General Equilibrium theory of Marketization of Services and Skill Premium in India's Non-Agricultural sector *

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Abstract

This study examines the relationship between the marketization of services, the relative supply of skilled labor, and the skill premium in India's non-agricultural sector. We develop a general equilibrium model that predicts the impact of market produced services on skill premium. Our model suggests that an increase in the expenditure share on market produced services by skilled workers in the economy will lead to an increase in the relative supply of skilled workers and a decline in the skill premium in the economy. Furthermore, the model predicts the effects of factors such as education time, higher preferences toward market-produced services, and home productivity on marketization of services and skill premium. Our model helps explain the trends observed using the data from the Periodic Labor Force Survey (PLFS) from 2017-18 to 2023-24 in India's non-agricultural sector. We found that during the period 2017-18 to 2023-24, the relative supply of skilled labor has increased by 19.93% and 26.54% in the service and manufacturing sectors, respectively. On the other hand, the skill premium in the service sector and the manufacturing sector has declined by 2.24% and 14.16%, respectively. During the same period, there was an increase in the percentage of individuals hiring domestic personnel by 29.91%, indicating a higher preference for market-produced services and thus an increase in the marketiza-

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tion of services.

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1 Introduction

The structural transformation in India has taken the form of premature de-industrialization and a rise in service sector growth. With a growth rate of 9.1 percent in the service sector in 2022-23, the sector is a source of strength for India. One factor contributing to this growth is the marketization of home-produced services, which are activities performed by household members for family members. When a service produced at home can be replaced by hiring someone from the market, it is referred to as the marketization of a home-produced service[1]. In this context, the paper examines the impact of higher marketization of home-produced services on labor market outcomes, specifically the supply of working hours by skilled labor relative to unskilled labor and skill premium in the India's non-agricultural sector. Furthermore, we study how factors such as higher preferences towards market produced services, education time, and home productivity impact the marketization of home-produced services and skill premium in the economy.

Our paper contributes to the literature on structural transformation and marketization by providing a unified theory of relative supply and demand that explains the role of market-produced services and other factors in determining the skill premium in the economy. To the best of our knowledge, our paper is the first to examine these linkages in the context of India. Our findings differ from those of Buera and Kaboski (2012), who developed a theoretical model that explained the rise in skill premium with the rising service sector in the US in the post-1950s [2]. However, in the case of India, despite the rise in the service sector, the skill premium declined by 2.24% in the service sector and by 14.16% in the manufacturing sector, from 2017-18 to 2023-24.
As a result, we develop a general equilibrium model in a closed economy setup to understand the impact of market-produced services on skill premium. The model shows that an increase in the expenditure share on market-produced services by skilled workers relative

[1]Hiring someone from the market to cook meals at home is an example of marketization of home produced service, in this case, cooking.

[2]They predicted that with development (that is, productivity improvement in high skill-intensive services), there would be an increase in the demand for market-produced services, leading to higher quantity and higher price of skills. Higher prices of skills would, in turn, lead to a higher supply of skilled labor.

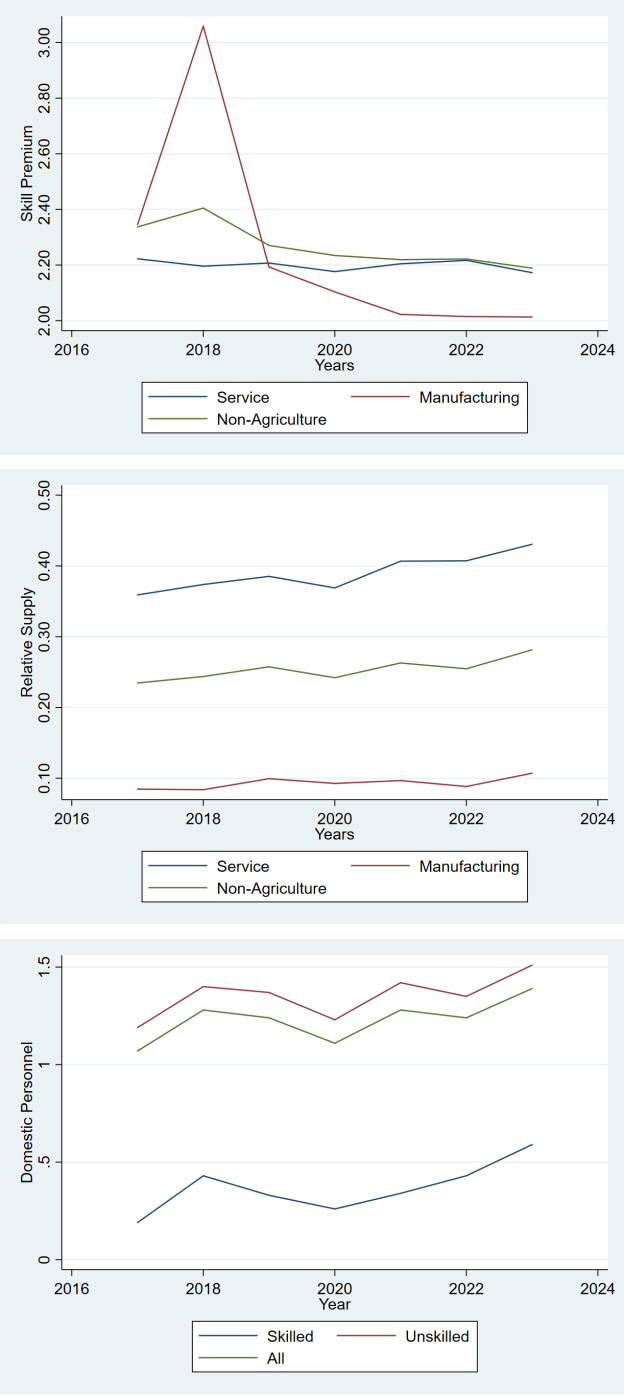
to that of unskilled workers in the economy will lead to a decrease in the skill premium. Furthermore, it predicts that higher preferences of skilled workers towards market produced services and a reduction in education time cause skill premium in the economy to decline. Also, higher home productivity of skilled workers relative to that of unskilled workers will cause an increase in the skill premium in the economy.

Using data from the Periodic Labor Force Survey (PLFS) from 2017-18 to 2023-24, measures of skill premium and the relative supply of skilled labor were constructed for the non-agricultural sector (Manufacturing and Services) in India. The survey data was also used to compute the percentage of individuals hiring domestic personnel[3]. Domestic personnel is considered as an indicator of market produced services for the purpose of our study. We observe that at the All-India level, during the period 2017-18 to 2023-24, the skill premium has declined in both the service and manufacturing sectors which form the non-agricultural sector of the economy. While the decline in the service sector has been of 2.24%, in manufacturing the skill premium has declined by a greater magnitude of 14.16%. Also, the relative supply of skilled labor has increased in the non-agricultural sector. It increased by 19.93% and 26.54% in the service and manufacturing sectors, respectively. Moreover, the percentage of individuals hiring domestic personnel during this period has increased by 29.91%. However, we observe that the increase in the percentage of skilled individuals hiring domestic personnel is much larger than in the case of unskilled individuals. In the case of skilled individuals, this has increased by 210.53% as compared to 26.90% in the case of unskilled individuals. These are shown in Figure 1.

Similar trends were observed across different employment types: self-employment and casual labor. These are shown in Figure 2 and Figure 3. In both the cases, skill premium declined, and relative supply increased in the service, and manufacturing sector. While the skill premium in the non-agricultural sector declined by 5.26% for self-employment, for casual labor this decline was by 4.48 %. Within the service sector, self-employment has the highest increase in the relative supply of skilled labor, 24.90%. However, casual labor showed the highest increase, by 38.83% in the manufacturing sector. In the case of regular workers as well, relative supply increased in both the service and manufacturing sectors by 16.63% and 23.55%, respectively. However, the skill premium declined only in the manufacturing sector. In the case of the service sector, the skill premium increased by 5.77%, as shown in Figure 4. Overall, the direction of change in skill premium and relative supply has been similar in all the cases except for the skill premium for regular

[3]PLFS collects data on activities of households as employers of domestic personnel- housemaid/servant, governess/baby-sitter, cook, tutor, gardener, driver, gatekeeper/chowkidar/watchman and others.

Figure 1: Skill Premium, Relative Supply and Market Produced Services

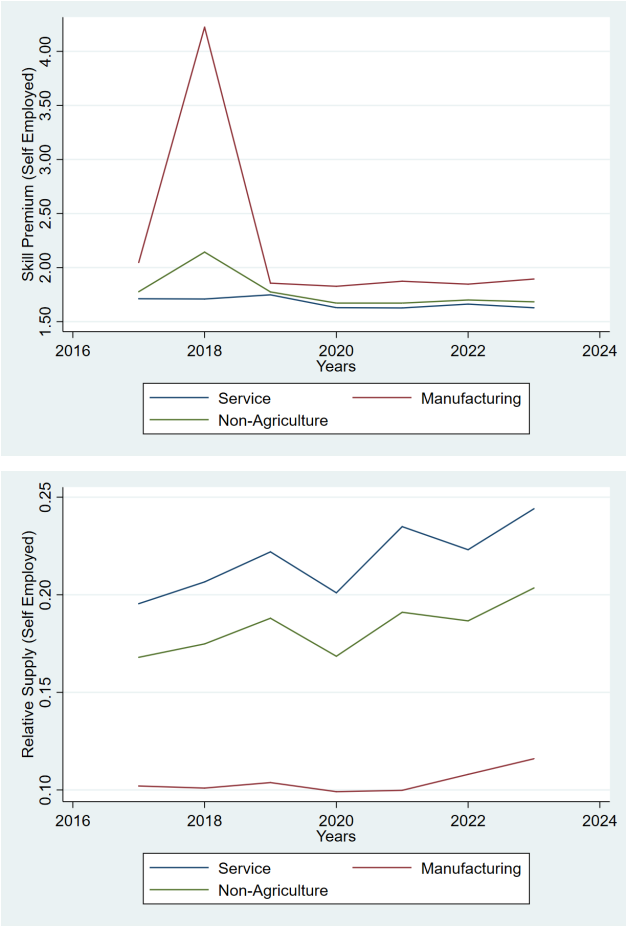


Source: Author's calculations using Periodic Labor Force Survey (PLFS)

workers.

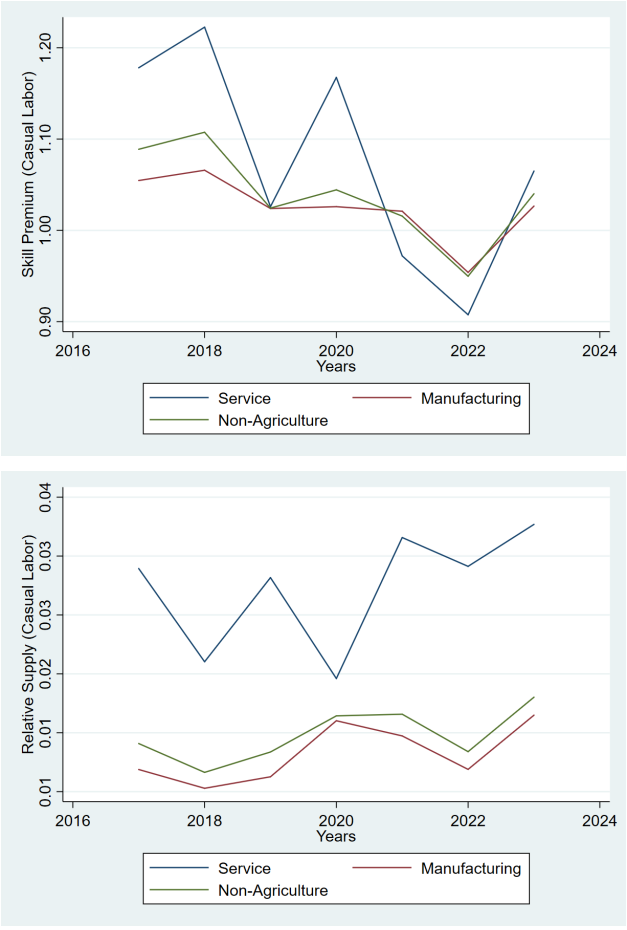
We also observed similar trends across both males and females. As shown in Figure 5, the relative supply of skilled labor increased for both males and females in the service and manufacturing sectors. However, the hours supplied (by skilled and unskilled labor)

Figure 2: Skill Premium and Relative Supply in Self-Employment



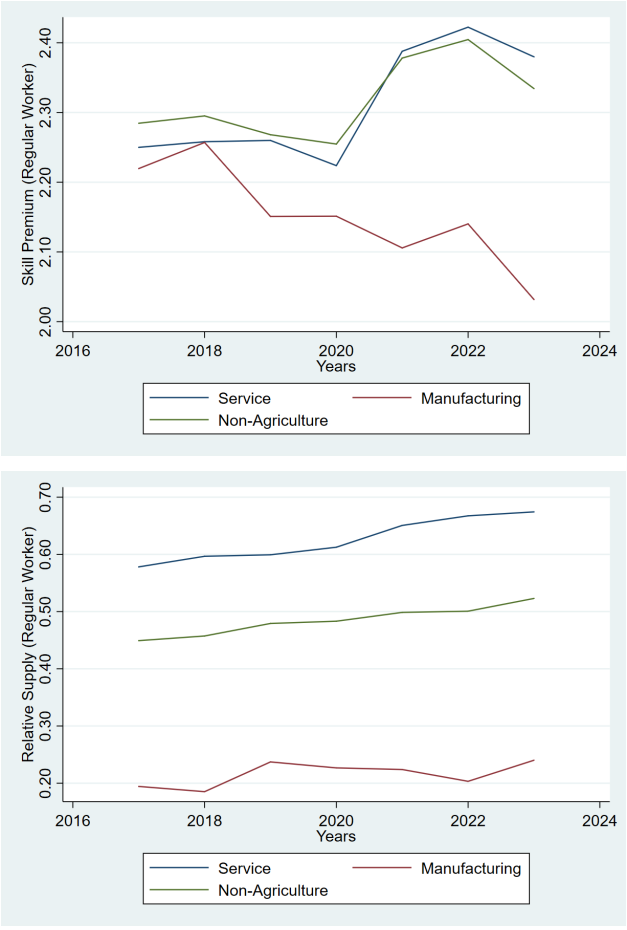
Source: Author's calculations using Periodic Labor Force Survey (PLFS)

Figure 3: Skill Premium and Relative Supply in Casual Labor



Source: Author's calculations using Periodic Labor Force Survey (PLFS)

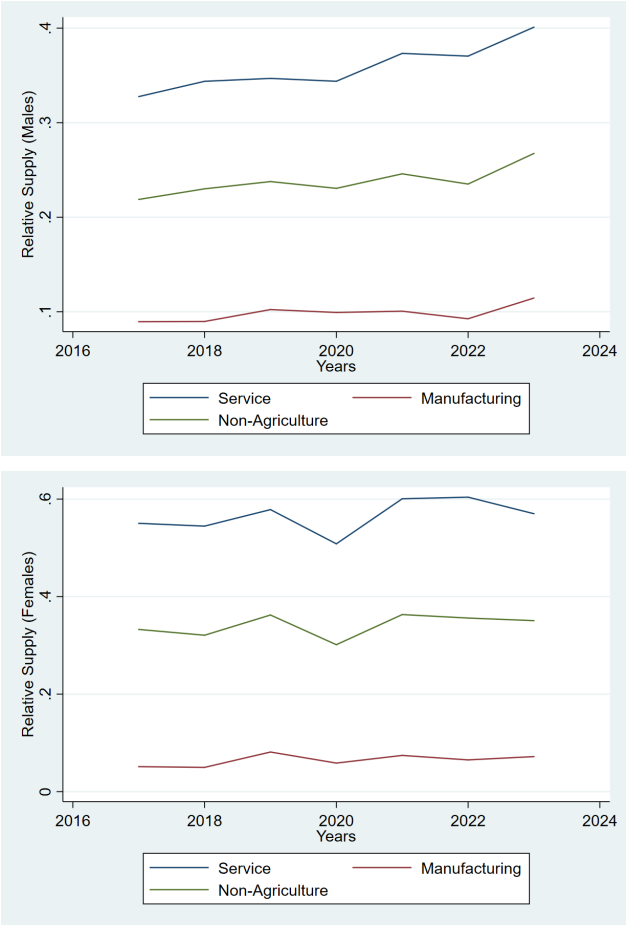
Figure 4: Skill Premium and Relative Supply Regular Worker



Source: Author's calculations using Periodic Labor Force Survey (PLFS)

have increased more in the case of females than for males, indicating that marketization of services may have enabled more females to participate in the labor market. The highest increase in hours supplied was observed in the manufacturing sector for both males and females. While the supply of skilled females increased by 123.18% in manufacturing, that for males increased by 55.30%. The relative supply of males increased by 22.42% in the service sector and 27.91% in manufacturing. In case of females, the relative supply in the service and manufacturing sectors increased by 3.59% and 40.18%, respectively. The skill premium has also declined in the non-agricultural sector for both males and females by 7.80% and 2.87%, respectively. While there has been a decline in the skill premium in both the manufacturing and service sectors for males, the skill premium has increased in the service sector for females by 6.18%. This can be seen in Figure 6

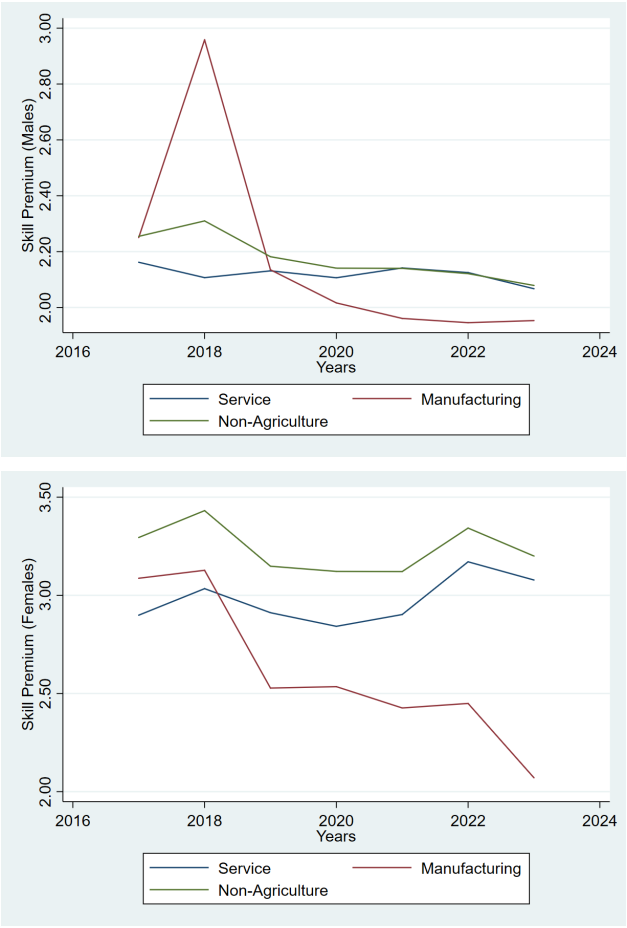
Figure 5: Relative Supply in case of males and females



Source: Author's calculations using Periodic Labor Force Survey (PLFS)

In general, there has been an increase in the relative supply of skilled labor across all sectors, types of employment, and genders. The skill premium has also declined, except for regular workers and females in the service sector.

Figure 6: Skill Premium in case of males and females



Source: Author's calculations using Periodic Labor Force Survey (PLFS)

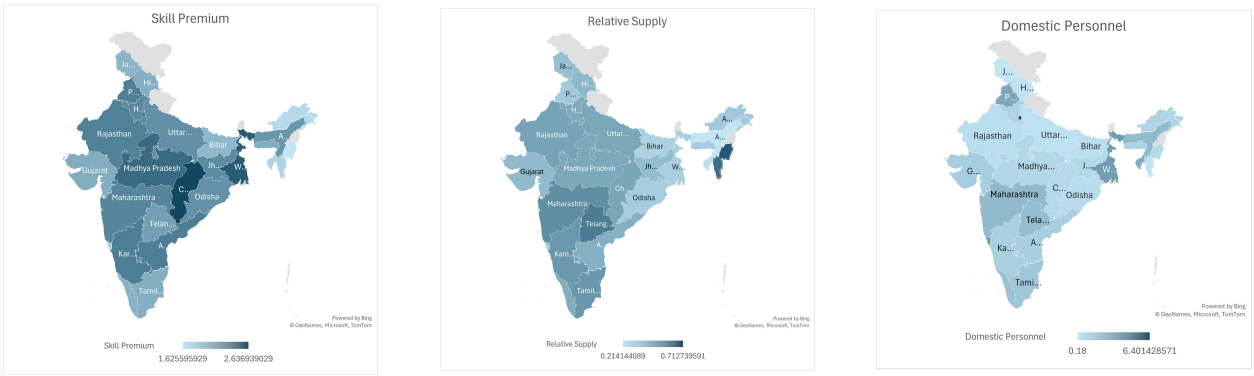
We found variations in skill premium, relative skilled labor supply, and domestic personnel across states [4]. As shown in Figure 7, areas with a high skill premium tend to have a lower relative supply of skilled labor and lower numbers of domestic personnel.

These observations motivated us to explore the linkage between the three variables: skill premium, relative supply of skilled workers and market produced services. This will be crucial in understanding the impact of the rising service sector on skill premium in the Indian economy.

Marketization of home production or services is not a recent phenomenon. Previous studies have discussed it as part of the development process. According to Reid (1934), over time, many home production tasks such as spinning and weaving have been taken over by commercial production. Furthermore, other services provided by household mem-

[4] At state level measures were calculated only for the service sector.

Figure 7: Skill Premium, Relative Supply and Domestic Personnel in States



Source: Author's calculations using Periodic Labor Force Survey (PLFS)

bers, such as child care, education, and caring for the sick, are increasingly being carried out by paid workers. Vanek (1973) notes a shift in household tasks from "maintenance and production" to managerial and interactional tasks. Vanek (1974) also found that more time is now spent on managerial tasks and shopping. Lebergott (2014) suggests that household work now largely consists of services. Locay (1990) discusses the coexistence of home production and market production due to scale economies, alongside the role of development in expanding the range of market production. Moro et al. (2017) shows that a slowdown in home labor productivity was a key factor in the rise of services in the US in the late seventies.

Gollin and Kaboski (2023) have noted in their review paper that transitions between home and market are an important part of structural transformation. Recent studies have explored structural transformation by incorporating the household sector as in Bridgman et al. (2018). Using time-use survey data from 43 countries, they found that with development, hours at the household decrease and those in the market increase. Freeman and Schettkat (2005) studied the effect of marketization on the EU-US employment gap and found that both the rate of employment per adult and the hours worked per employee were lower in the EU than in the US. They attribute this difference to the marketization of home-produced goods and services such as food production and childcare. Their study establishes a strong negative correlation between time spent on work at home and time spent in the market. They also attribute higher labor force participation in the US to lower market prices of goods such as food and childcare.

Furthermore, some studies have examined the impact of marketization on market hours and labor force participation. In their work, Greenwood et al. (2005) developed a household decision model that explains the positive influence of labor-saving household capital on female labor force participation. Dinkelman and Ngai (2021) and Dinkelman

and Ngai (2022) have studied the implications of structural transformation for women's work at home and market. Ngai and Pissarides (2008) use a growth framework to analyze the impact of substitution between home and market-production on supply of working hours and employment shifts across sectors. Their model demonstrates that the dynamics of home production significantly impact working hours in a balanced growth path. The paper also underscores the role of marketization of home production in increasing female employment in the US.

In the paper by Rogerson (2008), a model is developed to analyze time allocation and the decline in working hours in Europe compared to the US. The study finds that the increase in taxes in Europe has restricted the growth of market service sector thereby, impacting the labor market outcomes. De Vries (1994) discuss the rising importance of market production and female labor force participation at the early stages of the Industrial Revolution.

In the study by Ramey (2009), the author estimated the time spent on home production in the US during the twentieth century and found that the time spent on home production did not decrease despite the widespread adoption of modern appliances. The study suggests that these appliances mainly replaced hired household servants rather than reducing the time spent on home production. This contradicts the expectation that modern appliances would free up time from home production and increase labor force participation. In fact, the study concludes that the average time spent on home production changed very little during the twentieth century for all prime-age individuals.

The study by Vanek (1974) also found that the introduction of modern technology did not change the amount of time spent employed women spent at home, but there was a 40 percent rise in the proportion of married women entering into labor force. Another study by Ngai and Pissarides (2011) show that allocation of market hours varied across Japan, Sweden and the Unites States in the health and social work sector. They attributed this variation to different tax and subsidy policies across the countries. They explained that taxation on market goods led to a substitution to home produced goods, provided that substitutes were available. Similarly, subsides on market goods, such as in the health sector, led to less production of goods at home. The rise in female market hours and wages in the US was attributed to marketization by Ngai and Petrongolo (2017) and women having a relative comparative advantage in the service sector, as they are more intensive in "brain" skills, compared to males who are relatively more intensive in "brawn" skills. They also observed that the rise in female hours took place entirely in the service sector. Buera et al. (2022) have developed a two- sector model to analyze the rise in skill premium associated with a structural change biased towards high skill-intensive sectors. They found

that 18 to 24 percent of rise in skill premium in US economy can be attributed to this skill-biased structural change.

The rest of the paper is organized as follows. The next section explains the general equilibrium model. Section 3 discusses the theoretical results from our model. Section 4 discusses the data and empirical findings. Lastly, section 5 provides the conclusion.

2 Theoretical Framework

2.1 Consumers

We consider an economy with θ_E number of skilled workers and θ_U number of unskilled workers. Each individual is assumed to be endowed with Z hours, which is normalized to 1. If an individual chooses to pursue education, their endowed time becomes $1 - T'$, where T' is the exogenously given time on education that an individual needs to spend in order to acquire skills. An individual can allocate their endowment time among market work (t_w) and household work (t_h).

In the economy two types of services are produced: Market produced services and Home produced services. Services such as child care, member care, purchasing of goods and services, meal preparation, and household work can be both produced in market and home. For instance, an individual can prepare a meal at home himself, which would be a home produced service, or he can hire someone to cook a meal, which would be a market produced service.

The individual obtains utility by consuming services produced in the market (M) and services produced at home (H). M denotes the composite of market produced services,x_i;$i \in [1, N]$. Let, P^M denote the price of a unit of M in the market. In order to produce one unit of service at home (that is, one unit of H), an individual needs to spend a_h^j; $j = E$, hours of his time. Hence, the time spent at home to produce H units of services is given by $t_h^j = a_h^j H$. The wages of skilled and unskilled labor are given as W_E and W_U, respectively. Thus, individual's total time spent at work is given by $t_w^j = 1 - T' - a_h^j H$. He spends his labor income $W_j(1 - T' - a_h^j H)$ on consuming market produced services.

A representative individual is assumed to have non-homothetic preferences as given below:

$$U_j = [\alpha_j (M_j + \bar{M}_j)^\rho + (1 - \alpha_j) H_j^\rho]^{\frac{1}{\rho}} \tag{1}$$

Where, $j = E, U$ and $0 < \alpha_j < 1$ Note that under the assumption $\bar{M}_j > 0$, the preferences represented by the above utility function are non-homothetic [5]. The above utility function shows that $\frac{1}{1-\rho}$ is the elasticity of substitution between market and home produced services, where $0 < \rho < 1$.

An individual's (skilled or unskilled) optimal expenditure share on market and home produced services can be derived through a two-stage optimization. In the first stage, the individual maximizes the utility function in Equation (1) subject to his budget constraint. This gives his optimal expenditure on market produced services which will be spent on consuming $x_i; i \in [1, N]$ services. In the second stage, the consumer maximizes his utility over x_i subject to the budget constraint (determined by his expenditure share on market produced services).

Following is the first-stage optimization for a skilled worker:

$$\begin{aligned} \max_{M_E, H_E} \quad & U_E = [\alpha_E (M_E + \bar{M}_E)^\rho + (1 - \alpha_E) H_E^\rho]^{\frac{1}{\rho}} \\ \text{subject to} \quad & W_E[1 - T' - a_h^E H_E] + Y_E = P_M M_E \end{aligned} \tag{2}$$

Where, Y_E is non-labor income of a skilled individual. The budget constraint can be rewritten as: $W_E[1 - T'] + Y_E = P_M M_E + W_E a_h^E H_E$.
Note that, $W_E a_h^E$ can be interpreted as the opportunity cost of producing a unit of H_E. We set up the Lagrangian and derive the following first-order conditions:

$$\max_{M_E, H_E} \quad \mathcal{L} = [\alpha_E (M_E + \bar{M}_E)^\rho + (1 - \alpha_E) H_E^\rho]^{\frac{1}{\rho}} + \lambda_1^E [W_E(1 - T') + Y_E - P_M M_E - W_E a_h^E H_E] \tag{3}$$

$$\frac{\partial \mathcal{L}}{\partial M_E} = \frac{1}{\rho} (U_E)^{\frac{1}{\rho} - 1} (\alpha_E) \rho (M_E + \bar{M}_E)^{\rho - 1} - \lambda_1^E P_M = 0 \tag{4}$$

$$\frac{\partial \mathcal{L}}{\partial H_E} = \frac{1}{\rho} (U_E)^{\frac{1}{\rho} - 1} (1 - \alpha_E) \rho (H_E)^{\rho - 1} - \lambda_1^E W_E a_h^E = 0 \tag{5}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_1^E} = W_E(1 - T') + Y_E - P_M M_E - W_E a_h^E H_E = 0 \tag{6}$$

[5] We follow Buera et al. (2022) in assuming this form of non-homothetic preferences.

Dividing (4) by (5), we get:

$$\begin{aligned} &\frac{\alpha_E}{1-\alpha_E}\left[\frac{H_E}{M_E+\bar{M}_E}\right]^{1-\rho} = \frac{P^M}{W_E a_h^E} \\ &\implies H_E = \left[\frac{P^M}{W_E a_h^E}\left(\frac{1-\alpha_E}{\alpha_E}\right)\right]^{\frac{1}{1-\rho}}[M_E+\bar{M}_E] \end{aligned} \tag{7}$$

Substituting the value of H_E from (7) in (6), we get:

$$\begin{aligned} &M\left[P_M + (W_E a_h^E)^{\frac{-\rho}{1-\rho}} P_M^{\frac{1}{1-\rho}}\left(\frac{1-\alpha_E}{\alpha_E}\right)^{\frac{1}{1-\rho}}\right] = I_E - \bar{M}_E\left[P_M + (W_E a_h^E)^{\frac{-\rho}{1-\rho}} P_M^{\frac{1}{1-\rho}}\left(\frac{1-\alpha_E}{\alpha_E}\right)^{\frac{1}{1-\rho}}\right] \\ &\implies P_M M_E \phi_E = I_E - P_M \bar{M}_E \phi_E \\ &\implies \frac{P_M M_E}{I_E} = \frac{1}{\phi_E} - \frac{P^M \bar{M}_E}{I_E} = \tau_E \end{aligned} \tag{8}$$

Where, $\phi_E = \left[1 + \left(\frac{P_M}{W_E a_h^E}\right)^{\frac{\rho}{1-\rho}}\left(\frac{1-\alpha_E}{\alpha_E}\right)^{\frac{1}{1-\rho}}\right]$ and, I_E is skilled worker's endowment income given by: $I_E = W_E(1-T') + Y_E$. Equation (8) shows that the expenditure share on market produced services (τ_E) is a function of skilled worker's endowment income. Higher the I_E, higher is the expenditure share on market produced services[6].

τ_E is also a function of ϕ_E which in turn is a function of the relative prices of market produced services $\left(\frac{P_M}{W_E a_h^E}\right)$ and relative preference parameter $\left(\frac{1-\alpha_E}{\alpha_E}\right)$. Specifically, higher relative prices of market produced services will increase ϕ_E and reduce τ_E. Similarly, higher preferences towards market produced services relative to the home produced services (that is lower $\left(\frac{1-\alpha_E}{\alpha_E}\right)$) will reduce ϕ_E and increase τ_E. Note that, here α_E is an exogenous parameter in the model. Relative prices and endowment income are determined endogenously within the model. Also, one can observe expenditure share, τ_E being equal to α_E when, $\bar{M}_E = 0$ and $\rho = 0$. Thus, Cobb-Douglas preferences are a special case of these preferences.

Using (6) and $P_M M_E = \tau_E I_E$, we get the expenditure share on home produced services as:

$$\frac{(W_E a_h^E) H_E}{I_E} = 1 - \tau_E \tag{9}$$

[6]Note that if we had $M_j - \bar{M}_j$ in the utility function then expenditure share on market produced services will be decreasing with income which contradicts the real world scenario. Thus, $M_j + \bar{M}_j$ has been used in the utility function.

We now move to the second stage optimization problem of a skilled worker. Here the worker optimally allocates his expenditure on market produced services, that is, $\tau_E I_E$ on consumption of x_i; $i \in [1, N]$. We assume P_i to be the price of a unit of x_i. The optimization problem is given below:

$$\begin{aligned} \max_{x_i^E} \quad & M_E = \left[\sum_{i=1}^{N} (x_i^E)^{\epsilon}\right]^{\frac{1}{\epsilon}} \\ \text{subject to} \quad & \tau_E I_E = \sum_{i=1}^{N} P_i x_i^E \end{aligned} \tag{10}$$

Where, $0 < \epsilon < 1$, measures the elasticity of substitution, $\left(\frac{1}{1-\epsilon}\right)$ between N services. Endowment income, I_E is given by $W_E(1 - T') + Y^E$. Setting up the Lagrangean and deriving the first order conditons:

$$\max_{x_i^E} \quad \mathcal{L} = \left[\sum_{i=1}^{N} (x_i^E)^{\epsilon}\right]^{\frac{1}{\epsilon}} + \lambda_2^E \left[\tau^E I_E - \sum_{i=1}^{N} P_i x_i^E\right] \tag{11}$$

$$\frac{\partial \mathcal{L}}{\partial x_i^E} = \left[\sum_{i=1}^{N} (x_i^E)^{\epsilon}\right]^{\frac{1}{\epsilon}-1} (x_i^E)^{\rho-1} - \lambda_2^E P_i = 0 \tag{12}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_2^E} = \tau^E I_E - \sum_{i=1}^{N} P_i x_i^E = 0 \tag{13}$$

Equation (12) can be rewritten as:

$$\begin{aligned} & \frac{\left[\sum_{i=1}^{N} (x_i^E)^{\epsilon}\right]^{\frac{1}{\epsilon}}}{\sum_{i=1}^{N} (x_i^E)^{\epsilon}} (x_i^E)^{\rho-1} = \lambda_2^E P_i \\ \implies & \frac{M^E}{(M_E)^{\rho}} (x_i^E)^{\rho-1} = \lambda_2^E P_i \\ \implies & x_i^E = (\lambda_2^E P_i)^{\frac{1}{\rho-1}} M^E \end{aligned} \tag{14}$$

We substitute the value of x_i^E obtained in equation (14) in (13) to obtain the value of

λ_2^E as:

$$(\lambda_2^E)^{\frac{1}{\rho-1}} = \frac{\tau_E I_E}{M_E \sum_{i=1}^{N} P_i^{\frac{\rho}{\rho-1}}} \tag{15}$$

Substituting λ_2^E from the above in (14), we obtain optimal demand for x_i^E:

$$\begin{aligned} x_i^E &= \left[\frac{\tau_E I_E}{\sum_{i=1}^{N} P_i^{\frac{\rho}{\rho-1}}}\right] P_i^{\frac{1}{\rho-1}} \\ \implies x_i^E &= \frac{\tau_E I_E}{P_x} \end{aligned} \tag{16}$$

Where, $P_x = \frac{\sum_{i=1}^{N} P_i^{\frac{\rho}{\rho-1}}}{P_i^{\frac{1}{\rho-1}}}$.

We can rewrite equation (16) as:

$$\begin{aligned} \sum_{i=1}^{N} (x_i^E)^\rho &= \left[\frac{\tau_E I_E}{\sum_{i=1}^{N} P_i^{\frac{\rho}{\rho-1}}}\right]^\rho \sum_{i=1}^{N} P_i^{\frac{\rho}{\rho-1}} \\ \implies M_E &= \frac{\tau_E I_E}{[\sum_{i=1}^{N} P_i^{\frac{\rho}{\rho-1}}]^{\frac{\rho-1}{\rho}}} \end{aligned} \tag{17}$$

Note that the last expression in Equation (17) is the same as we get from (8), where $P_M = [\sum_{i=1}^{N} P_i^{\frac{\rho}{\rho-1}}]^{\frac{\rho-1}{\rho}}$.

We repeat the same steps as above to find the optimal expenditure share for an unskilled worker. Following is the first-stage optimization of an unskilled worker:

$$\begin{aligned} \max_{M_u, H_u} \quad & U_u = [\alpha_u (M_u + \bar{M_u})^\rho + (1-\alpha_u) H_u^\rho]^{\frac{1}{\rho}} \\ \text{subject to} \quad & W_u[1 - a_h^u H_u] + Y_u = P_M M_u \end{aligned} \tag{18}$$

Where, Y_u is non-labor income of an unskilled individual. The budget constraint can be rewritten as: $W_u + Y_u = P_M M_u + W_u a_h^u H_u$.
Note that, $W_u a_h^u$ denotes the opportunity cost of producing a unit of H_u. Also, an unskilled worker doesn't spend time on acquiring education. Thus, his total time spent at work is the time left after spending time on home production.

We set up the Lagrangian and derive the following first-order conditions:

$$\max_{M_u, H_u} \quad \mathcal{L} = [\alpha_u (M_u + \bar{M_u})^\rho + (1-\alpha_u) H_u^\rho]^{\frac{1}{\rho}} + \lambda_1^u [W_u + Y_u - P_M M_u - W_u a_h^u H_u] \tag{19}$$

$$\frac{\partial \mathcal{L}}{\partial M_u} = \frac{1}{\rho}(U_u)^{\frac{1}{\rho}-1}(\alpha_u)\rho(M_u + \bar{M_u})^{\rho-1} - \lambda_1^u P_M = 0 \tag{20}$$

$$\frac{\partial \mathcal{L}}{\partial H_u} = \frac{1}{\rho}(U_u)^{\frac{1}{\rho}-1}(1-\alpha_u)\rho(H_u)^{\rho-1} - \lambda_1^u W_u a_h^u = 0 \tag{21}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_1^u} = W_u + Y_u - P_M M_u - W_u a_h^u H_u = 0 \tag{22}$$

Dividing (20) by (21), we get:

$$\begin{aligned} &\frac{\alpha_u}{1-\alpha_u}\left[\frac{H_u}{M_u + \bar{M_u}}\right]^{1-\rho} = \frac{P^M}{W_u a_h^u} \\ &\implies H_u = \left[\frac{P^M}{W_u a_h^u}\left(\frac{1-\alpha_u}{\alpha_u}\right)\right]^{\frac{1}{1-\rho}}[M_u + \bar{M_u}] \end{aligned} \tag{23}$$

Substituting the value of H_u from (23) in (22), we get:

$$\begin{aligned} &M\left[P_M + (W_u a_h^u)^{\frac{-\rho}{1-\rho}} P_M^{\frac{1}{1-\rho}}\left(\frac{1-\alpha_u}{\alpha_u}\right)^{\frac{1}{1-\rho}}\right] = I_u - \bar{M_u}\left[P_M + (W_u a_h^u)^{\frac{-\rho}{1-\rho}} P_M^{\frac{1}{1-\rho}}\left(\frac{1-\alpha_u}{\alpha_u}\right)^{\frac{1}{1-\rho}}\right] \\ &\implies P_M M_u \phi_u = I_u - P_M \bar{M_u}\phi_u \\ &\implies \frac{P_M M_u}{I_u} = \frac{1}{\phi_u} - \frac{P^M \bar{M_u}}{I_u} = \tau_u \end{aligned} \tag{24}$$

Where, $\phi_u = \left[1 + \left(\frac{P_M}{W_u a_h^u}\right)^{\frac{\rho}{1-\rho}}\left(\frac{1-\alpha_u}{\alpha_u}\right)^{\frac{1}{1-\rho}}\right]$ and, I_u is unskilled worker's endowment income given by: $I_u = W_u + Y_u$. The interpretation of the parameters affecting τ_u and ϕ_u remains same as in case of the skilled worker.

Using (22) and $P_M M_u = \tau_u I_u$, we get the expenditure share on home produced services as:

$$\frac{(W_u a_h^u)H_u}{I_u} = 1 - \tau_u \tag{25}$$

We now move to the second stage optimization problem of an unskilled worker.

$$\begin{aligned} \max_{x_i^u} \quad & M_u = \left[\sum_{i=1}^{N}(x_i^u)^{\epsilon}\right]^{\frac{1}{\epsilon}} \\ \text{subject to} \quad & \tau_u I_u = \sum_{i=1}^{N} P_i x_i^u \end{aligned} \tag{26}$$

Where, $0 < \epsilon < 1$, measures the elasticity of substitution, $\left(\frac{1}{1-\epsilon}\right)$ between N services. Endowment income, I_u is given by $W_u + Y^u$. Setting up the Lagrangean and deriving the first order conditons:

$$\max_{x_i^u} \quad \mathcal{L} = \left[\sum_{i=1}^{N}(x_i^u)^{\epsilon}\right]^{\frac{1}{\epsilon}} + \lambda_2^u \left[\tau^u I_u - \sum_{i=1}^{N} P_i x_i^u\right] \tag{27}$$

$$\frac{\partial \mathcal{L}}{\partial x_i^u} = \left[\sum_{i=1}^{N}(x_i^u)^{\epsilon}\right]^{\frac{1}{\epsilon}-1} (x_i^u)^{\rho-1} - \lambda_2^u P_i = 0 \tag{28}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_2^u} = \tau^u I_u - \sum_{i=1}^{N} P_i x_i^u = 0 \tag{29}$$

Equation (28) can be rewritten as:

$$\begin{aligned} & \frac{\left[\sum_{i=1}^{N}(x_i^u)^{\epsilon}\right]^{\frac{1}{\epsilon}}}{\sum_{i=1}^{N}(x_i^u)^{\epsilon}}(x_i^u)^{\rho-1} = \lambda_2^u P_i \\ \implies & \frac{M^u}{(M_u)^{\rho}}(x_i^u)^{\rho-1} = \lambda_2^u P_i \\ \implies & x_i^u = (\lambda_2^u P_i)^{\frac{1}{\rho-1}} M^u \end{aligned} \tag{30}$$

We substitute the value of x_i^u obtained in equation (30) in (29) to obtain the value of λ_2^u as:

$$(\lambda_2^u)^{\frac{1}{\rho-1}} = \frac{\tau_u I_u}{M_u \sum_{i=1}^{N} P_i^{\frac{\rho}{\rho-1}}} \tag{31}$$

Substituting λ_2^u from the above in (30), we obtain optimal demand for x_i^u:

$$\begin{aligned} x_i^u &= \left[\frac{\tau_u I_u}{\sum_{i=1}^N P_i^{\frac{\rho}{\rho-1}}}\right] P_i^{\frac{1}{\rho-1}} \\ \implies x_i^u &= \frac{\tau_u I_u}{P_x} \end{aligned} \tag{32}$$

Where, $P_x = \frac{\sum_{i=1}^N P_i^{\frac{\rho}{\rho-1}}}{P_i^{\frac{1}{\rho-1}}}$.

We can rewrite equation (32) as:

$$\begin{aligned} \sum_{i=1}^N (x_i^u)^\rho &= \left[\frac{\tau_u I_u}{\sum_{i=1}^N P_i^{\frac{\rho}{\rho-1}}}\right]^\rho \sum_{i=1}^N P_i^{\frac{\rho}{\rho-1}} \\ \implies M_u &= \frac{\tau_u I_u}{[\sum_{i=1}^N P_i^{\frac{\rho}{\rho-1}}]^{\frac{\rho-1}{\rho}}} \end{aligned} \tag{33}$$

In the next subsection we discuss the production side of the economy.

2.2 Producers

In a market N differentiated services are being produced denoted by $x_i; i \in [1, N]$. Each of the i^{th} service market is assumed to be perfectly competitive. Further, each i^{th} service is assumed to be produced according to the following Cobb-Douglas production function:

$$x_i = A_i (E_i)^\beta (u_i)^{1-\beta} \tag{34}$$

Where, $0 < \beta < 1$ and A_i denotes the total factor productivity of an i^{th} service. E_i and u_i are the total hours of skilled and unskilled labor, respectively, used in the production of the i^{th} service. Through the following cost minimization exercise we obtain the optimal demand functions for skilled and unskilled labor:

$$\begin{aligned} \min_{E_i, u_i} \quad & C_i = W_E E_i + W_u u_i \\ \text{subject to} \quad & \bar{x_i} = A_i (E_i)^\beta (u_i)^{1-\beta} \end{aligned} \tag{35}$$

On setting up the Lagrangean, we get the following first order conditions:

$$\frac{\partial \mathcal{L}}{\partial E_i} = W_E - \lambda_i A_i \beta (E_i)^{\beta-1} (u_i)^{1-\beta} = 0 \tag{36}$$

$$\frac{\partial \mathcal{L}}{\partial u_i} = W_u - \lambda_i A_i (1-\beta) (E_i)^\beta (u_i)^{-\beta} = 0 \tag{37}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_i} = \bar{x_i} - A_i(E_i)^{\beta} - (u_i)^{1-\beta} = 0 \tag{38}$$

Using (36) and (37), we obtain the following input demand functions:

$$E_i = \frac{\lambda_i \beta x_i}{W_E} \tag{39}$$

$$u_i = \frac{\lambda_i (1-\beta) x_i}{W_u} \tag{40}$$

Substituting (39) and (40) into the cost function defined in (35), we get the following optimal cost function:

$$C_i = \lambda_i x_i \tag{41}$$

Now we substitute the input demands from (39) and (40) into (36) to obtain the value of λ_i as:

$$\lambda_i = \frac{W_E^{\beta} W_u^{1-\beta}}{A_i \beta^{\beta} (1-\beta)^{1-\beta}} \tag{42}$$

Profit maximization gives:

$$P_i = MC = \frac{\partial C_i}{\partial x_i} = \lambda_i \tag{43}$$

Where, MC is the marginal cost that can be obtained from (41).

Substituting the value of λ_i from (42) and $x_i = 1$ into the optimal demand functions in (39) and (40), we obtain the following unit labor requirements for skilled and unskilled, respectively:

$$a_E(i) = \left(\frac{W_u}{W_E}\right)^{1-\beta} \frac{1}{A_i} \left[\frac{\beta}{1-\beta}\right]^{1-\beta} \tag{44}$$

$$a_u(i) = \left(\frac{W_E}{W_u}\right)^{\beta} \frac{1}{A_i} \left[\frac{1-\beta}{\beta}\right]^{\beta} \tag{45}$$

2.3 Equilibrium Skill Premium

In this section, we will derive the relative demand and relative supply of skilled labor to determine the equilibrium value of skill premium.

The Relative demand curve is defined as the demand for skilled labor relative to that of demand for unskilled labor. The demand for skilled workers and unskilled workers will be determined by the amount of market services demanded by the consumers and their unit labor requirements. Thus, relative demand curve of skilled labor will be given by the following equation:

$$RD = \frac{\sum_{i=1}^{N} a_E(i)(\theta_E x_i^E) + \sum_{i=1}^{N} a_E(i)(\theta_u x_i^u)}{\sum_{i=1}^{N} a_u(i)(\theta_E x_i^E) + \sum_{i=1}^{N} a_u(i)(\theta_u x_i^u)} \tag{46}$$

Here, the numerator represents the total demand for skilled workers required to produce aggregate market produced services demanded by all the skilled and unskilled labor. Similarly, the denominator represents the demand for unskilled labor required to produce the aggregate demand of market produced services by all the workers in the economy.

Substituting the optimal demand of x_i^j from equations (16) and (32), and unit labor requirements ($a_j(i)$) from equations (44) and (45) into the above relative demand curve equation , we get:

$$RD = \frac{\sum_{i=1}^{N} \left[\left(\frac{W_u}{W_E}\right)^{1-\beta} \frac{1}{A_i} \left[\frac{\beta}{1-\beta}\right]^{1-\beta}\right] (\theta_E) \left[\frac{\tau_E I_E}{P_x}\right] + \sum_{i=1}^{N} \left[\left(\frac{W_u}{W_E}\right)^{1-\beta} \frac{1}{A_i} \left[\frac{\beta}{1-\beta}\right]^{1-\beta}\right] (\theta_u) \left[\frac{\tau_u I_u}{P_x}\right]}{\sum_{i=1}^{N} \left[\left(\frac{W_E}{W_u}\right)^{\beta} \frac{1}{A_i} \left[\frac{1-\beta}{\beta}\right]^{\beta}\right] (\theta_E) \left[\frac{\tau_E I_E}{P_x}\right] + \sum_{i=1}^{N} \left[\left(\frac{W_E}{W_u}\right)^{\beta} \frac{1}{A_i} \left[\frac{1-\beta}{\beta}\right]^{\beta}\right] (\theta_u) \left[\frac{\tau_u I_u}{P_x}\right]} \tag{47}$$

The above relative demand curve can be rewritten as:

$$\begin{aligned} RD &= \frac{\left[\left(\frac{W_u}{W_E}\right)^{1-\beta} \left[\frac{\beta}{1-\beta}\right]^{1-\beta}\right] \left[\sum_{i=1}^{N} \frac{1}{A_i}(\theta_E) \left[\frac{\tau_E I_E}{P_x}\right] + \sum_{i=1}^{N} \frac{1}{A_i}(\theta_u) \left[\frac{\tau_u I_u}{P_x}\right]\right]}{\left[\left(\frac{W_E}{W_u}\right)^{\beta} \left[\frac{1-\beta}{\beta}\right]^{\beta}\right] \left[\sum_{i=1}^{N} \frac{1}{A_i}(\theta_E) \left[\frac{\tau_E I_E}{P_x}\right] + \sum_{i=1}^{N} \frac{1}{A_i}(\theta_u) \left[\frac{\tau_u I_u}{P_x}\right]\right]} \\ \implies RD &= \frac{1}{W} \frac{\beta}{1-\beta} \end{aligned} \tag{48}$$

We observe from the above relative demand curve equation that higher skill premium ($W = \frac{W_E}{W_u}$) reduces the relative demand of skilled workers as they are not relatively more costly. Also, higher β increases the relative demand of skilled workers.

The relative supply of skilled labor is determined by the total supply of working hours by all the skilled workers in the economy, relative to the total supply of working hours by unskilled workers in the economy. This is given by:

$$
\begin{aligned}
RS &= \frac{\theta_E t_w^E}{\theta_u t_w^u} \\
&= \frac{\theta_E}{\theta_u}\left[\frac{1-T'-a_h^E H_E}{1-a_h^u H_u}\right]
\end{aligned}
\tag{49}
$$

Substituting the value $a_h^E H_E$ and $a_h^u H_u$ from equations (9) and (25) in the above , we get:

$$
RS = \frac{\theta_E}{\theta_u}\left[\frac{1-T'-\frac{(1-\tau_E)I_E}{W_E}}{1-\frac{(1-\tau_u)I_u}{W_u}}\right] \tag{50}
$$

Substituting the actual values of I_E and I_u, we can rewrite relative supply curve as:

$$
RS = \frac{\theta_E}{\theta_u}\left[\frac{1-T'-\frac{(1-\tau_E)(W_E(1-T')+Y_E)}{W_E}}{1-\frac{(1-\tau_u)(W_u+Y_u)}{W_u}}\right] \tag{51}
$$

From Equation (51), we observe that a higher skill premium ($W = \frac{W_E}{W_u}$) leads to a reduction in time spent in home production and hence, increases the relative supply of hours by skilled workers. Furthermore, a higher share of expenditure on services produced on the market by skilled workers (τ_E) compared to that of unskilled workers (τ_u) reduces the demand for services produced at home and therefore the time spent on home production. This leads to a higher relative supply of skilled workers' hours. Moreover, reduction in education time (T^{prime}), increases the time spent at work by the skilled workers, and hence the relative supply of skilled workers' hours.

The equilibrium skill premium ($W = \frac{W_E}{W_u}$) will be determined by the interaction of relative demand and relative supply of skilled labor. In other words, the skill premium is determined by equating the equation of the relative demand curve in (48) with the relative supply curve equation in (51):

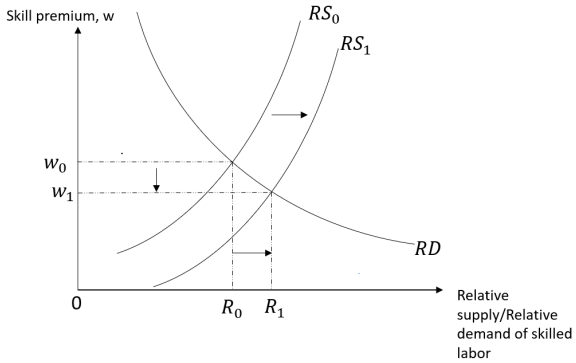
$$
\frac{1}{W}\frac{\beta}{1-\beta} = \frac{\theta_E}{\theta_u}\left[\frac{1-T'-\frac{(1-\tau_E)(W_E(1-T')+Y_E)}{W_E}}{1-\frac{(1-\tau_u)(W_u+Y_u)}{W_u}}\right] \tag{52}
$$

3 Results

Proposition 1:a. The increase in the expenditure share of market produced by skilled workers will decrease the skill premium. b. The increase in the expenditure share of market produced by unskilled workers will increase the skill premium.

An exogenous rise in the share of expenditure on market produced services by skilled workers implies a rise in τ_E. As can be seen from equation (51), the rise in τ_E will reduce

Figure 8: Impact of Rise in Market Produced Services Expenditure Share on Skill Premium



the expenditure share on home produced services. This in turn will lead to reduction in time spent on home production. Thus, leading to increase in the working hours supplied by the skilled workers in the economy. This can be seen mathematically below:

We use equation (51), to derive the derivative of relative supply with respect to τ_E.

Log Linearizing equation (51), we get:

$$ln(RS) = ln\left(\frac{\theta_E}{\theta_u}\right) + ln\left[\frac{1 - T' - \frac{(1-\tau_E)(W_E(1-T')+Y_E)}{W_E}}{1 - \frac{(1-\tau_u)(W_u+Y_u)}{W_u}}\right] \tag{53}$$

Let, $G = \frac{1-T'-\frac{(1-\tau_E)(W_E(1-T')+Y_E)}{W_E}}{1-\frac{(1-\tau_u)(W_u+Y_u)}{W_u}}$; $G_1 = 1 - T' - \frac{(1-\tau_E)(W_E(1-T')+Y_E)}{W_E}$ and $G_2 = 1 - \frac{(1-\tau_u)(W_u+Y_u)}{W_u}$. Upon differentiating the above equation with respect to τ_E, we get:

$$\begin{aligned} \frac{1}{RS}\frac{\partial RS}{\partial \tau_E} &= \frac{1}{G}\frac{1}{G_2}\left[(1-T') + \frac{Y_E}{W_E}\right] \\ \implies \frac{\partial RS}{\partial \tau_E} &= RS\frac{1}{G}\frac{1}{G_2}\left[(1-T') + \frac{Y_E}{W_E}\right] > 0 \end{aligned} \tag{54}$$

This will result in the rightward shift in the relative supply curve of skilled labor (as shown in the Figure 8). There will be no change in relative demand curve (as can be seen from equation (48)). The excess relative supply of skilled workers at a given skill premium leads to reduction in the skill premium. Note that, this reduction in skill premium induces a higher relative demand of skilled labor by the producers. The skill premium continues to fall till relative demand equates with the new increased relative supply of skilled workers.

By the same argument, rise in τ_u will lead to increase in the working hours supplied by the unskilled workers in the economy. This can bee seen below:

We differentiate equation (53) with respect to τ_u, we get:

$$\begin{aligned} \frac{1}{RS}\frac{\partial RS}{\partial \tau_u} &= \frac{G_1}{G}\left[\frac{-1}{G_2^2}\right]\left[1+\frac{Y_u}{W_u}\right] \\ \implies \frac{\partial RS}{\partial \tau_E} &= -(RS)\frac{G_1}{G}\left[\frac{1}{G_2^2}\right]\left[(1+\frac{Y_u}{W_u}\right] < 0 \end{aligned} \tag{55}$$

Thus, relative supply curve shifts leftwards resulting into an increase in the skill premium.

Proposition 2: The reduction in education time will decrease the skill premium in the economy.
We can observe from equation (48) that the reduction in education time has no impact on the relative demand curve. However, it impacts the relative supply of skilled labor through two channels ((51)). Firstly, it increases the time spent at work through its direct impact on the skilled worker's endowment time (that is, the increase in $1-T'$). Secondly, from equation (8), we observe that increase in $1-T'$ leads to higher endowment income (that is I_E) and thus, a rise in expenditure share on market produced services by skilled workers. As discussed in the proposition 1, this will lead to higher time spent at work and thus, higher relative supply of skilled workers in the economy. Upon differentiating equation (53) with respect to T', we get:

$$\begin{aligned} \frac{1}{RS}\frac{\partial RS}{\partial T'} &= \frac{1}{G}\frac{1}{G_2}\frac{\partial G_1}{\partial T'} \\ \implies \frac{\partial RS}{\partial T'} &= \frac{RS}{G}\frac{1}{G_2}\left[-\tau_E - [W_E(1-T')]\left[\frac{P_M \bar{M}_E W_E}{I_E^2}\right]\right] < 0 \end{aligned} \tag{56}$$

Thus, both the effects lead to increase in relative supply curve of skilled workers in the economy leading to a reduction in the skill premium.

Proposition 3: a. The increase in preferences of skilled workers towards the market produced services will decrease the skill premium in the economy. b. The increase in preferences of unskilled workers towards the market produced services will increase the skill premium in the economy.

We observe from the expenditure share on market produced services by the skilled workers in (8), that higher preferences of skilled workers towards market produced services, that is, α_E will decrease ϕ_E and thus, increase the expenditure share on market produced services by skilled workers. Upon differentiating equation (53) with respect to

α_E, we get:

$$\frac{1}{RS}\frac{\partial RS}{\partial \alpha_E} = \frac{1}{G}\frac{1}{G_2}\left[(1-T') + \frac{Y_E}{W_E}\right]\frac{\partial \tau_E}{\partial \alpha_E}$$
$$\implies \frac{\partial RS}{\partial \alpha_E} = \frac{RS}{G}\frac{1}{G_2}\left[(1-T') + \frac{Y_E}{W_E}\right]\frac{-1}{\phi_E^2}\left(\frac{P_M}{W_E a_h^E}\right)^{\frac{\rho}{1-\rho}}\frac{1}{1-\rho}\left[\frac{1-\alpha_E}{\alpha_E}\right]^{\frac{\rho}{1-\rho}}\frac{(-1)}{\alpha_E^2} > 0 \tag{57}$$

This will lead to a rightward shift in the relative supply curve. As change in α_E has no impact on the relative demand curve, a higher relative supply of skilled workers leads to a reduction in the skill premium. By the same reasoning, an increase in preferences of unskilled workers towards market produced services ,that is, α_u, will increase the skill premium.

Proposition 4: a. An increase in the home productivity of skilled workers will increase the skill premium in the economy. b. An increase in the home productivity of unskilled workers will decrease the skill premium in the economy.

The increase in the home productivity of skilled workers will reduce a_h^E, as in (8), leading to an increase in ϕ_E. This will lead to a reduction in the expenditure share on market produced services. Thus, causing a leftward shift in the relative supply curve. We can see this by differentiating equation (53) with respect to a_h^E, we get:

$$\frac{1}{RS}\frac{\partial RS}{\partial a_h^E} = \frac{1}{G}\frac{1}{G_2}\left[(1-T') + \frac{Y_E}{W_E}\right]\frac{\partial \tau_E}{\partial a_h^E}$$
$$\implies \frac{\partial RS}{\partial a_h^E} = \frac{RS}{G}\frac{1}{G_2}\left[(1-T') + \frac{Y_E}{W_E}\right]\frac{-1}{\phi_E^2}\left[\frac{1-\alpha_E}{\alpha_E}\right]^{\frac{1}{1-\rho}}\frac{\rho}{1-\rho}\left(\frac{P_M}{W_E a_h^E}\right)^{\frac{2\rho-1}{1-\rho}}\frac{P_M}{W_E}\frac{(-1)}{(a_h^E)^2} > 0 \tag{58}$$

Hence, reduction in a_h^E will lead to a decline in the relative supply of skilled workers in the economy and hence, an increase in the skill premium in the economy. Note that change in home productivity will not have any impact on the relative demand curve.
Similarly, a rise in home productivity of unskilled workers (a_h^u as in Equation (24)), will reduce their share of expenditure on market-produced services. Thus, leading to an increase in the skill premium in the economy.

Proposition 5: An increase in the skill intensity of the sector will increase the skill premium in the economy.

The skill intensity of a sector is defined as the ratio of skilled workers to unskilled workers used by the industry. In the context of our model, it is given by $\frac{E_i}{u_i}$. On dividing equation (39) by (40), we get:

$$\frac{E_i}{u_i} = \frac{1}{W}\frac{\beta}{1-\beta} \tag{59}$$

Thus, at a given skill premium, W, a higher skill intensity (due to the higher β) will lead to a rightward shift in the relative demand curve. As the change in β will not have an impact on the relative supply curve, an increase in the relative demand for skilled workers will lead to an increase in the skill premium.

In the next section we discuss the empirical validity of our results.

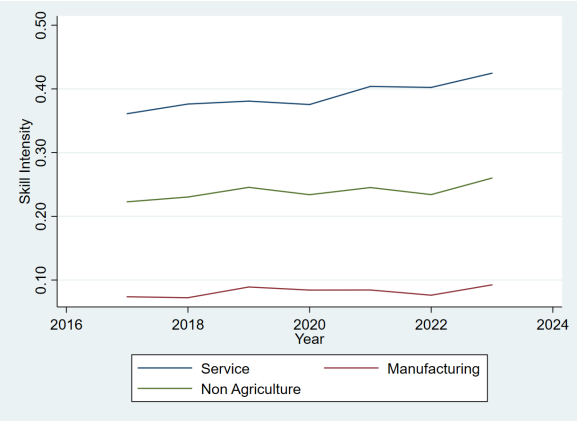
4 Data and Empirical Investigation

The skill premium and relative supply of skilled workers (measured in hours) were estimated for each year from 2017-2018 to 2023-2024 using data from the Periodic Labor Force Survey (PLFS), at both the national and State levels. We also used survey information on domestic personnel hired by the households as a proxy for market produced services. The PLFS survey offers a comprehensive data on various employment and unemployment attributes in both rural and urban areas. The data is provided annually for both urban and rural areas, while quarterly data is exclusively available for urban areas. Therefore, we used annual data collected at the individual (household member) level. Each year, there are approximately 400,000 observations. Our study considered the individuals who are employed in the non-agricultural sector (services and manufacturing) of the economy.

As illustrated in Figure 1, a 29.91% rise in the individuals hiring domestic personnel during the period 2017–18 to 2023–23, indicates a shift in preferences towards market produced services. However, this shift has been significantly higher in the case of skilled individuals (by 210. 53 %) than of unskilled individuals (by 26.90 %). Thus, from proposition 3, this shift in preferences indicate an increase in relative supply of skilled workers in the economy. This is evident from 1, which shows an increase in the the relative supply of skilled workers overtime by 19.93 % and 26.54% in service and manufacturing sectors, respectively. Further, this has resulted into a decline in the skill premium by 2.24% and 14.16%, in these sectors, respectively. Thus, our Proposition 3 elucidate these patterns. This further supports proposition 1, implying that higher expenditure share on market produced services by skilled workers will lead to a decline in the skill premium in the economy.

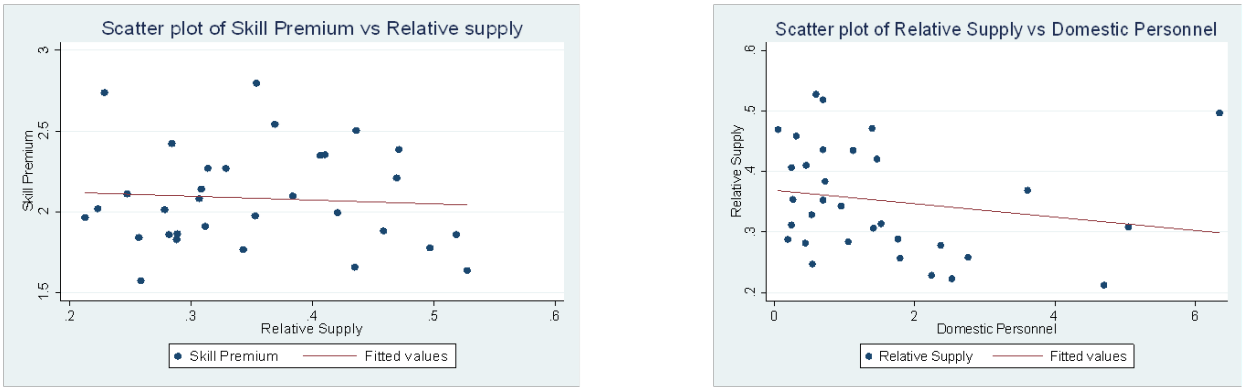
We calculated the skill intensities for each sector during the period 2017–18 to 2023–23. As shown in 9,there has been rise in skill intensity of both service and manufacturing sectors by 17.61% and 25.28%, respectively. According to Proposition 5, this indicates a rise in relative demand for skilled labor over time and, thus, an increase in skill premium. However, as mentioned previously, overall there has been decline in skill premium in both the service and manufacturing sectors. This indicates that the effect of higher preferences towards market produced services offsets the effect of higher skill intensity.

Figure 9: Skill Intensity in the sectors



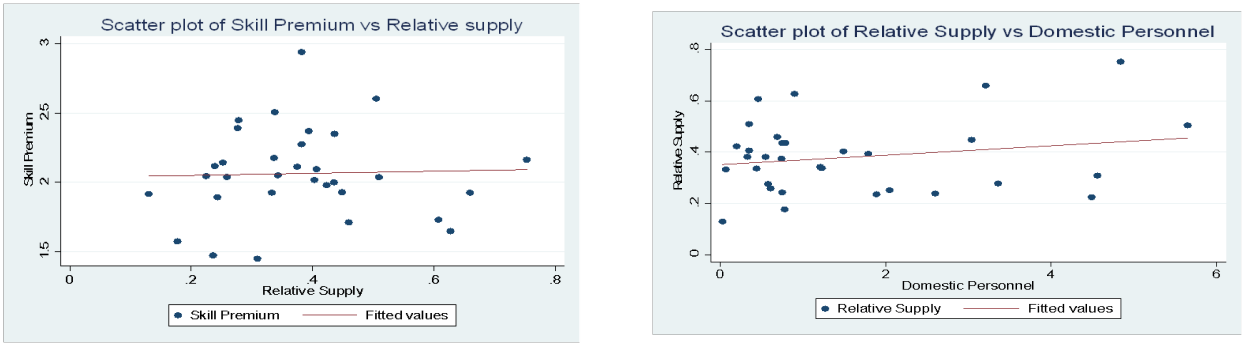
Using PLFS data, we calculated the skill premium, relative supply, and domestic personnel at the state level for the years 2017-18 to 2023-24. Through the scatter plots for each year (see Figures 10 to 16) we observe a positive correlation between relative supply and domestic personnel for all the years except for 2017-18. This implies that the states in which a higher percentage of households hire domestic personnel are also those that have a higher relative supply of skilled workers. Moreover, a positive correlation between skill premium and relative supply was observed (except for 2017-18 and 2021-22), which is consistent with an upward-sloping relative supply curve derived in the model.

Figure 10: Skill Premium, Relative Supply and Domestic Personnel in States (2017-18)



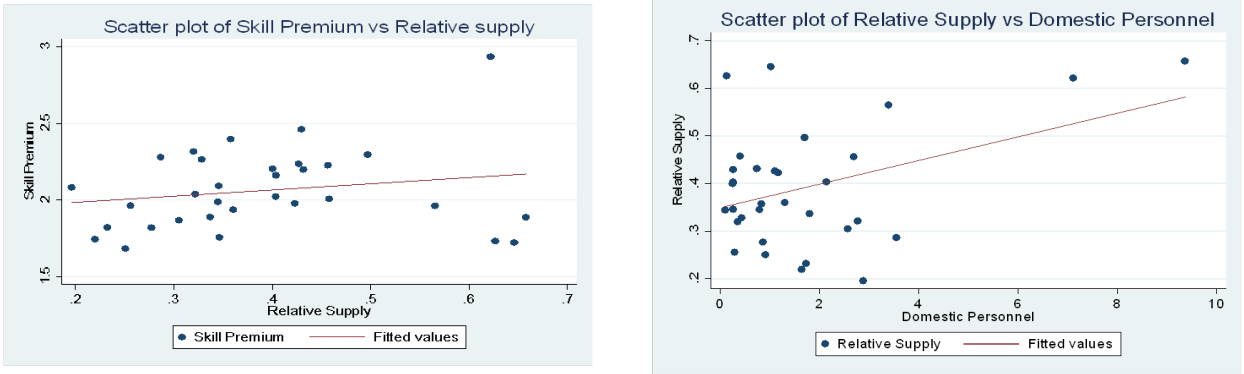
Source: Author's calculations using Periodic Labor Force Survey (PLFS)

Figure 11: Skill Premium, Relative Supply and Domestic Personnel in States (2018-19)



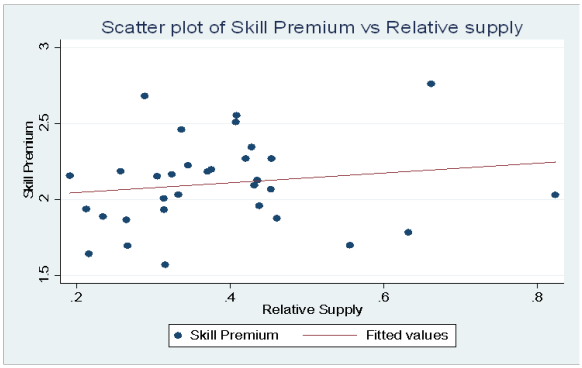
Source: Author's calculations using Periodic Labor Force Survey (PLFS)

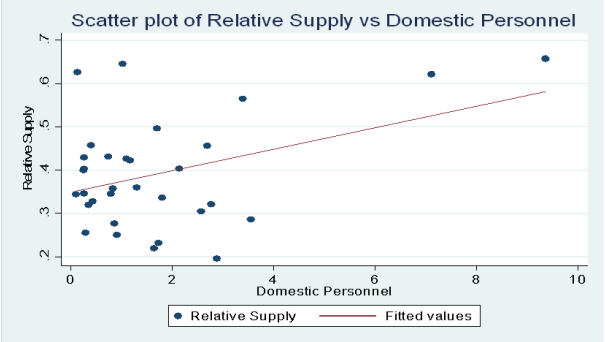
Figure 12: Skill Premium, Relative Supply and Domestic Personnel in States (2019-20)



Source: Author's calculations using Periodic Labor Force Survey (PLFS)

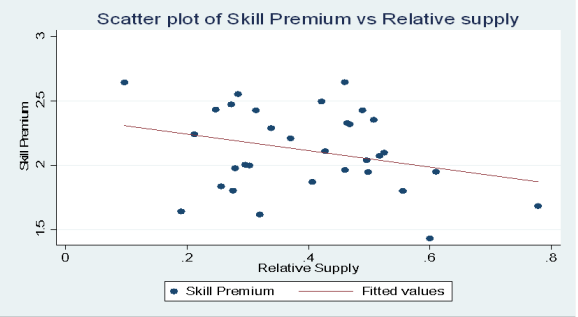
Figure 13: Skill Premium, Relative Supply and Domestic Personnel in States (2020-21)

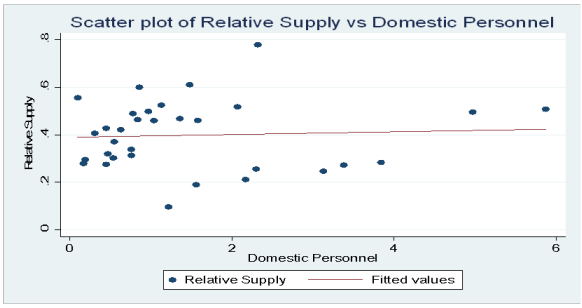




Source: Author's calculations using Periodic Labor Force Survey (PLFS)

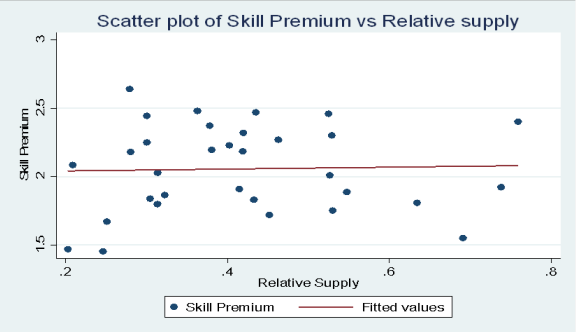
Figure 14: Skill Premium, Relative Supply and Domestic Personnel in States (2021-22)

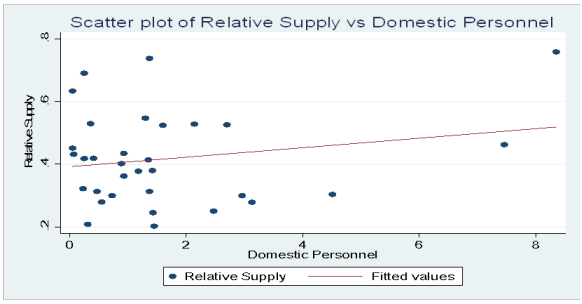




Source: Author's calculations using Periodic Labor Force Survey (PLFS)

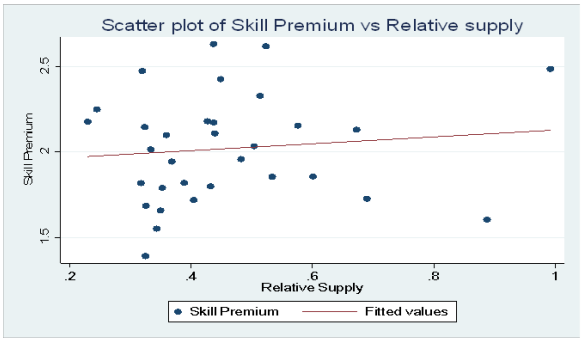
Figure 15: Skill Premium, Relative Supply and Domestic Personnel in States (2022-23)

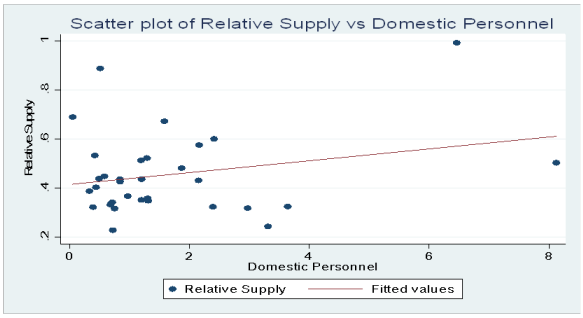




Source: Author's calculations using Periodic Labor Force Survey (PLFS)

Figure 16: Skill Premium, Relative Supply and Domestic Personnel in States (2023-24)

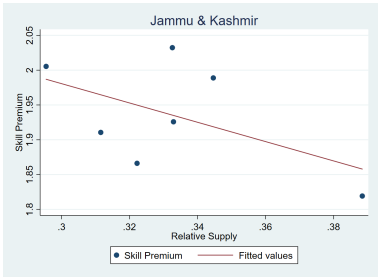


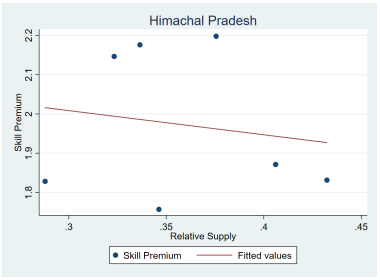


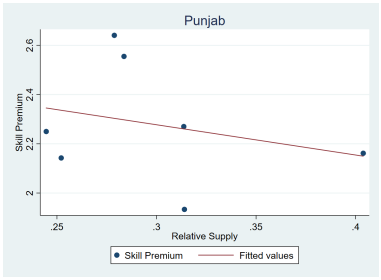
Source: Author's calculations using Periodic Labor Force Survey (PLFS)

Next, we observe how skill premium and relative supply of skilled labor are varying overtime for each state. The scatter plots in Figures 17 to 24 were drawn for each state considering all the years. They showed that for around 69% of the states, the increase in relative supply of labor over time was accompanied by a lower skill premium. This indicates that a higher relative supply of skilled labor (causing a shift in the relative supply curve) decreases the relative wages of high-skilled workers.

Figure 17: Trends in Skill Premium and Relative Supply at the State level

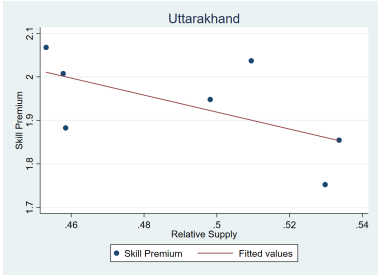


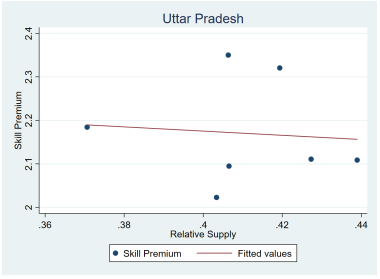


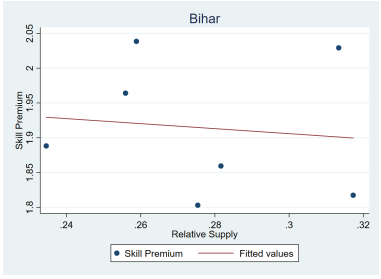


Source: Author's calculations using Periodic Labor Force Survey (PLFS)

Figure 18: Trends in Skill Premium and Relative Supply at the State level

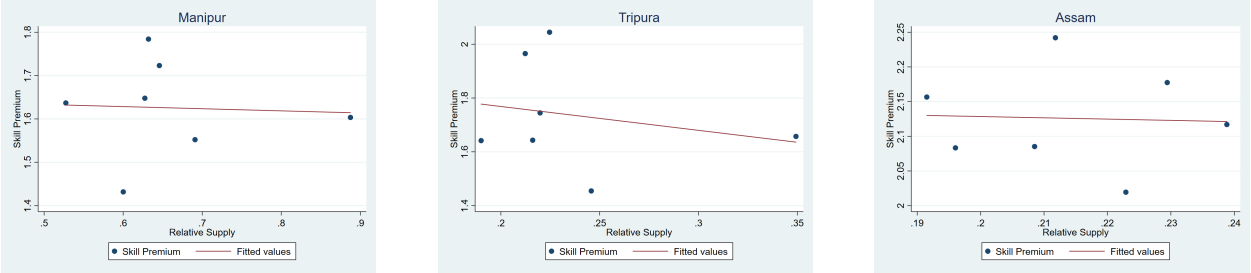






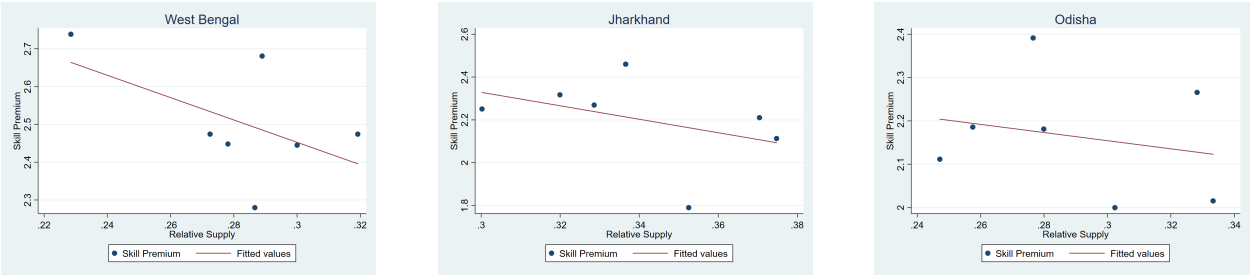
Source: Author's calculations using Periodic Labor force Survey (PLFS)

Figure 19: Trends in Skill Premium and Relative Supply at the State level



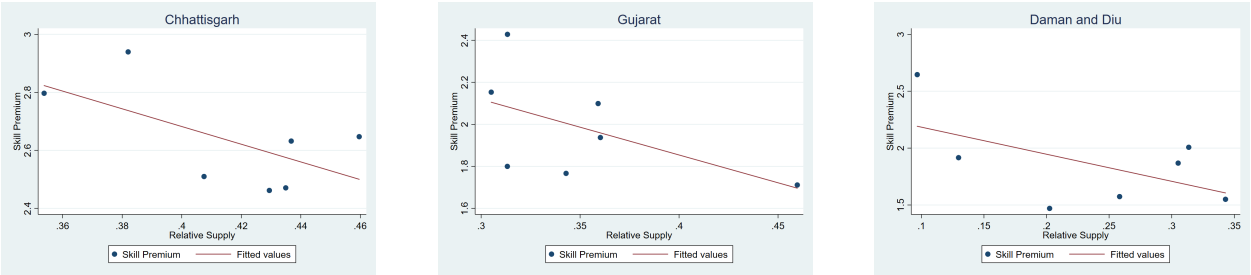
Source: Author's calculations using Periodic Labor Force Survey (PLFS)

Figure 20: Trends in Skill Premium and Relative Supply at the State level



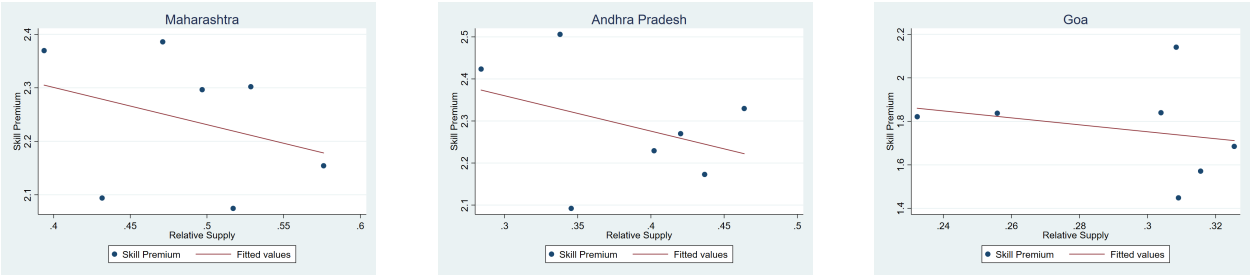
Source: Author's calculations using Periodic Labor Force Survey (PLFS)

Figure 21: Trends in Skill Premium and Relative Supply at the State level



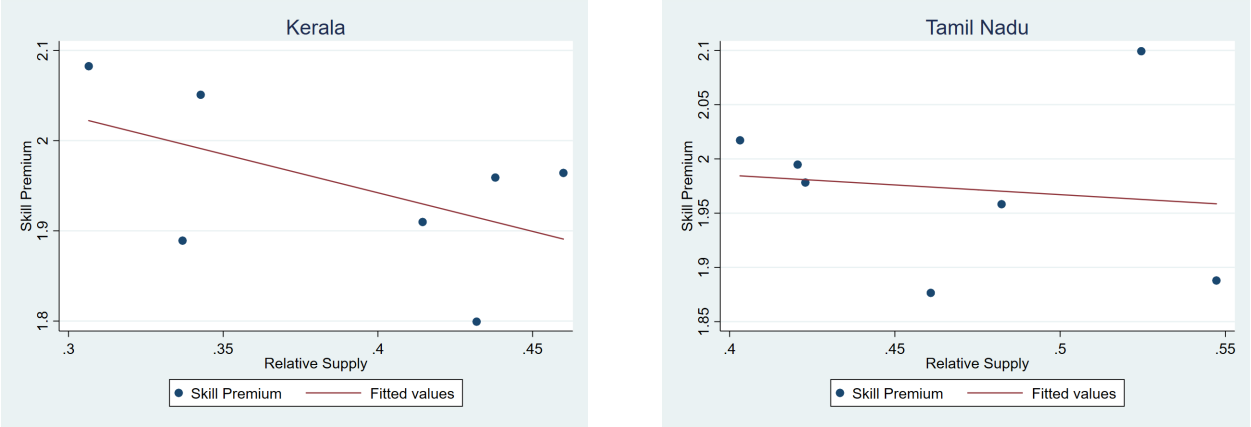
Source: Author's calculations using Periodic Labor Force Survey (PLFS)

Figure 22: Trends in Skill Premium and Relative Supply at the State level



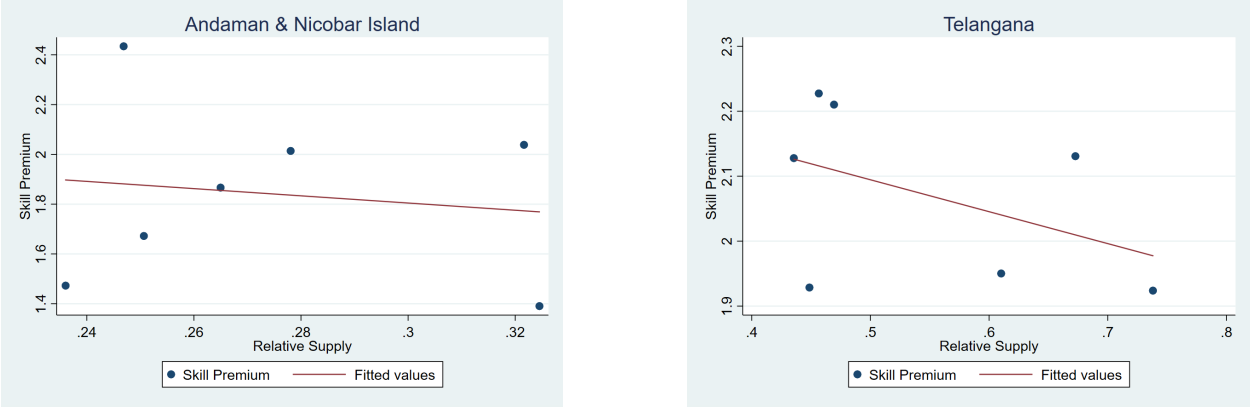
Source: Author's calculations using Periodic Labor Force Survey (PLFS)

Figure 23: Trends in Skill Premium and Relative Supply at the State level



Source: Author's calculations using Periodic Labor Force Survey (PLFS)

Figure 24: Trends in Skill Premium and Relative Supply at State level



Source: Author's calculations using Periodic Labor Force Survey (PLFS)

5 Conclusion

This paper provides a general equilibrium framework that establishes a link between the marketization of services, the relative supply of skilled labor, and the skill premium in the economy. The model demonstrates that the skill premium can decline as a result of an increase in the expenditure share on market produced services by the skilled workers in the economy. Using PLFS data for the years 2017-18 to 2023-24, we found that there has been an increase in the percentage of individuals hiring domestic personnel in the case of skilled and unskilled individuals. Thus, implying that there has been a shift in both skilled workers' and unskilled workers' preferences toward market produced services. However, this increase has been significantly higher in the case of skilled workers, resulting in a higher relative supply of skilled workers in the economy, thus reducing

the skill premium. These findings are in line with the trends observed in the context of India. In our empirical investigation, we estimate a decline in the skill premium in the service and manufacturing sectors by 2.24% and 14.16%, respectively, during the period 2017-18 to 2022-23. During the same period, we observed an increase in the percentage of individuals hiring domestic personnel by 29.91%. Furthermore, the relative supply of skilled labor increased by 19.93% and 26.54% in the service and manufacturing sectors, respectively. Our results from the theoretical model clearly elucidiate these patterns.

Our theoretical model also provides insights into the influence of other factors such as education time, home productivity and skill intensity on the skill premium in the economy. Specifically, we found that the reduction in education time leads to higher marketization of services and thus, decreases the skill premium in the economy [7]. Furthermore, we found that higher home productivity of skilled workers will lead to a reduction in the expenditure share on market produced services by the skilled workers and, hence an increase in skill premium. Besides, we also observed that there has been a rise in the skill intensity in both the service and manufacturing sectors in India. Our model explains this as an increase in the relative demand of skilled labor and thus, causing an increase in the skill premium in the economy.

In general, our study implies that in the context of India, increased marketization of services has led to a rise in the relative supply of skilled labor and, thus, a decrease in skill premium in the economy. It has a significant implication in terms of the growing service sector in India, which can lead to a decrease in wage inequality. This finding differs from the observation of Buera and Kaboski (2012) in the United States in the post-1950s. In accordance with the US data, their theory predicts an increase in skill premium with the rising service sector. Furthermore, subsidies in the education sector can lead to greater marketization of services by reducing the education cost.

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[7] Our finding on higher marketization of services with reduction in education cost is consistent with the Ngai and Pissarides (2011) paper, which suggests that subsidies such as in the health sector should lead to greater marketization.

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