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Economic recession, demand constraint and labour markets in a developing economy

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Abstract: The paper develops a three-sector, specific factor, general equilibrium model with two high-skill sectors and unemployment of skilled labour. One of the two high-skill sectors produces a non-traded commodity whose aggregate demand consists of both domestic demand and an exogenously given foreign demand. The consequences of a decline in the foreign demand for the non-traded good resulting from worldwide economic recession on the skilled and unskilled labour markets in a developing economy have been examined. The analysis finds that the effects on the labour markets crucially hinge on the relative factor intensities of the two high-skill sectors and that through adoption of appropriate fiscal measures; the country can shield its workforce from the rage of global economic downturn.

Keywords: Economic recession; skilled labour; unskilled labour; skilled unemployment; informal wage; Sen's (1974) welfare measure; general equilibrium.

JEL classification: F13; J31.

Economic recession, demand constraint and labour markets in a developing economy

1. Introduction

The financial and economic crisis that started in 2008 has deep implications for employment across the world. While the precise consequences cannot be predicted, it appears certain that both jobs and wage levels would suffer in many developing countries. The crisis is underscoring the relevance of the ILO's Decent Work Agenda. As per the annual Global Employment Trends report (2009) of the ILO the global economic crisis could result in an additional 18 million unemployed in the world and increased levels of vulnerable people in employment.

The economic crisis that originated in developed countries affects the developing economies in a number of ways. The fall in the imports of the developed nations from developing countries has spelt gloom. Consequent decline in commodity prices have resulted in lower export earnings, which left the latter countries high and dry. Developing countries which depend on primary and processed products are hit hard. Countries like India and China that are large exporters of high-skill commodities like computer software are facing serious problem due to decreased demand from developed countries resulting in lower prices for these products. For India, it is even a bigger problem because India is the land of IT outsourcing and a lot of large western companies outsource their IT services to Indian companies. So, it is obvious that the supply of works for Indian outsourcing companies will suffer until the crisis gets over.

On the other hand, during economic downturns migrant workers in the developed nations are often the first to lose their jobs and while some may well choose to return home, policies aimed at sending migrant workers home tend to be based on the perception that "migrants take jobs" or "compete for welfare benefits". More restrictive immigration policies are being adopted to protect the local labour market and in response to a demand for fewer foreign workers. For example, a reduction in the number of migrants to be

admitted for employment has already been announced in some countries (Italy, U.K.) or is under discussion in others (e.g. U.S. and Australia). In Spain, the Government has introduced financial incentives to encourage unemployed migrants to return home. Such protectionist policies on the part of the rich nations accentuate the miseries of the developing economies.

Under the circumstances, the present paper is designed to examine the consequences of economic slump on both skilled and unskilled labour markets in a developing economy[1] in terms of a three-sector general equilibrium model with two high-skill sectors and a low-skill informal sector.[2] One of the two high-skill sectors produces a non-traded commodity and skilled workers receive their efficiency wage. The latter gives rise to the phenomenon of skilled unemployment. On the other hand, unskilled workers in the informal sector[3] receive the competitive wage. The informal wage is completely flexible so that the unskilled labour market always clears.[4] We formalize economic recession in

[1] This problem has not so far been adequately addressed in the theoretical literature on trade and development. Marjit, Kar and Chaudhuri (2010) is, of course, a notable exception where it is shown that economic downturn in the high-skill sector may in fact increase the real informal unskilled wage. The paper, however, has considered a full-employment model and does not address issues like skilled unemployment and consequence of the problem on the economic well-being of the working class as a whole which are quite important from the view point of policymaking.

[2] The Unskilled labour market in a developing economy is imperfect and there is formal-informal sector segmentation. In the formal sector unskilled workers are organized and receive a higher unionized wage than what their counterparts receive in the informal sector of the economy. The unskilled workers who are unable to get employment in the formal sector are automatically absorbed in the informal sector. We, however, do not include a low-skill formal sector in our model as its inclusion cannot affect our main results in a big way.

[3] There is a vast theoretical literature that discusses various aspects of the informal sector in a developing economy. This includes works of Chaudhuri and Banerjee (2007), Marjit (2003), Chaudhuri et al. (2006), Chaudhuri (2001, 2002, 2003, 2005, 2006 a,b, 2007, 2010 a,b,c), Chaudhuri and Mukhopadhyay (2002 a, b), Chaudhuri and Dwibedi (2007), Chaudhuri and Yabuuchi (2010) etc.

[4] In reality, the informal sector and open unemployment of unskilled labour coexist. This happens if the informal sector unskilled wage is also rigid in the downward direction. However, we do not

the high-skill sector as follows. The price of the non-traded high-skill commodity is determined by demand-supply forces with total demand for the good being equal to domestic demand (which depends on relative commodity prices and national income) and exogenously given foreign demand. Economic recession is then captured through a reduction in foreign demand for the non-traded commodity that causes its price to fall and the sector to contract. If this sector happens to be less (more) intensive in the use of capital (skilled labour) relative to the other high-skill sector the aggregate demand for skilled labour falls. This leads to a reduction in skilled wage and an increase in the unemployment of skilled labour. The consequences of economic recession on the informal unskilled wage and welfare of the workers (skilled plus unskilled) in terms of Sen's (1974) welfare measure have also been studied. We find that most of the above effects crucially hinge on the relative factor intensities of the two high-skill sectors. Notwithstanding the initial effects, the analysis shows that through adoption of appropriate fiscal measures, the country can shield its workforce (both skilled and unskilled) from the fury of global economic downturn.

2. The Model

We consider a small open economy consisting of three sectors: a low-skill informal sector and two high-skill sectors. The low-skill sector (sector 1) produces a primary exportable commodity by using unskilled labour and capital. Sector 2 is the services sector that produces a non-traded high-skill product (services) by means of skilled labour and capital. Finally, sector 3 produces an internationally traded high-skill commodity like computer software with the help of skilled labour and capital. So, unskilled labour is specific to sector 1. Skilled labour is mobile between sector 2 and sector 3 while capital is

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consider unemployment of unskilled labour because in an economy the possibility of being unemployed also rises with increasing education and skills. In the case of India, NSSO surveys conducted over the years show that the unemployment rate among those educated above the secondary level was higher, in both rural and urban areas, than those with lesser educational attainments. The NSSO 61st Round report, *Employment and Unemployment Situation in India 2004-05*, attributes this to the fact that "the job seekers become gradually more and more choosers as their educational level increases." Serneels (2007) also has found that in Ethiopia unemployment is concentrated among relatively well-educated first time job seekers who come from the middle classes.

perfectly mobile among all the three sectors of the economy. There is unemployment of skilled labour in the society which is explained by using the wage efficiency hypothesis (WEH). The efficiency function of skilled labour is a simplified version of that available in Agell and Lundborg (1992, 1995).[5] This function can be derived from the effort norm of the skilled workers, which is sensitive to both the skilled wage and the skilled unemployment rate. Production functions exhibit constant returns to scale with positive and diminishing marginal productivity to each factor. The prices of the traded commodities are given internationally while the price of the non-traded good (commodity 2) is determined domestically by demand and supply forces. The demand for the non-traded good consists of both domestic demand which depends on relative commodity price and national income and an exogenously given foreign demand. Finally, commodity 1 is chosen as the numeraire.

The following symbols will be used for formal presentation of the model.

a_{Ki} = amount of capital required to produce 1 unit of output in the ith sector, $i = 1,2,3$;

a_{Li} = unskilled labour-output ratio in sector 1;

a_{Si} = skilled labour-output ratio in the ith sector, $i = 2,3$;

P_3 = exogenously given relative price of the commodity 3;

P_2 = endogenously determined price of the non-traded high-skill commodity (good 2);

X_i = level of output of the ith sector, $i = 1,2,3$;

h = efficiency of each skilled worker;

W_S = wage rate of skilled labour;

$\frac{W_S}{h}$ = wage rate per efficiency unit of skilled labour;

W = competitive wage rate of unskilled labour in sector 1;

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[5] Interested readers may check that the qualitative results of the model do not change much even if we allow the effort norm of skilled workers to depend on the functional distribution of income of different factors of production. However, we do not consider this case because it would unnecessarily complicate the algebra. In this connection, one may look at Chaudhuri and Banerjee (2010a, b) for a general treatment of the WEH.

$r =$ return to capital;

$\bar{D} =$ exogenously given foreign demand for commodity 2;

$D_2 =$ aggregate demand (domestic plus foreign) for the non-traded commodity;

$L =$ endowment of unskilled labour;

$S =$ endowment of skilled labour (in physical unit);

$v =$ unemployment rate of skilled labour;

$K =$ economy's capital stock (given exogenously;

$\theta_{ji} =$ distributive share of the j th input in the i th sector for $j = L, S, K$ and $i =$ 1, 2, 3;

$\lambda_{ji} =$ proportion of the j th input employed in the i th sector for $j = S, K$ and $i = 1,2,3$;

$'\wedge' =$ proportional change.

2.1. Determination of the efficiency wage of skilled labour

Skilled workers in the two high-skill sectors (sector 2 and sector 3) receive the efficiency wage. We assume that the effort norms of the skilled labour depend positively on both (i) skilled wage; and, (ii) the unemployment rate of skilled labour.[6] Therefore, we write

$$h = h(W_S, v) \tag{1}$$

The efficiency function satisfies the following mathematical restrictions:

$h_1, h_2, > 0$; $h_{11} < 0$; $h_{12} = 0$.[7]

The unit cost of skilled labour in sector 2 and sector 3, denoted by ϖ, is given by

$$\varpi = (\frac{W_S}{h(.)}) \tag{2}$$

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[6] See footnotes 5 and 7 in this context.

[7] Mathematical derivation of the efficiency function from the optimizing behavior of a representative rational skilled worker and explanations of the mathematical restrictions on the partial derivatives are available in Agell and Lundborg (1992, 1995). Also see Chaudhuri and Banerjee (2008) in this context.

Each firm in sector 2 and sector 3 minimizes its unit cost of skilled labour as given by (2). The first-order condition of minimization is

$$h = W_S h_1 \tag{3}$$

where h_1 is the partial derivative of the efficiency function with respect to W_S. Equation (3) can be rewritten as

$$E_1 = 1 \tag{3.1}$$

where E_1 is the elasticity of the $h(.)$ function with respect to W_S. This is the well-known Solow condition as found in the efficiency wage literature.

Solving equation (3.1) we obtain W_S as a negative function of v. We, therefore, have

$$W_S = W_S(v); W_S^{'} = (\frac{\partial W_S}{\partial v}) = (\frac{h_2}{W_S h_{11}}) < 0 \text{ (note that } h_{11} < 0 .) \tag{4}$$

The optimum efficiency of each skilled worker is given by

$$\underset{(+)(-)(+)}{h^* = h^*(W_S(v), v)} \tag{5}$$

From (5) it is clear that the skilled unemployment rate, v, produces two opposite effects on the optimum efficiency, h^*. For determining the net effect totally differentiating (5) we get

$$dh^* = h_1(\frac{\partial W_S}{\partial v})dv + h_2 dv$$

Using (4) and simplifying we obtain[8]

$$\underset{(+)(-)}{(\frac{dh^*}{dv}) = (\frac{h_2}{W_S h_{11}})(h_1 + W_S h_{11})} \quad \text{(note that } h_1 > 0; h_{11} < 0) \tag{6}$$

[8] The sign of $(\frac{dh^*}{dv})$ depends on the sign of $(h_1 + W_S h_{11})$ which in turn depends on the specific algebraic form of the efficiency function.

2.2. The general equilibrium

Given the perfectly competitive commodity markets the three price-unit cost equality conditions relating to the three industries are as follows.

$$Wa_{L1} + ra_{K1} = 1 \tag{7}$$

$$(\frac{W_S}{h^*})a_{S2} + ra_{K2} = P_2 \tag{8}$$

$$(\frac{W_S}{h^*})a_{S3} + ra_{K3} = P_3 \tag{9}$$

Full utilization of unskilled labour and capital, respectively, imply

$$a_{L1}X_1 = L \tag{10}$$

$$a_{K1}X_1 + a_{K2}X_2 + a_{K3}X_3 = K \tag{11}$$

There is unemployment of skilled labour in the economy and the rate of unemployment is v. The skilled labour endowment equation is, therefore, given by

$$a_{S2}X_2 + a_{S3}X_3 = (1-v)h^*S \tag{12}$$

The aggregate factor income[9] in the economy is given by

$$Y = WL + W_S(1-v)S + rK \tag{13}$$

where $WL, W_S(1-v)S$ and rK stand for aggregate unskilled wage, skilled wage and rental income on capital, respectively.

Commodity 2 is a non-traded high-skill product (services). The aggregate demand for this commodity (D_2) consists of both domestic demand and foreign demand. The foreign demand is exogenously given at $\bar{D}$ while the domestic demand depends negatively and

[9] This is also the national income at domestic (or world) prices as there are no tariffs and/or subsidies.

positively on the relative price of the commodity (P_2) and aggregate factor income (Y), respectively.[10] We, therefore, write

$$D_2 = D_2(P_2, Y) + \bar{D} \tag{14}$$

In equilibrium, the aggregate demand for commodity 2 is equal to its supply (X_2). Hence in equilibrium we have

$$D_2(P_2, Y) + \bar{D} = X_2 \tag{15}$$

In this general equilibrium set-up we have eleven endogenous variables - $W, W_S, r, h^*, P_2, v, D_2, Y, X_1, X_2$ and X_3 and the same number of independent equations; namely equations (4), (5) and (7) – (15). h^*, v, W, W_S and r are obtained as functions of P_2 from equations (4), (5) and (7) – (9). Once factor prices are known factor-coefficients (a_{ji} s) are also obtained as functions of P_2. Y and D_2 are found from (13) and (14) while X_1, X_2 and X_3 are solved as functions of P_2 from (10) – (12). Finally, P_2 is obtained from (15).

As sector 2 and sector 3 use two common inputs, skilled labour and capital, they together form a Heckscher-Ohlin subsystem (HOSS) and can be classified in terms of factor intensities. However, we do not want to make factor intensity rankings of these two sectors at this stage. We would like to show how most of the results crucially hinge on the relative factor intensities of the two high-skill sectors.

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[10] The relative price of commodity 3 i.e. P_3 is also an argument in D_2. But we do not explicitly include it in the demand function as it is given internationally.

3. Consequences of Economic Recession

In this section we are going to examine the consequences of economic recession in the skilled sector on the two labour markets. An economic recession in the skilled labour market is here captured through a decrease in the exogenous foreign demand for the non-traded high-skill commodity ($\bar{D}$). A decrease in $\bar{D}$ affects the price of this commodity (P_2) which in turn affects all the endogenous variables.

3.1 Effects on factor prices and aggregate factor income

For examining the consequences of a drop in $\bar{D}$ on the endogenous variables after totally differentiating equations (4), (5) and (7) – (9), using (4) and (5) and solving by using the Cramer's rule one can derive the following expressions.

$$\left.\begin{aligned}
\hat{r} &= -\left(\frac{h_2 v\theta_{S3}}{h^*|\theta|}\right)\hat{P}_2 \\
\hat{v} &= -\left(\frac{\theta_{K3}}{|\theta|}\right)\hat{P}_2 \\
\hat{W} &= \left(\frac{h_2 v\theta_{K1}\theta_{S3}}{h^*|\theta|\theta_{L1}}\right)\hat{P}_2 \\
\hat{W}_S &= -\left(\frac{h_2 v\theta_{K3}}{W_S{}^2 h_{11}|\theta|}\right)\hat{P}_2 \\
\hat{h}^* &= -\left(\frac{h_2 v\theta_{K3}}{h^* W_S h_{11}|\theta|}\right)(h_1 + W_S h_{11})\hat{P}_2 \\
(\hat{W}_S - \hat{h}^*) &= \left(\frac{h_2 v\theta_{K3}}{h^*|\theta|}\right)\hat{P}_2
\end{aligned}\right\} \qquad (16.1)$$

where $|\theta| = E_2(\theta_{S2}\theta_{K3} - \theta_{S3}\theta_{K2})$; and,

$E_2 = \left(\frac{h_2 v}{h^*}\right) > 0$ is the elasticity of $h^*(.)$ with respect to v. (16.2)

Again differentiating equations (10) – (12) and solving we can also obtain the following expressions.

$$\left.\begin{aligned}\hat{X}_2 &= -(\frac{\hat{P}_2}{|\lambda|})[\lambda_{S3}A_1 + \lambda_{K3}A_2] \\ \hat{X}_3 &= (\frac{\hat{P}_2}{|\lambda|})[\lambda_{S2}A_1 + \lambda_{K2}A_2]\end{aligned}\right\} \qquad (17.1)$$

$$\left.\begin{aligned}&\text{where: } A_1 = (\frac{h_2 v}{h^*|\theta|})[(\frac{\theta_{S3}\lambda_{K1}}{\theta_{L1}})(S^1_{KL} + S^1_{LK}) + \lambda_{K2}S^2_{KS} + \lambda_{K3}S^3_{KS}]; \\ &A_2 = (\frac{v}{|\theta|})[(\frac{h_2}{h^*})(\lambda_{S2}S^2_{SK} + \lambda_{S3}S^3_{SK}) + \theta_{K3}\{(\frac{1}{1-v}) - \frac{h_2(h_1 + W_S h_{11}}{h^* W_S h_{11}}\}]; \text{ and,} \\ &|\lambda| = (\lambda_{K2}\lambda_{S3} - \lambda_{K3}\lambda_{S2}).\end{aligned}\right\} \qquad (17.2)$$

Here S^k_{ji} is the degree of substitution between factors in sector k. For example, $S^1_{LL} = (\frac{W}{a_{L1}})(\frac{\partial a_{L1}}{\partial W})$, $S^1_{LK} = (\frac{r}{a_{L1}})(\frac{\partial a_{L1}}{\partial r})$ etc. $S^k_{ji} > 0$ for $j \neq i$; and, $S^k_{jj} < 0$.

Differentiating (13), using (16.1) and simplifying one can find

$$\hat{Y} = A_3\hat{P}_2 \qquad (18.1)$$

$$\text{where: } A_3 = (\frac{v}{Y|\theta|})[(\frac{\theta_{K1}\theta_{S3}h_2 WL}{h^*\theta_{L1}}) + W_S S\theta_{K3} - (\frac{h_2}{W_S h^* h_{11}})\{h^*(1-v)S\theta_{K3} + rK\theta_{S3}W_S h_{11}\}] \qquad (18.2)$$

Differentiation of (14) yields

$$\hat{D}_2 = E_{P2}\hat{P}_2 + E_Y\hat{Y} + (\frac{\bar{D}}{D_2})\hat{\bar{D}} \qquad (19)$$

where $E_{P2} = (\frac{\partial D_2}{\partial P_2}\frac{P_2}{D_2}) < 0$; and, $E_Y = (\frac{\partial D_2}{\partial Y}\frac{Y}{D_2}) > 0$ are the own price and income elasticities of the non-traded good, respectively.

Using (18.1) equation (19) may be rewritten as follows.

$$\hat{D}_2 = (E_{P2} + A_3 E_Y)\hat{P}_2 + (\frac{\bar{D}}{D_2})\hat{\bar{D}} \tag{20}$$

For Walrasian static stability in the market for the non-traded good (commodity 2) we need

$$(\frac{\hat{D}_2}{\hat{P}_2}) - (\frac{\hat{X}_2}{\hat{P}_2}) = \Delta < 0 \tag{21.1}$$

where

$$\Delta = [(E_{P2} + A_3 E_Y) + \frac{(\lambda_{S3} A_1 + \lambda_{K3} A_2)}{|\lambda|}] < 0 \tag{21.2}$$

Differentiation of the equilibrium condition in the market good 2 i.e. equation (15), use of (17.1), (20) and (21.2) and simplification lead to the following result.

$$(\frac{\hat{P}_2}{\hat{\bar{D}}}) = -[(\frac{\bar{D}}{D_2}) / \Delta] > 0 \tag{22}$$

(-)

Using equations (21.2) and (22) from (17.1) it then follows that

$$\left.\begin{aligned} (\frac{\hat{X}_2}{\hat{\bar{D}}}) &= (\frac{\bar{D}}{D_2 \Delta |\lambda|})[\lambda_{S3} A_1 + \lambda_{K3} A_2] > 0 \text{ ; and,} \\ (\frac{\hat{X}_3}{\hat{\bar{D}}}) &= -(\frac{\bar{D}}{D_2 \Delta |\lambda|})[\lambda_{K2} A_2 + \lambda_{S2} A_1] < 0 \end{aligned}\right\} \tag{23}$$

The above results can be summarized in terms of the following proposition.

Proposition 1: A drop in the foreign demand for the non-traded good resulting from economic recession leads to (i) an unambiguous decrease in the price of the commodity; and, (ii) a contraction (an expansion) of sector 2 (sector 3).

The intuitive explanations of these results are fairly straightforward. A fall in the exogenously given foreign demand results in a decrease in the aggregate demand for good 2 which lowers its price, P_2, given the supply. A fall in P_2 then produces a Stolper-

Samuelson effect and a consequent Rybczynski effect in the HOSS thereby leading to a contraction of sector 2 and an expansion of sector 3. These results are independent of the factor intensity rankings of the two high-skill sectors.

Besides, from (16.1), (16.2), (18.1), (18.2), (21.2) and (22) the following proposition can be established.[11]

Proposition 2: If sector 3 is more capital-intensive relative to the non-traded sector (sector 2) a decrease in the autonomous foreign demand for the non-traded commodity leads to (i) decreases in both skilled and unskilled wages; and, (ii) increases in both return to capital and skilled unemployment rate. Besides, the policy lowers the aggregate factor income of the economy if additionally $(\frac{a_{K3}}{a_{S3}}) \geq [\frac{K\xi}{(1-v)S}]$ where $\xi = -(\frac{W_S h_{11}}{h_1}) > 0$ is the elasticity of the $h_1(.)$ function with respect to W_S.

In proposition 1 we have seen that a decrease in $\bar{D}$ lowers the price of the non-traded commodity, P_2 and a contraction of sector 2. Now if sector 2 is less (more) capital-intensive (skilled labour-intensive) vis-à-vis sector 3 the skilled wage falls and the return to capital rises due to the Stolper-Samuelson effect. The aggregate demand for skilled labour falls as the skilled labour-intensive sector contracts. This raises the unemployment rate of skilled labour. The expanding capital-intensive sector (sector 3) requires more capital which is released by both sector 2 and sector 1.[12] consequently, sector 1 also contracts and the competitive unskilled wage falls. The aggregate wage income of both types of labour falls but the rental income on capital rises. So there are two opposite effects on the aggregate factor income. Our analysis shows that the aggregate factor income falls if additionally the capital-skilled labour ratio in sector 3 is not less than a

[11] These results have been proved in Appendix I.

[12] As the capital-intensive sector (sector 3) expands at the cost of the skilled labour-intensive sector (sector 2), the aggregate demand for capital in the HOSS increases. In other words, the capital released by the contracting sector 2 is inadequate for the expansion of sector 3. The remaining amount of extra capital must, therefore, come from sector 1.

critical value (see proposition 2). However, the consequences on different factor prices and aggregate factor income are completely opposite if sector 2 is more (less) capital-intensive (skilled labour-intensive) vis-à-vis sector 3.

4. Effect of economic recession on welfare of workers

We are now going to analyze the effect of economic recession in the skilled sector on the welfare of the workers. There are two types of worker in the economy: skilled and unskilled. We assume that workers are the owners of capital and that the capital income is equally received by the workers[13] (both skilled and unskilled). There are three income groups in the economy: unskilled workers, employed skilled workers and unemployed skilled workers. The income distribution of the different working groups is given as follows.

	Income		
(wage income plus capital income):	$[W+(\frac{rK}{L+S})]$	$[W_S+(\frac{rK}{L+S})]$	$[(\frac{rK}{L+S})]$
Employment:	L	$(1-v)S$	vS

After normalizing the aggregate labour endowment (skilled plus unskilled) to unity we write

$$(S+L)=1 \qquad (24)$$

As the incomes of the different groups of worker differ, there is a positive Gini-coefficient, G, of the income distribution of the workers.

The welfare measure of Sen (1974), defined as the per-capita income multiplied by one minus the Gini-coefficient of the income distribution, is an appropriate measure of

[13] This is a simplifying assumption. The welfare analysis becomes extremely complicated if the owners of capital (capitalists) are considered as a separate group of income earning people. Besides, Gupta (1994), Chaudhuri (2000) and Dwibedi and Chaudhuri (2010) have also made this assumption on different contexts.

welfare of the workers. Let V be the social welfare measure of Sen (1974) which is given as follows.

$$V = y(1-G) \tag{25}$$

where y is the average wage income of all workers. From (13) after using (24) we note that

$$y = [WL + W_S(1-v)S + rK] \tag{26}$$

$$\text{Also } yG = (1-v)SL(W_S - W) + (1-v)SvSW_S + LvSW \tag{27}$$

Using (26) and (27) and simplifying from (25) we can write

$$V = W[1 - S(S + 2vL)] + rK + W_S S^2[1 - v(1+L)] \tag{28}$$

Differentiating (28) the following proposition can be proved.[14]

Proposition 3: A drop in exogenous demand for the non-traded high-skill commodity resulting from economic recession lowers welfare of the workers if (i) $|\theta| > 0$; (ii) $1 \geq 2v$; and, (iii) $(\frac{a_{S3}}{a_{K3}}) \leq (\frac{vS^2(1+L)}{E_2 K})$. On the contrary, if the non-traded sector is more capital-intensive relative to the other high-skill sector and conditions (ii) and (iii) hold welfare of the workers improves.

5. Policy implications of results and concluding remarks

The recent economic recession though originated in developed countries, has affected the economies of many developing countries as well. India is by no means an exception. Rates of economic growth have fallen sharply and massive job losses and increasing poverty are all shaking the economic foundation of these countries. The developed countries have desperately fallen back upon monetary and fiscal measures for getting out of the crises. Besides, in a bid to protect domestic jobs they have laid off numerous migrant workers and restricted the entry of new skilled migrants into their territories. This

[14] See Appendix II.

protectionist policy on the part of developed nations adds to the dismay of the developing countries. In this backdrop this paper has examined the implications of economic recession in the high-skill sector on the wellbeing of the different groups of worker in a developing economy in terms of a three-sector general equilibrium model with two high-skill sectors.[15] One of the two high-skill sectors produces a non-traded commodity the aggregate demand for which consists of both domestic and foreign demand. There is unemployment of skilled labour in the model which has been explained by using the wage efficiency hypothesis. A reduction in the foreign demand for the non-traded commodity resulting from worldwide economic recession not only depresses the two wages and national income but also raises the unemployment of skilled labour in the case where the non-traded high-skill sector is less (more) capital-intensive (skilled labour-intensive) vis-à-vis the other high-skill sector (sector 3). Also this is likely to affect welfare of the working community adversely. On the contrary, if the non-traded sector is capital-intensive all the above results are likely to get reversed. The developed countries have already resorted to protectionist measures to safeguard the interest of their workers. There is no reason, therefore, as to why the developing economies should not also undertake protectionist policies to care for the interest of their workforce. If initially the non-traded sector (sector 2) is less capital-intensive relative to sector 3, the government should resort to a capital subsidy policy to sector 2 and/or impose a tax on the use of capital in sector 3 so as to increase the capital intensity of production in sector 2.[16]

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[15] This analytical structure may also be useful in examining the consequence of economic recession on the relative wage inequality in the developing world. There is, however, a vast theoretical literature that explains the widening of the skilled-unskilled wage inequality in the developing countries during the liberalized economic regime. This consists of works like Chaudhuri (2008), Chaudhuri (2004), Chaudhuri and Yabuuchi (2007, 2008), Beladi, Chaudhuri and Yabuuchi (2008), Yabuuchi and Chaudhuri (2009, 2007) etc. However, none of these papers has discussed the outcome of worldwide economic downturn on the relative wage inequality.

[16] A capital subsidy policy to sector 2 makes capital relatively cheaper which in turn induces the producers in sector 2 to substitute skilled labour by capital. As a result, the production technique in this sector becomes more capital-intensive than before. On the other hand, a tax on the use of capital in sector 3 lowers the capital intensity of production. There exist critical values of the subsidy and tax rates such that any further increases in these rates completely reverse the factor

These fiscal policies, if undertaken appropriately, are expected to result in an unequivocal improvement in the wellbeing of the working population and protect them from the wrath of global economic meltdown.

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intensity rankings of the two high-skill sectors. If this happens economic recession can no longer worsen the economic wellbeing of the workers.

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Appendix I: Effects of economic recession on factor prices and aggregate factor income

Using (16.1), (16.2), (21.2) and (22) and simplifying the following results can be obtained.

$$\left.\begin{aligned}
&(\frac{\hat{r}}{\hat{\bar{D}}}) = (\frac{h_2 v\theta_{S3}\bar{D}}{h^*|\theta| D_2\Delta}) < (>)0 \text{ iff } |\theta| > (<)0 \\
&(\frac{\hat{W}}{\hat{\bar{D}}}) = -(\frac{h_2 v\theta_{K1}\theta_{S3}\bar{D}}{h^*\theta_{L1}|\theta| D_2\Delta}) > (<)0 \text{ iff } |\theta| > (<)0 \\
&(\frac{\hat{v}}{\hat{\bar{D}}}) = (\frac{\theta_{K3}\bar{D}}{|\theta| D_2\Delta}) < (>)0 \text{ iff } |\theta| > (<)0 \\
&(\frac{\hat{W}_S}{\hat{\bar{D}}}) = (\frac{h_2 v\theta_{K3}\bar{D}}{W_S{}^2 h_{11}|\theta| D_2\Delta}) > (<)0 \text{ iff } |\theta| > (<)0 \\
&(\frac{\hat{h}^*}{\hat{\bar{D}}}) = [(\frac{h_2 v\theta_{K3}\bar{D}}{h^* W_S h_{11}|\theta| D_2\Delta})(h_1 + W_S h_{11})] > (<)0 \text{ iff } |\theta| > (<)0 \\
&(\frac{\hat{W}_S - \hat{h}^*}{\hat{\bar{D}}}) = -(\frac{h_2 v\theta_{K3}\bar{D}}{h^*|\theta| D_2\Delta}) > (<)0 \text{ iff } |\theta| > (<)0
\end{aligned}\right\} \qquad \text{(A.1)}$$

Similarly, using (22) and simplifying from equations (18.1), (18.2) and (21.2) we find

$$\left.\begin{aligned}
&(\frac{\hat{Y}}{\hat{\bar{D}}}) = -(\frac{A_3\bar{D}}{D_2\Delta}) > (<)0 \text{ iff } A_3 > (<)0 \\
&A_3 > (<)0 \text{ if (i) } |\theta| > (<)0\text{; and,} \\
&\qquad \text{(ii) } [h^*(1-v)S\theta_{K3} + rK\theta_{S3}W_S h_{11}] \geq 0 \Rightarrow (\frac{a_{K3}}{a_{S3}}) \geq [\frac{K\xi_1}{(1-v)S}]
\end{aligned}\right\} \qquad \text{(A.2)}$$

where $\xi_1 = -(\frac{W_S h_{11}}{h_1}) > 0$ is the elasticity of the $h_1(.)$ function with respect to W_S.

From (A.2) it, therefore, follows that

$$(\frac{\hat{Y}}{\hat{\bar{D}}}) = -(\frac{A_3\bar{D}}{D_2\Delta}) > (<)0 \text{ if (i) } |\theta| > (<)0\text{; and, (ii) } (\frac{a_{K3}}{a_{S3}}) \geq [\frac{K\xi}{(1-v)S}] \tag{A.3}$$

Appendix II: Effect of economic recession on V

Differentiating equation (28) we get

$$(\frac{dV}{d\bar{D}}) = (\frac{dW}{d\bar{D}})[1-S(S+2vL)] - (\frac{dv}{d\bar{D}})S[2WL + W_S S(1+L)] + K(\frac{dr}{d\bar{D}}) + (\frac{dW_S}{d\bar{D}})S^2[1-v(1+L)] \tag{A.4}$$

$$\text{Now, } [1-v(1+L)] = [(1-2v)+vS] > 0 \text{ if } 1 \geq 2v \tag{A.5}$$

$$\text{Again, } [1-S(S+2vL)] = 1-S[S+2v-2vS] = (1-2vS)-S^2(1-2v)$$

$$= 1-2v(1-L)-S^2(1-2v) = (1-2v)(1-S^2)+2vL > 0 \text{ if } 1 \geq 2v \tag{A.6}$$

Besides, using (A.1) from (A.4) one finds

$$\left.\begin{aligned} &[-(\frac{dv}{d\bar{D}})S^2W_S(1+L) + K(\frac{dr}{d\bar{D}})] \\ &\quad = [-S^2W_S(1+L)(\frac{v\theta_{K3}\bar{D}}{\bar{D}|\theta|D_2\Delta}) + (\frac{rK}{\bar{D}})(\frac{h_2 v\theta_{K3}\bar{D}}{h^*|\theta|D_2\Delta})] \\ &\quad = (\frac{\theta_{K3}W_S KE_2}{|\theta|D_2\Delta})[(\frac{a_{S3}}{a_{K3}}) - (\frac{vS^2(1+L)}{E_2K})] \\ &\text{where } E_2 = (\frac{\partial h}{\partial v}\frac{v}{h}) = (\frac{h_2 v}{h^*}) > 0 \end{aligned}\right\} \tag{A.7}$$

Using (A.7) equation (A.4) can be rewritten as follows.

$$(\frac{dV}{d\bar{D}}) = (\frac{dW}{d\bar{D}})[1-S(S+2vL)] - 2(\frac{dv}{d\bar{D}})SWL + (\frac{dW_S}{d\bar{D}})S^2[1-v(1+L)] + (\frac{\theta_{K3}W_S KE_2}{|\theta|D_2\Delta})[(\frac{a_{S3}}{a_{K3}}) - (\frac{vS^2(1+L)}{E_2K})] \tag{A.8}$$

Using (A.1) and simplifying from (A.8) we finally obtain

$$(\frac{dV}{d\bar{D}}) = (\frac{E_2}{|\theta|\Delta D_2})[-(\frac{\theta_{K1}\theta_{S3}W}{\theta_{L1}})\{1-S(S+2vL\}-2(\frac{SWL\theta_{K3}h^*}{h_2}) + (\frac{h^*\theta_{K3}S^2}{W_S h_{11}})\{1-v(1+L)\} + (\theta_{K3}W_S K)\{(\frac{a_{S3}}{a_{K3}})-\frac{vS^2(1+L)}{E_2 K}\}] \quad \text{(A.9)}$$

From (A.9) we find that

$$\left.\begin{aligned}(\frac{dV}{d\bar{D}}) > 0 \text{ if (i)} |\theta| > 0;\\ \text{(ii)} 1 \geq 2v \text{; and,}\\ \text{(iii)} (\frac{a_{S3}}{a_{K3}}) \leq (\frac{vS^2(1+L)}{E_2 K})\end{aligned}\right\} \quad \text{(A.10)}$$

$$\text{On the contrary, } (\frac{dV}{d\bar{D}}) < 0 \text{ if (i)} |\theta| < 0; \quad \text{(ii)} 1 \geq 2v \text{; and,} \quad \text{(iii)} (\frac{a_{S3}}{a_{K3}}) \leq (\frac{vS^2(1+L)}{E_2 K}) \quad \text{(A.11)}$$