social work sectors, and corresponds to both public expenditure and private household consumption in H.

The female and male employment is defined as the total number of hours worked by women and men engaged in the non-agricultural sector (all sectors excluding agriculture, forestry and fishing). Average female wage rate (w^F), average male wage rate (w^M) and average wage rate (w) are average hourly real wage rate in the non-agricultural sector calculated using the total non-agricultural labour compensation (in millions of Korean Won, deflated by the price

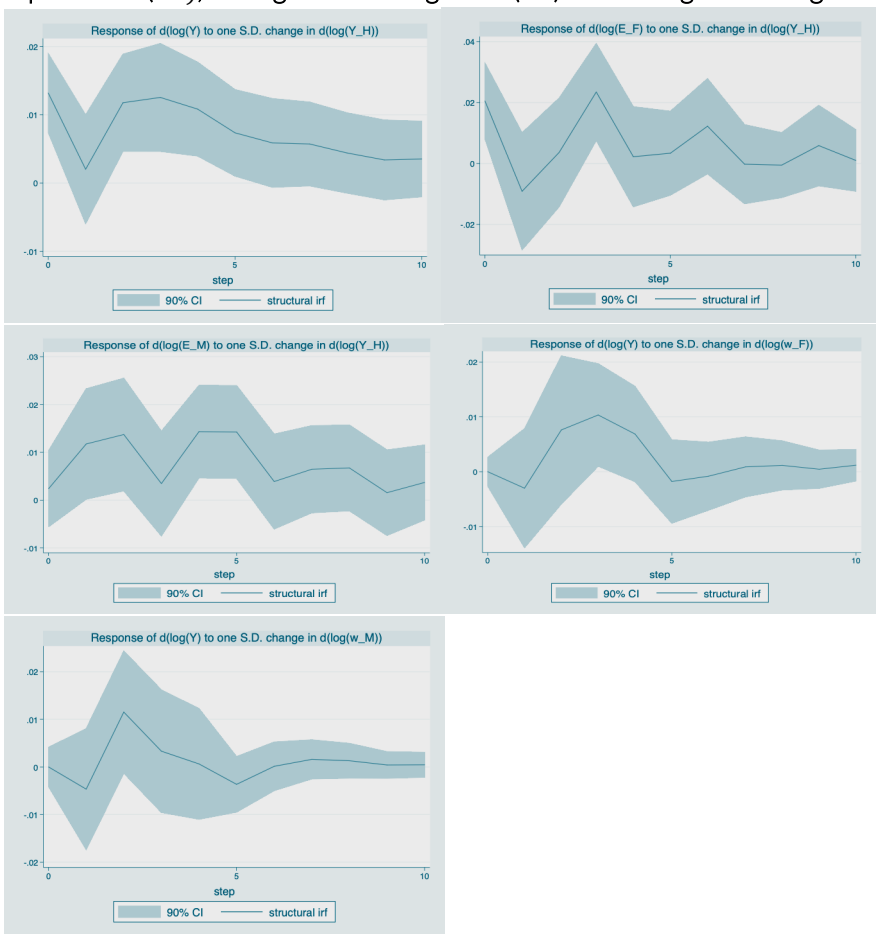
[11] In the theoretical model, an increase in social sector wages (w^H) could also contemporaneously reduce the employment in H (E^H) for a constant public social expenditure. To satisfy the number of required constraints in the SVAR specification, we exclude this possible contemporaneous effect on employment.

index) and hours of employment for female and male workers in the World Klems database. Both labour compensation and hours of employment data are adjusted by the Klems database to account for the labour income and hours of work of the self-employed women and men in the non-agricultural sector.

5.2 ESTIMATION RESULTS

We estimate the impact of social infrastructure expenditure, and female and male wage rates using the SVAR specification following the restrictions defined in equation (35). Figure 7 shows the impact of a one standard deviation increase in social infrastructure expenditure, or female and male wage rates, respectively, on non-agricultural output and employment of men and women over a period of 10 years.

Figure 7: Structural impulse response functions (SIRF) (impact of a standard deviation increase in social expenditure ($\boldsymbol{Y^H}$), average female wage rate ($\boldsymbol{w^F}$) and average male wage rate ($\boldsymbol{w^M}$))

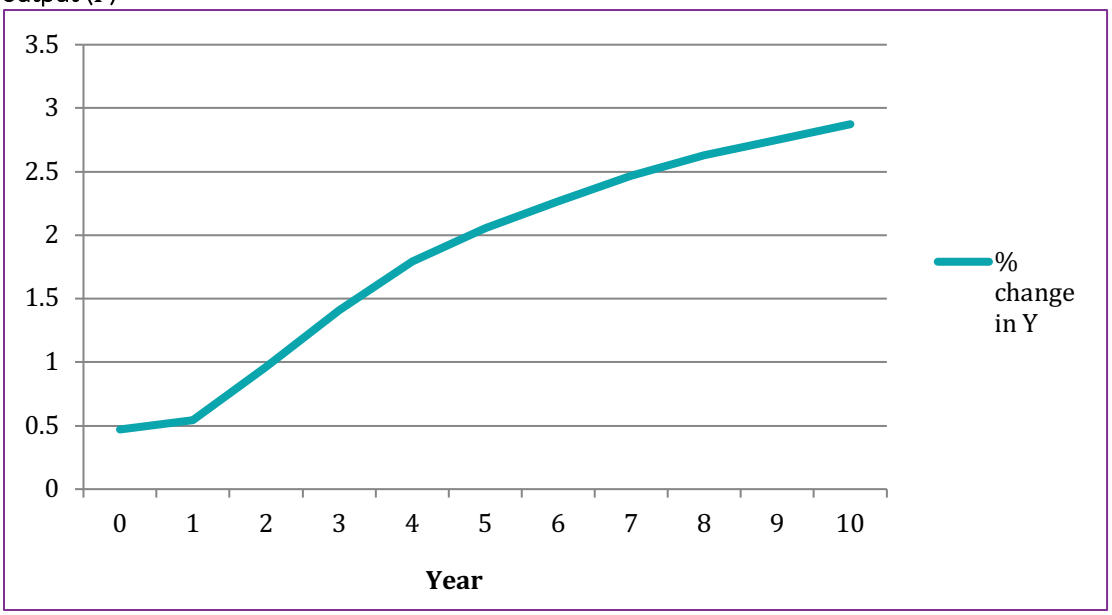


Note: Estimation period: 1970-2012

An increase in social expenditure increases output significantly in the short-run as well as over the 10 years, with significant positive effects in years 2-6. The contemporaneous

short-run impact of an increase in the social expenditure on female employment is positive; however, the effect on male employment is insignificant albeit positive. The impact of social expenditure on female employment is also significantly positive in year 3 and the effect on male employment is also significantly positive in years 1-2 and 4-5.

Figure 8: The cumulative impact of a 1% increase in social expenditure (Y^H) on aggregate non-agricultural output (Y)

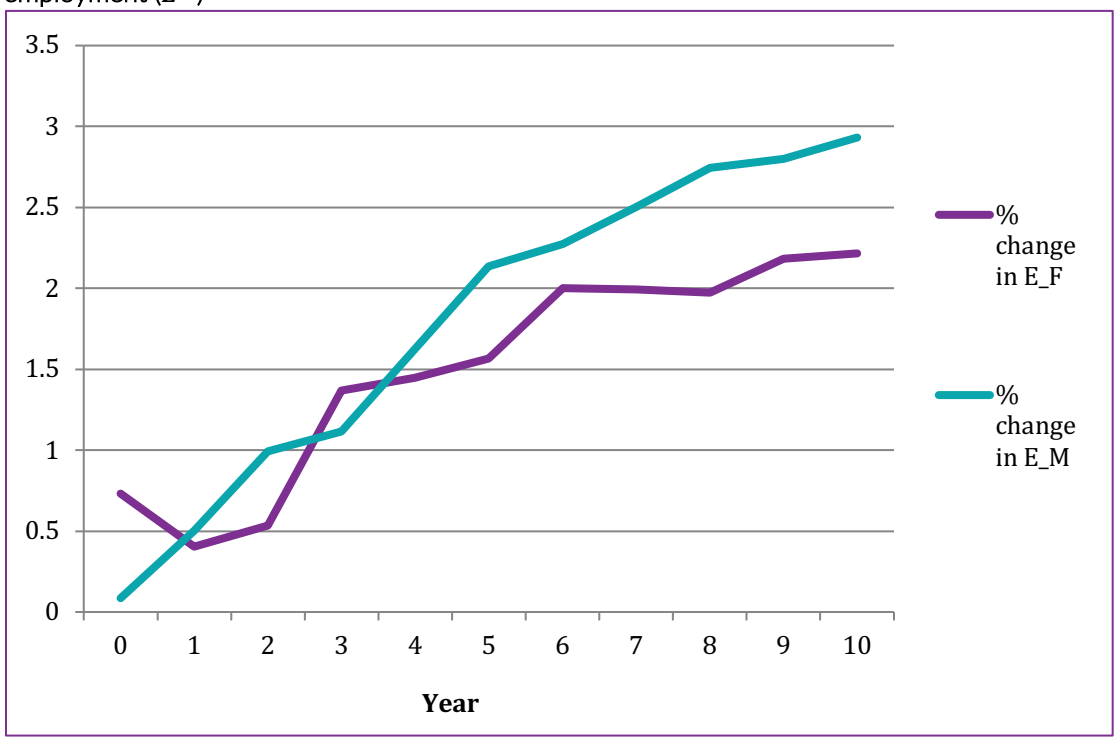


Note: Calculated based on the SIRFs reported in Figure 7.

Based on Figure 7, Figures 8-9 show the cumulative impact of a 1% increase in social expenditure (Y^H) on aggregate non-agricultural output (Y) and female and male employment. A 1% increase in social expenditure increases non-agricultural output by 0.5% contemporaneously, and in total by 2.3% over six years and 2.9% over ten years. A 1% increase in social expenditure increases female and male employment contemporaneously by 0.7% and 0.1% respectively. The short-run impact is larger for female employment as the share of women is substantially higher in the social sector compared to the rest of the non-agricultural sector. A 1% increase in social expenditure increases female and male employment over the ten years by 2.2% and 2.9% respectively.

Figure 10 shows the cumulative impact of a 1% increase in social expenditure (Y^H) on average labour productivity in the non-agricultural sector. A 1% increase in social expenditure increases labour productivity by 0.19% in the same period and by 0.22% over four years.

Figure 9: The cumulative impact of a 1% increase in social expenditure (Y^H) on female (E^F) and male employment (E^M)

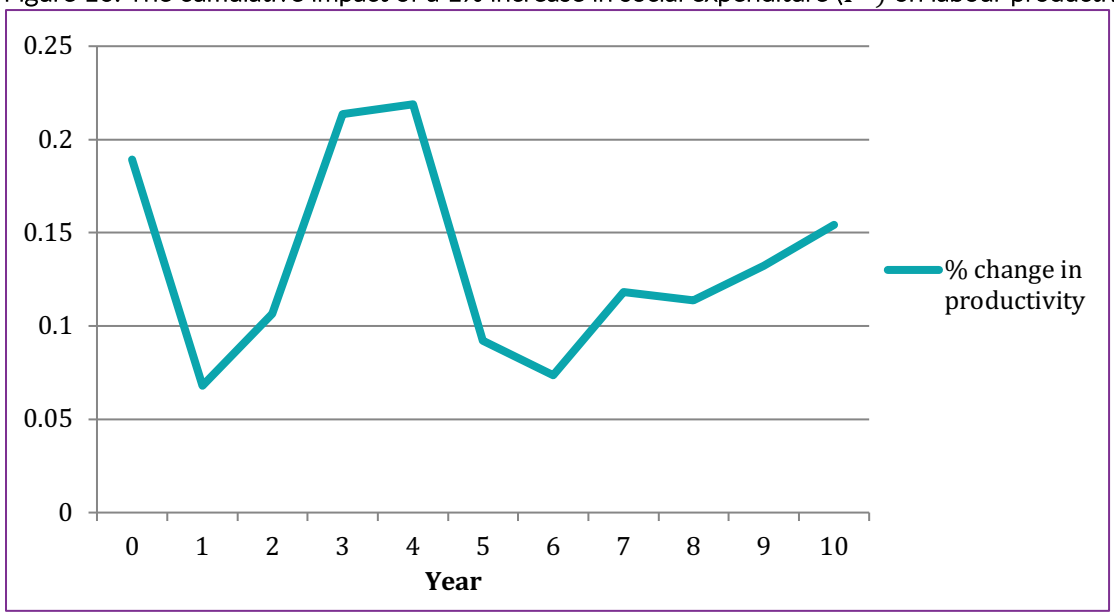


Note: Calculated based on the SIRFs reported in Figure 7.

The results in Figure 7 also show that an increase in the female wage rate has a significant positive effect on output in year 3. Our calculations based on Figure 7 show that a 1% increase in female wages leads to a cumulative increase in output by 0.2% in year 3 and by 0.3% over 10 years. This shows that the South Korean economy is *female wage-led/gender equality-led in the medium-run* following the terminology developed in Onaran, Oyvat and Fotopoulou (2019). An increase in the average male wage rate does not have a significant effect on output in any of the periods, albeit the effect is positive in most periods. The cumulative impact of a 1% increase in the male wage rate on output is 0.2% over 10 years. It is also important to emphasize that higher male wages are not an impediment to growth in South Korea. The results also indicate the importance of improving gender equality as part of equality-led development policy. These results are consistent with previous empirical estimations on the effect of functional income distribution on output in South Korea

(Onaran and Stockhammer, 2005; Onaran and Galanis, 2014; Oyvat, Oztunalı and Elgin, 2020).

Figure 10: The cumulative impact of a 1% increase in social expenditure (Y^H) on labour productivity (7)



Note: Calculated based on the SIRFs reported in Figure 7. Average values of aggregate non-agricultural output, female and male employment are used for calculations.

6. CONCLUSION

In this paper, we analyse the impact of an increase in social infrastructure expenditure, wages and gender equality on output and employment of men and women in South Korea using a post-Kaleckian feminist model, which we estimate using a SVAR model for the period of 1970-2012. We find that higher social infrastructure expenditure has a positive cumulative effect on output as well as female and male employment (hours of work) in the non-agricultural sector in South Korea both in the short-run and medium-run.

The positive effects of higher public spending in education, childcare, health and social care due to higher demand and productivity appear to offset any potentially negative impact due to higher borrowing. The results also show that higher social expenditure leads to significant productivity gains in South Korea.

Finally, our results show that an equitable development path in which both average wages increase and gender gaps close via an upward convergence in the wages of men and women is possible in South Korea. South Korean economy is *female wage-led/gender equality-led*

in the medium-run. Hence overall the economy is equality-led, although the effects are economically small in comparison to the strong effects of social spending, and become insignificant in the medium-run. The results indicate that sustainable equitable development and a substantial increase in employment requires a mix of both labour market and fiscal policies.

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