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Skill bias in the labour market: Evidence from Iran

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Abstract

Purpose — Most global economies are dealing with the issue of skill bias. In developing and underdeveloped countries, skill bias poses a problem by preventing the educated from participating in the economy's production function, especially in the long run. This paper expands on the skill-wage relationship and investigates this issue in the case of Iran from 1981 to 2021.

Methods — Applying Impulse Responses from VECM and the Structural VAR model separates the relationship between skill and wage into short- and long-term effects. The structural wage model was estimated using the structural vector auto-regression model.

Findings — The results show that skill played a significant role in wage determination only for three periods in the short run, and the effect was neutral in the long run. This means that skill accumulation through advancement in graduate and postgraduate study is unlikely to increase wages in the long run.

Implication — According to the findings, skill bias implies that education attainment in the Iranian labour market can only improve wages to a minimum extent. This also proves that factors other than education determine wage growth in the economy.

Originality — The skill-wage relationship has not been a focus of studies in education outcome fields. Moreover, in the case of Iran, this investigation is novel, and there is a lack of studies on the relationship between compensation and skill.

Keywords — Skill bias, long-run wage model, human capital, bargaining

Introduction

The basic concept of wage-skill determination is represented through the Mincerian earnings function that establishes a relationship between wage levels and corresponding skills. Jacob Mincer captures this concept in his study published in 1974, which provided a good background for many human capital studies. However, these investigations lack a focus on the assumption of stable effects of skill on wages, which is proven mostly by linear regression estimation of the Mincerian wage equation. Recently, it has been observed that although the number of university-educated is increasing globally, this number has failed to explain the variations in wage levels and has diminished their role in wage bargaining. This problem reflects the skill bias, characterized by high levels of human capital in a society with minimum power to define the equilibrium nominal wages. This study is mainly dedicated to the co-integration analysis of wages and the number of skilled workers in the short and long run. It considers the case of Iran to conduct the co-integration

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analysis and to determine how wages respond to a variation in the number of university-educated workers. With the time series being I(1) the study provides enough evidence of co-movement between wages and skills of these workers. Although Lazear and Oyer (2007) discussed various types of wage compensation, including various non-wage compensations, workers are mainly compensated through just wages in Iran. Hence, this study uses wage as a proxy for compensation. Subsequently, the study constructs a long-run relationship between wages and skills. It concludes that skills can determine wages for two to three periods in the short run, and, in longer horizons, the actual wage-skill curve lies lower than the potential curve. This finding implies that, at the same level of wages, the share of skilled workers in production in actual data is lower than the potential share. This pattern suggests the existence of possible skill neutrality that leads to the laziness of resources and recruitment of low-productive workers. Therefore, this will diminish the cost of damping skilled labour. According to Klenow and Blis (2000) and Tassaeva (2021), this will hamper economic growth and lead to a lack of equality in technological developments. This issue will then create negative externalities by increasing the social misbehavior of the unemployed. Concerning the long-run wage-skill relationships above, the study uses the vector error correction model (VECM) to solve the actual co-movement equation and estimate skill (which represents the number of workers with a university degree (Cunha et al., 2010; Hutter & Weber, 2021, 2022). The coefficient of skill in the wage model is 2.07, which is approximately equal to the coefficient in the structural vector auto-regression (SVAR) estimated in the subsequent section. To stabilize and filter the model considering unrelated shocks, which prevent accurate estimation of the coefficient of skill, the study adds the exogenous non-accelerating inflation rate of unemployment (NAIRU), estimated by the state space model solved by the Kalman Filter (Kalman, 2006).

Many studies are dedicated to labour performance and compensation in world economies. Hendricks (2002) revealed that, in the case of Iran, human capital can explain less than a 31 percent wage difference between Iran and the US. Barro and Lee (2001) conducted a similar investigation for countries with lower revenue than the US. They concluded that higher skill measured by educational attainment reduces earnings per worker by 20 percent for the richest and 40 percent for the poorest countries.

The primary goal of this study to examine structural macro-models based on microdata is rooted in the works by Becker (1964), Mincer (1974), Rosen (1976), Jones (2014), and Mankiw et al. (1992) and introduces the fact that, in the first decade of this century, firms did not adapt their wage structures to respond to the accumulation of human capital; this scenario has led to the determination of wages by skills only for two to three periods in short-run, implying skill-neutrality in the long-run. The current study bridges the literature gap by applying the SVAR as a macro-econometric estimation method. The specific identification procedure of the paper by applying specific restrictions according to the actual behaviors of wage, skill, and NAIRU, and restrictions like the ones followed by Blanchard and Perotti (2002) and Sims (1999), the model became fully identifiable which proves that 1 percent increase in NAIRU will decrease wages by 10 percent in Iran. The study solves the model and finds that the effects of skill shocks on wages last only for two to three periods in the short run, and, in the longer horizon, skill accumulations, even after seven periods, lead to a decline in wages in the economy. Consequently, wage determination will not take effect from the demography of university-educated workers; therefore, skill is neutral in wage bargaining. This finding from the country case further proves the first analysis of skill bias that while university attendance is increasing in most countries globally, in the long run, the share of educated workers will not play a significant role in wage determination.

Methods

By running a unit root test, the study checked whether variables in the model are following integration. All data used in the VECM and structural model, including wages, equilibrium unemployment rates, and educated labour, extracted from the census data, proved to be at I(1). This implies that the data follow a light random walk process. Hence, imposing a structural shock in SVAR will decay in impulse-response function, which is essential to analyzing structural shocks

to wages; these tend to be more short-run than long-run skill effects. Figures 1, 2, and 3 each variable with regard to time to check the possibility of changes in the same direction.

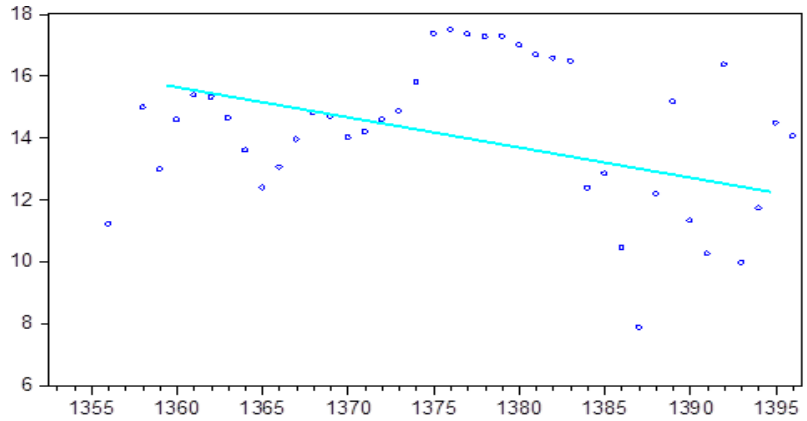

Figure 1. Unemployment in equilibrium rate by removing inflationary pressures

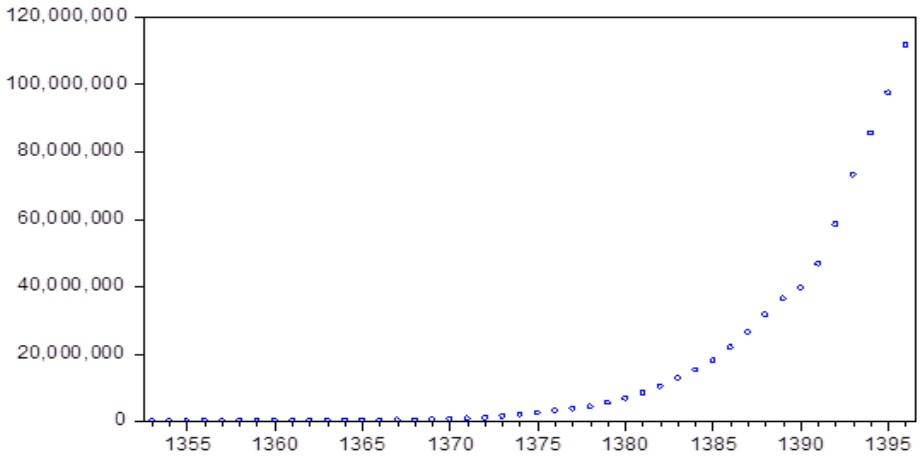

Figure 2. Average yearly wage of all agents in the economy according to Microdata of National Census

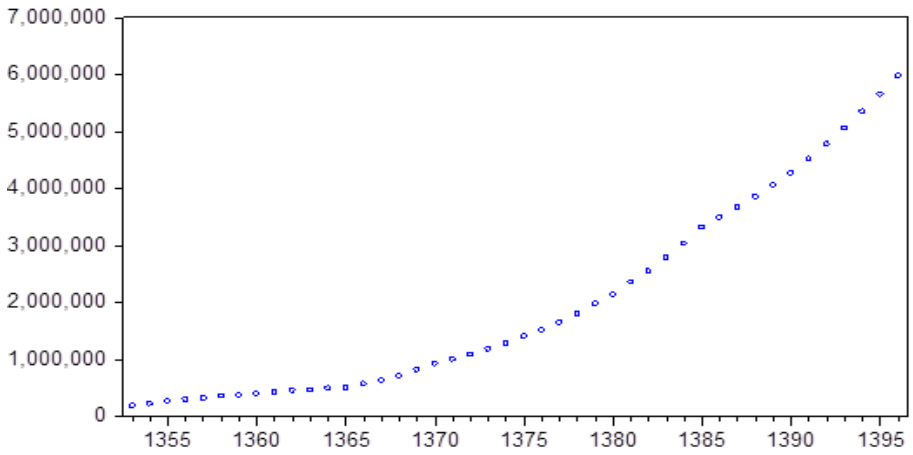

Figure 3. Number of Skilled workers for the whole nation according to Microdata of sample firms on Census data

Annual data analysis reveals partially similar paths of wage and skill; however, unemployment vacillates around a point but shows a downward-sloping trend identical to the linear pattern in scatter plots. The co-integration of wage with skill versus unemployment will approve

two strong co-integrating patterns in data, which tend to decay to a level just as I(0). The weakening of these co-movements can also be triggered by exogenous stimuli like working and job-matching arrangements because of changes in the skilled labour stock of the economy. Jones (2014) clarified the potential limitations of standard human capital accounting by employing the marginal productivity analysis through the regression model, which focuses on variation in *H* across countries. In practice, since the variation in *H* is modest, it appears to contribute negligibly to significant income variations. This study decomposes educated working labour into two parts, based on the significance of the short and long run in the structural wage model constructed and solved using econometrics tools. Concerning the long run, the results prove that wages are skill-neutral, as the hiring process and labour-matching mechanism are hindered by inefficient institutional procedures prevalent in developing economies, and an unskilled, low-quality workforce just dumps the educated population. As of 2016, only 18/7 percent of high school graduates attained a Bachelor's or higher university degree. This implies that any co-movement between wages and skills is not sustained in the long run and will decay in level.

Figures 2 and 3 illustrate changes in wages in a year assigned to a specific feature of that year of how workers in that year attended school for two or more years. This can be a direct implication of bias in the labour market, according to which an increase in the number of school years explains changes in wages within a yearly period, but, in the same time horizon, university education movements with regard to wages show instability. Hendricks (2002) explained that human capital could only account for 31 percent of the wage difference by the US, computed by the ratio of wage to US wage, for the country in this study, Iran. The coefficients for other countries are as follows: Iraq 32.3, Venezuela 47.4, Turkey 23.5, and Thailand 18.4. The coefficients for higher-income countries include Austria 72.6, Belgium 86.3, and France 82.6. The combined effect of the physical capital and measured skills is estimated to reduce earnings in the five poorest countries' total sample by 54 percent. Barro and Lee (2000) investigated the same condition for all source countries, and they proved that educational attainment in countries' global data is lower than that in the US. This effect reduces earnings per worker between 20 percent for the wealthiest countries and 40 percent for the poorest countries. The study investigated skill neutrality using Iran's microdata. It decomposed the time horizon into short- and long-run structural models considering Iran's economy's unique features and ran the SVAR model to solve these models. Subsequently, this study regresses wages to the schooling variable, denoting substantial explanation wage variations by schooling years with a coefficient meaningful at 99 percent interval and adjusted R-square of the model at 99.3 percent. This further supports the assumption that other factors suppress skill, and wages are neutral to workers' skills in the long term. The study analysed whether wages are neutral to skill when co-movements in the long run and short run are separated, to see if skill neutrality in labour market is provable. It used the features of two macro-econometric tools—VECM and restricted SVAR—to distinguish between the long and short horizons and probe whether the long-term bias is due to the economy's structure.

Model Specification

Generalization of wage and skill relationship

Co-integration based on the VECM model needs to be specified to investigate wage and human capital co-movements. Herrendorf and Schoellman (2018), Hutter and Weber (2021), and Klenow and Blis (2000) assumed that the logarithm of average years of schooling indicates skill affecting the logarithm of wage in Equation 1. To upgrade the indicator and make it suitable for the current job market and production function of firms with advanced technology, I took the number of workers with a specified contract period who have university degrees in their stock as how skilled they are.

$$\text{Log(Wage)} = \alpha \text{Log(schooling)} + \varepsilon \quad (1)$$

Equation 1 implies that when an economy is at equilibrium, there is a balance between demand and supply. Additionally, the equation means that the returns to human capital

for an additional year of education are equal to the rate of the logarithmic value of schooling, also known as the returns to wage (Mincer returns). The pace of technological advancements and complex production procedures requires us to consider precise variables as the proxy for human capital. Holmstrom (2017), the number of workers with a university education is reflective of productive labour supplied by a specific worker who is compensated through wages; therefore, the co-movement of wage and quality of a worker's performance is posited by a generic specification in a principal-agent contract.

It is essential to converge the long-run relationship between wages and human capital because firms are not inclined to change production procedures, increase the recruitment of educated workers, and assume linearity in that no shocks hit wages, human capital, or unemployment. The wage and skill relationship can be inferred by the co-integration coefficient of wage and human capital being I(1); this implies that the relationship between human capital fluctuations in the long run and wages is neutral; that is, wages cannot be affected. Error correction can be achieved in two ways by assuming a linear long-run relationship. In the first method, error correction can be achieved by adjusting human capital. (Figure 4).

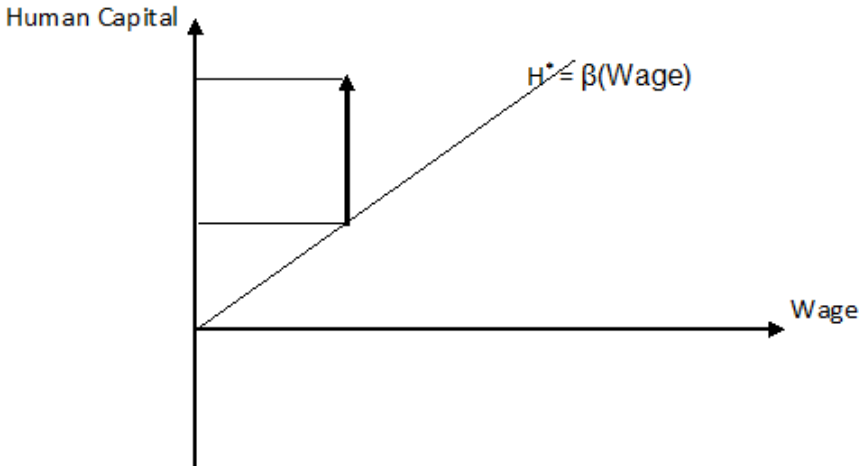

Figure 4. Long-run relationship of human capital, wage, and NAIRU by suppression of inflationary

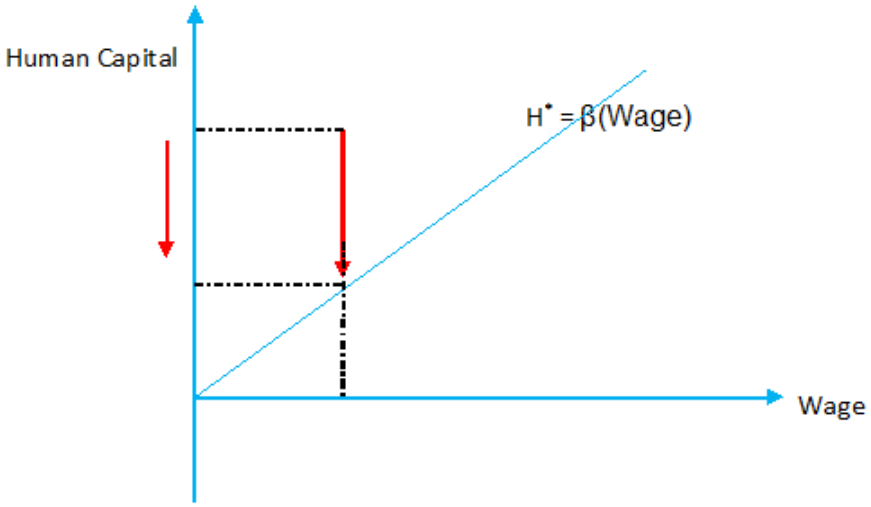

Figure 5. Convergence through Human capital (by the assumption of stabilizing long-run unemployment rate (NAIRU))

As shown in Figure 5, a hike in the number of educated workers creates a proportional gap. Assuming all points on the long-run line follow, it verifies the relationship $H^* = \beta(\text{Wage})$; there is a long-run steady state phase, and any diversion from this state will generate a gap. The dynamics of this co-movement require it to be placed at a point on the line. Similar results are obtained with

the co-moving equation approach. These findings follow those of Jones (2014) or developed Organisation for Economic Co-operation and Development (OECD) countries; they show the same stable steep linear relationship. Skill bias reflected in the slope of the line implies that a lower variation in wages in response to a one-percent shock from skilled labour mainly determines the structure of the economies.

Consequently, if a change in the gap is a linear function of the long-run relationship structurally dominated in the case of Iran's economy, then human capital in the form of the number of educated workers will decrease because of a positive error from a steady state. In such a case, α_h(error correction coefficient) should be below zero for the procedure to not diverge. Thus, the positive shock of an initial increase in educated workers would not last more than three periods. Therefore, the number of workers attaining a university degree will converge at initial wage levels.

$$H_t = \alpha_h(H_{t-1} - H^*_{t-1})\Delta \quad (2)$$

In the second method, the adjustment is achieved through wages. Suppose H_t is fixed, and H_t*(the potential capacity of an economy by adding to its stock of human capital, as reflected in the long-run line) and wages are indirectly adjusted to their ratio. Another assumption is that wage changes denote the linear function of the extent of divergence from the potential path, with α_w being more significant than zero to ensure that H_t increases to long-run potential levels in the economy.

$$W_t = \alpha_w(H_{t-1} - H_{t-1}^*)\Delta \quad (3)$$

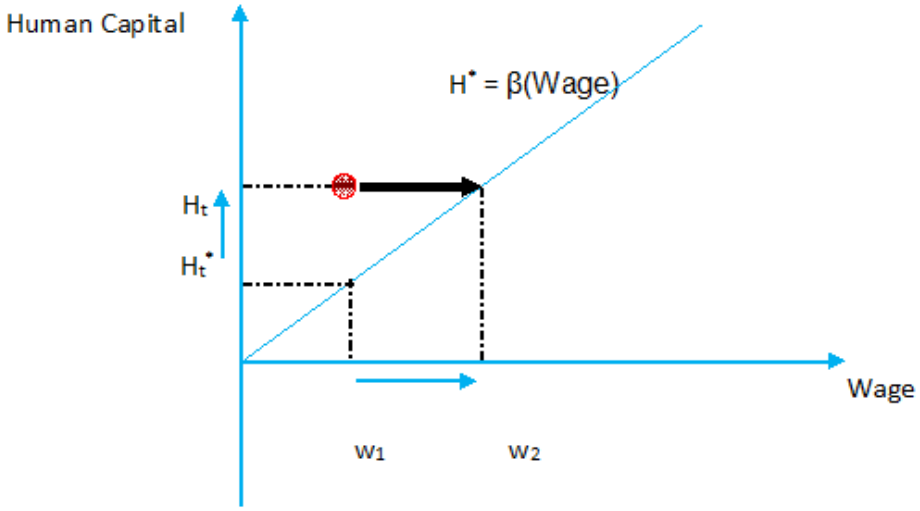

Figure 6. Convergence through wages to long-run skill/wage potential levels

As shown in Figure 6, wages move from W1 to W2 after divergence from the linear path. Therefore, there is a movement from the subsequent increase in the number of educated workers in the workplace (H_t) to the potential long-run value of the number of educated workers (H*). The fundamental intuition of the above graphs is that despite a new shock and heightened number of educated workers, the ratio of wages to the number of educated workers would be identical for various levels of wages. Thus, human capital would not impact wages, and consequently, educated workers would not have any influence over determining employees' wages. This study refers to this effect as skill gap bias in the labour market.

The third method achieves error correction when two co-integration combinations in equation 4, imposed by the labour market structure, lead the economy to its potential path.

$$H_t = \alpha_h(H_{t-1} - H_{t-1}^*) \quad \alpha_h<0\Delta$$
$$W_t = \alpha_w(H_{t-1} - H_{t-1}^*) \quad \alpha_w>0\ \Delta \quad (4)$$

The magnitude of coefficients explains the pace at which wage and human capital will adjust in the long run (Figure 7).

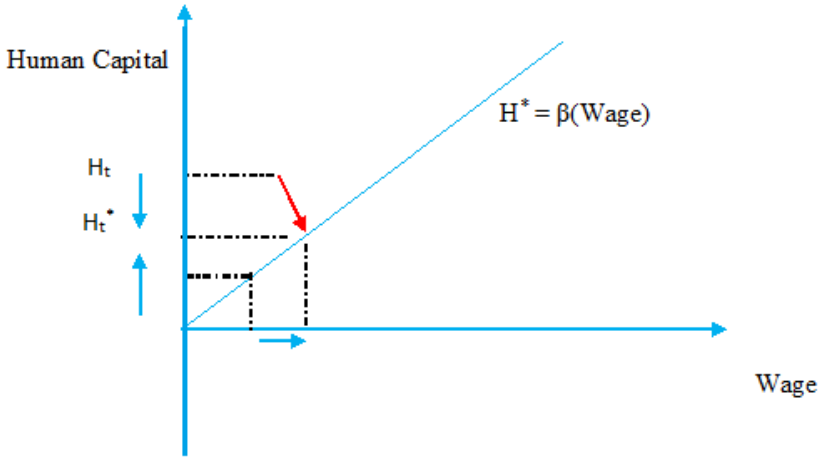

Figure 7. Convergence achieved through both Human Capital wages to long-run skill/wage potential levels

Supposing homogeneity of job search always a constant part of labour force by the given wage would be employed independent of workers ability which implies of β being constant. The assumption is made in the procedures explained above. Conversely, if it is assumed that job search due to structural inadequacies in the economy turns out to be a complicated process, then the probability of a worker being successful would be a function of the worker's participation in complex job search procedures and the success of a worker with average levels of human capital would be directly dependent on the worker's expectation from the labour market so that:

$$\text{Prob(Search Participation)} = e^{\delta w}\zeta \quad (5)$$

In the above probability function, the parameter e is perceived compensation expected by labour force and δ specifies the worker's expectations regarding the complexities of a job search. If δ is perceived to be greater than or equal to 1 (δ>1), then the worker would expect the job search in a closed labour market to be complicated and costly. On the other hand, δ<1 reflects partial improvement in the business environment, with the temporary elimination of international sanctions; this environment contributes to easing the job search for workers. W denotes the general levels of nominal wages that positively correlate with the probability of being involved in a job search, and ζ is a deterministic indicator of the current situation of the labour market. As expected, the increased involvement of a worker in search attempts leads to a decline in the rate of increase in δ and makes the long-run steady state vertical. Thus, the probability of labour participation multiplied by the labour force gives the number of workers that attained university degrees in the entire labour force, and β reflects the probability of the job search; hence,

$$\beta = e^{\delta w}\zeta \quad (6)$$

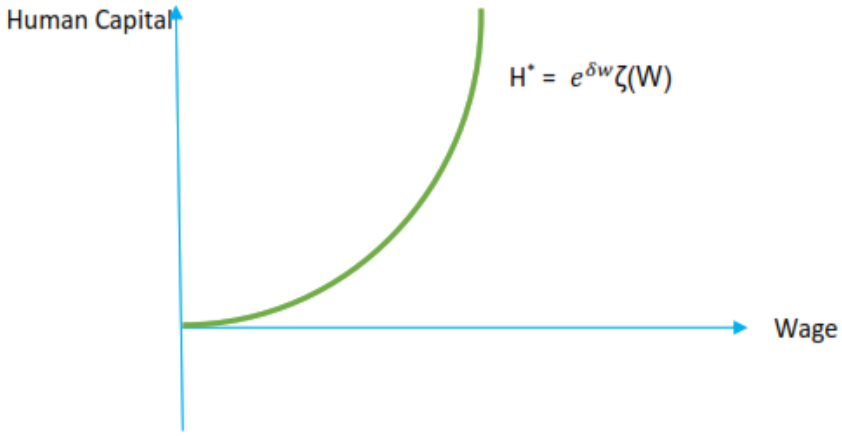

Figure I. Dynamic long-run relationship with search Probability

Considering the innate skills of workers, Herrendorf and Schoellman (2018) reveal that workers are endowed with one unit of unskilled labour that requires no education and can be supplied immediately to the market. Alternatively, individuals may become skilled by acquiring human capital, characterized by a high amount of abstract knowledge that facilitates innovation and the development of new ideas. This is reflected in the intercept of the curve denoted by β as the capital-wage long-run relationship rate (Figure 8).

General Structural model of wage

Assuming human capital is the production agent, the recruitment decisions of firms will be based on the expected function of these agents. For better analysis, assume that production is labour intensive, and therefore, in the wage model, we can consider the complete substitution of both human and physical capital as follows:

$$Log(\text{wage}) = \alpha Log(\text{Equilibrium Job Demand}) + \beta \iint \left(\frac{\text{Physical Capital}}{\alpha}\right)\left(\frac{\text{Human Capital}}{\beta}\right) \text{dpdh} + \Omega_t \quad (7)$$

Human capital tends to accumulate over time, so we used the double integration index as the capital part of our formula. In the above equation, *depth* is the first difference between physical and human capital. To remove the cost effects of job search and to achieve homogeneity in job demand, inflation computed according to the Phillips Curve is excluded from expectations that determine labour decisions regarding the job search method. Equation (8)

$$\log(\text{Equilibrium Job demand}) = \text{Log}\left(\frac{Gross\ Job\ Demand}{net\ inflation}\right) \quad (8)$$

such that,

Equilibrium Job Demand = (Equilibrium Job Demand Rate) (Labour Force);
Gross Job Demand = (Labour Force) (Unemployment Rate)

Substituting equation VIII by its components gives:

$$\text{Log}\left(\frac{(\text{Labour Force})(\text{Unemployment Rate})}{\text{net inflation}}\right) = \text{Log}\big((\text{Equilibrium Job demand Rate})(\text{Labour Force})\big) \quad (9)$$

Eliminating the Labour Force factor from both sides will give the form $\log\left(\frac{(\text{Unemployment Rate})}{\text{net inflation}}\right)$.

On the right-hand side, this will give the unemployment rate filtered by the effects of inflation; it is also known as NAIRU or the equilibrium job demand rate.

The total capital in the production process by a firm in the second part of Equation 7, based on the assumption of the Leontief-type production process, can be substituted by human capital because technology growth requires workers of a higher quality. The wage deterministic equation about the equilibrium unemployment will eventually take the following form:

$$\text{Log(wage)} = \alpha\log(\text{Equilibrium Job Demand}) + \beta\log\left(\int_{t=12}^{t=18} \text{Human Capital}\right)\text{dH} + \Omega_t \quad (10)$$

where t is the number of years of university attendance (between 12 and 18 years) of a sample worker (It takes 12 years to complete pre-college education in Iran). As the summation implies, human capital accumulation is similar to that of Manuelli and Seshadri (2014). They assume that technology accumulation is constant during schooling, which will, at last, positively affect average wages.

Procedure for Estimating the structural wage-human capital model for Iran

The SVAR is the most beneficial macro-econometric tool, proposed by Christopher Sims, applied to aggregated microdata. To know the effects of skill on wages, we use the intuition that an increase in the workers' skills leads to better adjustment to job positions and puts them in a higher place in

negotiation with firms, thus resulting in higher wages by matching procedures. To estimate the effects of variations of skilled labour on wages, one needs to identify and isolate purely exogenous and independent movements or shocks to the variable of interest or wage and examine how the variable reacts to these movements. The reaction is reflected in the impulse responses. To identify skill shocks, we need to identify the structural model. The structural model facilitates the isolation of purely structural shocks and gets the responses of exogenous variables after the economy heats by these shocks. Getting the structural model means determining the proper identification for our models. The identification is the interpretation of historically observed variation in data in a way that allows the variation to predict the consequences of an action not yet undertaken. Hence, the main challenge is to identify pure shocks. Suppose the structural model follows the following form;

$$AX_t = \beta_0 + \beta_1 X_{t-1} + u_t \quad (11)$$

In our model, the vector X_t depends on its own lag and structural shocks u_t. These structural shocks are independently distributed. Suppose that X has the following three variables: $X_t = \begin{bmatrix} W \\ NAIRU \\ Skill \end{bmatrix}$, where W denotes the Wage, NAIRU the equilibrium unemployment to suppress the inflationary movements in the model, and the number of employees with graduate-level studies is denoted by skill. In such variable specifications, the system will be expressed through the following three equations;

$$\begin{aligned} &W_t + \alpha_{12}NAIRU_t + \alpha_{13}Skill_t = \beta_{10} + \beta_{11}W_{t-1} + \beta_{12}NAIRU_{t-1} + \beta_{13}Skill_{t-1} + u_{wt} \\ &\alpha_{12}W_t + NAIRU_t + \alpha_{23}Skill_t = \beta_{20} + \beta_{21}W_{t-1} + \beta_{22}NAIRU_{t-1} + \beta_{23}Skill_{t-1} + u_{NAIRUt} \\ &\alpha_{31}W_t + \alpha_{23}NAIRU_t + Skill_t = \beta_{30} + \beta_{31}W_{t-1} + \beta_{23}NAIRU_{t-1} + \beta_{33}\, Skill_{t-1} + u_{Skillt} \end{aligned} \quad (12)$$

If we pre-multiply this VAR specification by the inverse of matrix $A(A^{-1})$, then we will get the reduced form VAR;

$$\begin{aligned} &A^{-1}AX_t = A^{-1}\beta_0 + A^{-1}\beta_1 X_{t-1} + A^{-1}u_t \\ &X_t = G_0 + G_1 X_{t-1} + \varepsilon_t \quad (G_0 = A^{-1}\beta_0 \text{ and } G_1 = A^{-1}\beta_1) \end{aligned} \quad (13)$$

We impose $\alpha_{12} = 0$, $\alpha_{21} = 0$, and $\alpha_{32} = 0$, which reflect the stable character of NAIRU desire. Therefore, the wage is not affected by shocks to equilibrium unemployment. NAIRU is also neutral, and surprises to NAIRU will not affect the number of educated firms. Shocks to NAIRU will only affect wage and skill with a lag, but shocks to skill will change Equilibrium.

Results and Discussion

According to data for the average years of schooling, including primary, secondary, and high school, workers with a certificate of school education will have positive co-movements for 56 years, as in Figure 9. Upper secondary education is not compulsory in Iran. Schooling is provided free for the entire population by the government. It includes primary schooling and higher schooling 1 and 2, where higher schooling 1 is equivalent to secondary education at an international level.

As it is clear from the above figure, the average years of schooling is 7 to 8 years, and the average wage growth is about 20 percent. Herrendorf and Schoellman (2018) use this relationship to study the effect of schooling by eliminating the error term from the right-hand side of the equation and thereby ignoring the influence of shocks of skills on wages, which is primarily investigated in this study. This study determines the structural skill shocks decomposed into short and long runs.

Figure 10 depicts the history of labour demography in Iran from the years before the revolution that occurred from 1978 to 1988. The figure shows that the workers hired through the pre-revolution system had not retired and continued to work in an environment with outdated infrastructure and institutional systems after the revolution. In these years, variation in the growth of skilled workers was higher than in wages. This can be primarily attributed to a firm's tendency to hire more skilled labour. Subsequently, the imposition of institutional changes on the economy and structural shocks like war worsened the distance rate. According to census data collected from

3904 individuals each in urban and rural areas of Iran for the year 2016, only 18.7 percent of currently active workers attained a Bachelor's or higher degree, which, regarding the high growth of university graduates in the last decade, brings inefficiency to the labour market.

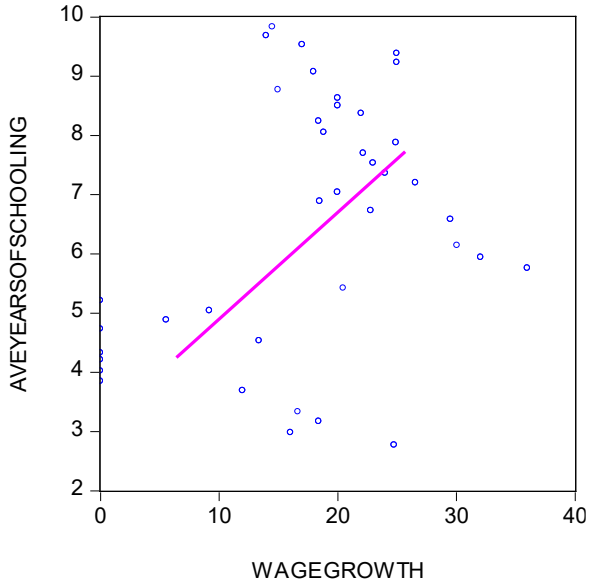

Figure 9. Scatter of wage variations and long-run changes in the number of workers with school education attainments

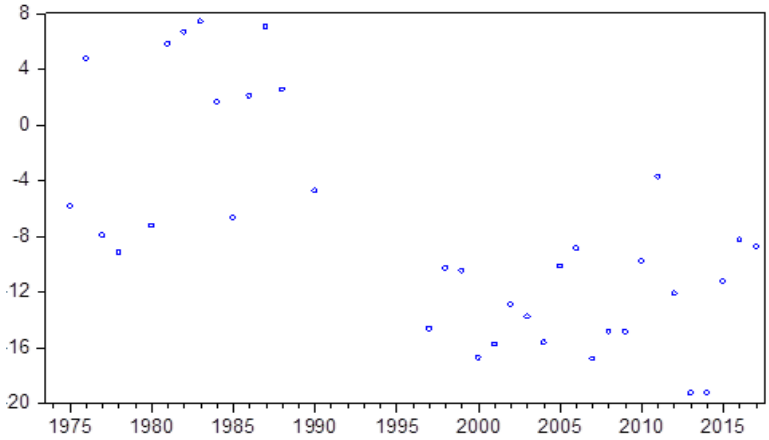

Figure 10. Distance between skilled labor force growth and minimum compensation growth

Results in Table 1 show that human capital shocks in the short run lead to an increase in wages, which is according to the impulse-response function in Figure 13 for about 2 to 3 by coefficient equal to 2.07 significant at five percent according to Table 1, meaning that one percent increase in number of workers with university degree by its short-run surprise is concurrent of wages moving 2.07 percent lasting for about three periods. On the other hand, in the long run, if the structural shock of human capital affects wages, the wages will dwindle by -2.217 percent, as in Table 1, which will be significant at a 5 percent level. These results prove the initial assumption that educated workers play a minimum role in wage bargaining compared to other workers with different qualities, implying that a rise or fall in wages does not happen due to firms' stock of human capital. This result complies with the study performed by Hendricks (2002), which found that human capital can explain the low wage difference (about 31 percent) in Iran. This phenomenon leads to a smooth curve in Figure 11 by increasing the general levels of wages in the horizontal axis. According to Figure 14, structural shocks of NAIRU to human capital are positive, which implies that being unemployed will drive skilled workers to increase their job-search efforts. These workers search for jobs using complicated methods like costly registration in private

job campaigns, which, according to statistics, increased significantly among the educated in recent years. Despite an increase in the share of university-educated workers, their share in firms' wages fails to adopt accordingly, which is approved by studies done by Becker (1964), Mincer (1974), Rosen (1976), Mankiw et al. (1992), and Jones (2014) that in developing countries educating does not guarantee job attainment without enough attempt by the educated job seekers. Moreover, an increase in the number of PhD students in recent years is another adjustment considered in the study to show how these students can contribute toward increasing the share of university-educated workers in firms. This is revealed through the increase in the unemployment rate in the past 25-30 years, during which a PhD student is expected to attain a PhD degree.

Table 1. Results of estimation of VECM model and co-movement equations

Variables	Dependent variable wage		Mean	Standard Error	P-value
Exogenous variable	Skill	2.076	7.9	1.05	0.0375
Independent variable	NAIRU	-2978279	12	0.5	0.042
R-squared			0.909		
F-statistic			114.25		

The coefficient of NAIRU in the solved model is -2978279, implying that an increase in unemployment by one unit will result in a fall in general wage levels to IRR 2,978,279, as revealed through the empirical data of private firms. The Mincer coefficient for Iran is estimated to be 2.076 percent; that is, in the short run, means a one percent increase in skill will at last increase wages by 2.076 percent, which later by the specification of wage structural model, according to economic theory intuition and Impulse-Responses will be shown not to be persistent for more than two to three periods and in more periods effects decay and impact of human capital will be negative. Subsequently, it solved the estimated model for the sampled period to see if real-world data can prove the dynamic long-run correlation in Figure 11. Results of the solving model with the baseline scenario are presented against actual values for each of the three variables in Figure 12. Figure 11 shows that the real-world human capital and wage relationship starts at around zero and at low wage levels. This finding is based on the sampled years between 1978 and 1988 before the Iranian revolution when education was the main criterion for hiring a worker, and a minimum rise in wage resulted in a significant increase in the number of workers with university degrees.

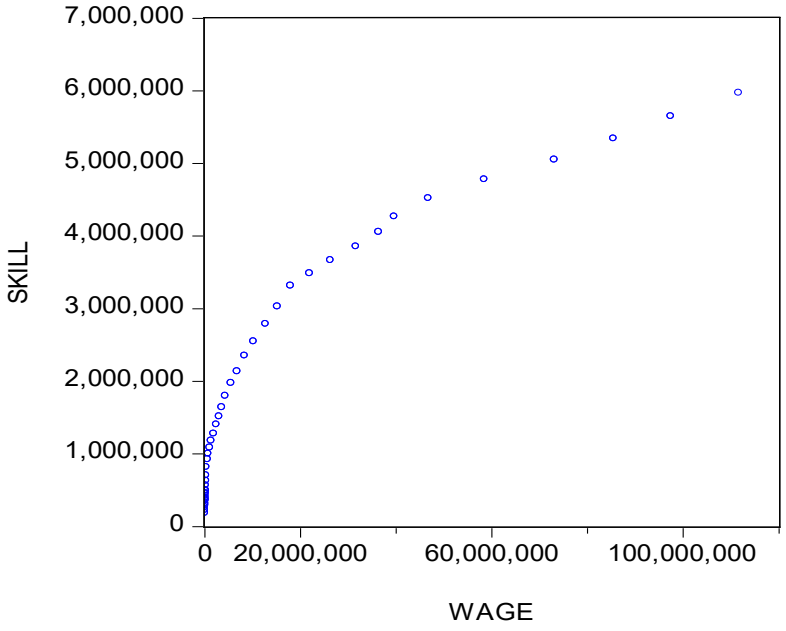

Figure 11. Skill bias in Iran economy

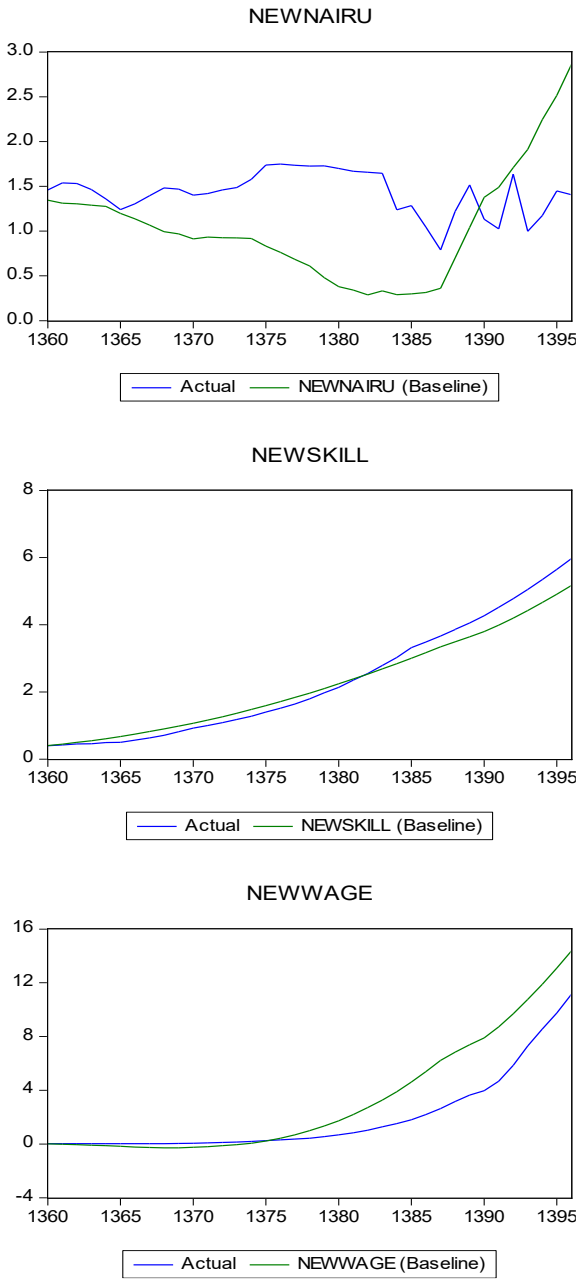

Figure 12. Solving model with baseline scenario

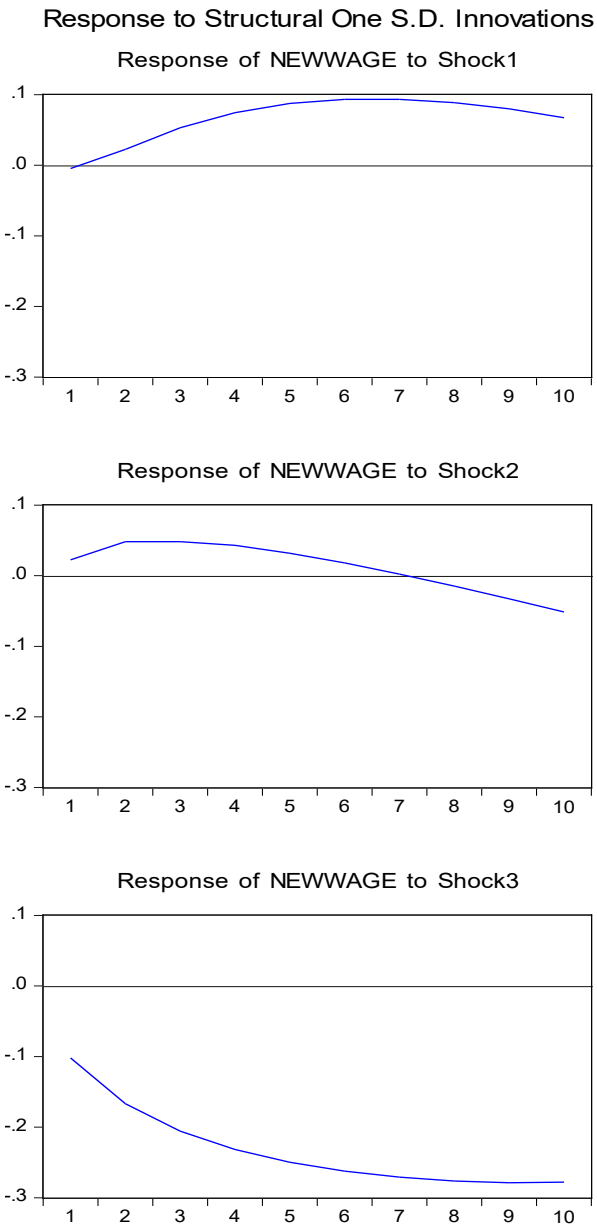

Figure 13. Response of wage to one standard structural shock hit of three endogenous variables

The error correction feature of the wage model ensures the existence of significant co-integration. It observed this in the individual level microdata in the form of co-movements. Scatter plot of wage and human capital denotes that due to firms inflexible production function, new technological shocks will not change their labour employment capacity. This situation is described as adverse selection when wages taking effects of human capital is presumed by macro-production function but wages mostly change due to error term in wage model this is approved by study done by Carbonero et al. (2022).

The short-term effects of human capital shocks can be proven further by estimating the response of wage to skill shocks, as in Figures 14 and 15. According to the IR figure, the response of wage to human capital shocks as the intercept of IR shows and discusses above for the short run starts at a point 2 percent; it means that a one unit shock of human capital will increase the wages by about 2 percent. This positive feedback will increase to about 5 percent in the second- and third period, and will start to decline after that point, becoming smaller than zero after seven periods, and thereby supporting our result that an increase in human capital in firms in the long

run will cause wages to drop. This implies a low bargaining power in wage bargaining and smoother long-run human capital-wage relationships.

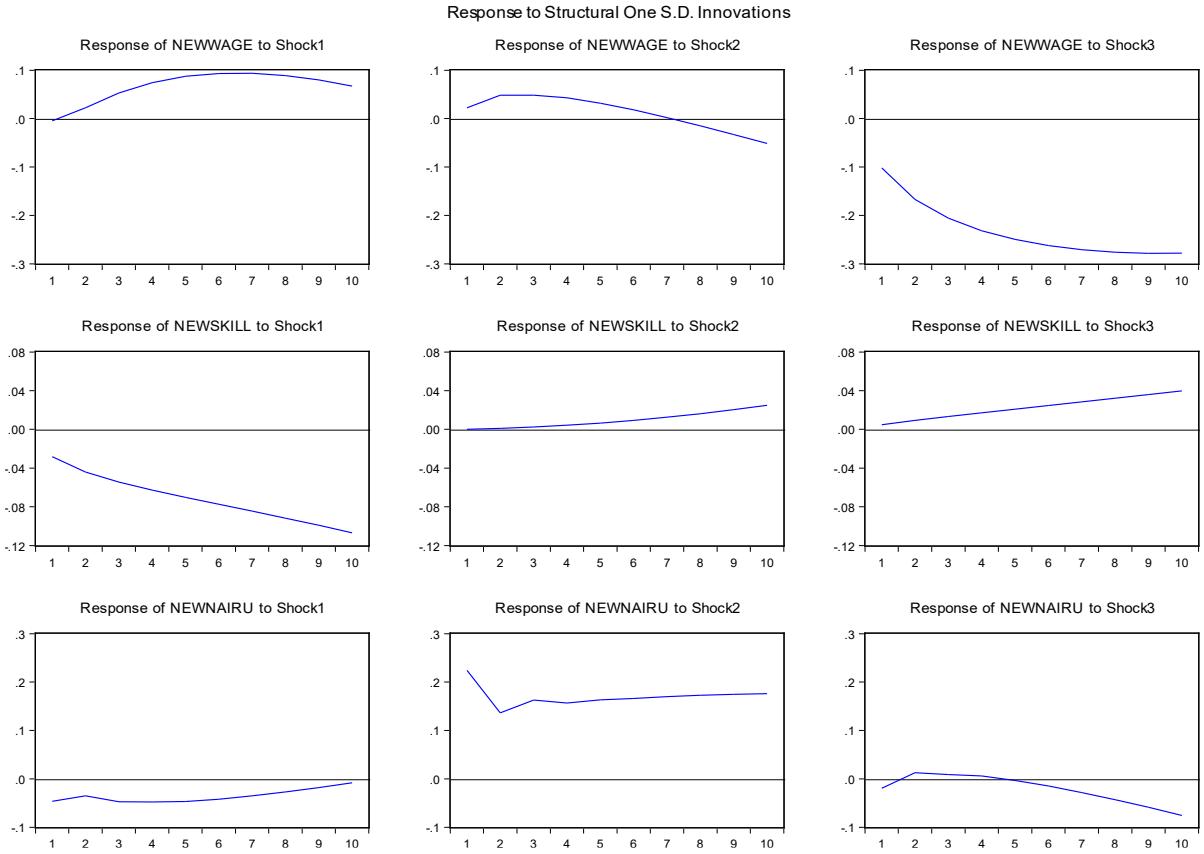

Figure 14. Responses of three endogenous variables to one structural shock hit in wage model

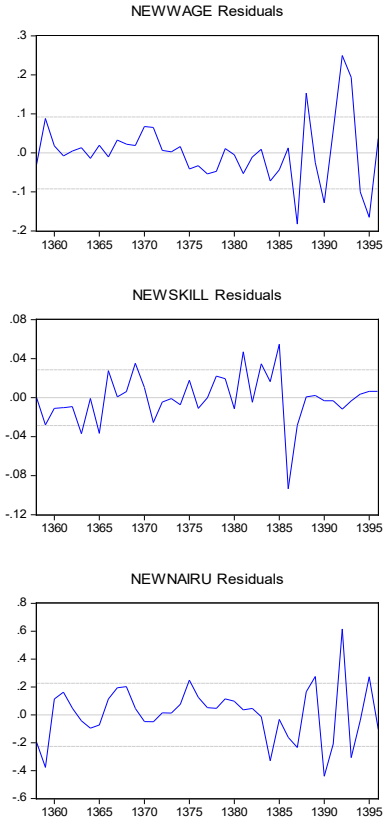

Figure 15. Residuals of endogenous variables in SVAR model

Conclusion

This study puts forward the missing link in the existing literature on wage and human capital models. In other words, although there is an increase in human capital owing to a recent expansion in university education, the low rate of educated workers' employment in firms and their role in wage bargaining fail to adapt. This problem is reflective of the bias of the highly educated workers. Their neutrality has led to a decline in human capital in firms, which, in this study, is defined as skill bias. This study fit data from Iran, derived from microdata of rural and urban centers, to the model specification of the time series. Additionally, according to the co-movement equation approach, it is found co-movements in the long-run wage-skill relationship that is lower than the actual curve, implying that the recruitment of university-educated workers is lower than the optimum trend. An estimation of the co-moving equation by VECM gave a coefficient of 2.06 for skill; this was also proved through the SVAR estimation. This study configured a model of wage for the Iranian economy and subsequently solved it using the SVAR approach on aggregated microdata. It is concluded that skilled workers play a significant role in wage bargaining for two to three periods, and, in the longer horizons comprising about seven periods, the educated population negatively determines wage levels. The results imply that human capital causes negative externalities both for the macro-economy and individuals, which minimizes the significance of job search efforts of the educated, thereby thwarting their expectations and isolating them from the labour market. This study refers to this phenomenon as skill bias, where education, intended to facilitate labour market wage negotiations, loses its effectiveness and becomes neutral, as illustrated in the case of Iran.

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