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Characterization of Economic Growth in Developing Economies with Informal Sector

Shubhasankar Chattopadhyay, Rima Mondal

Abstract

This paper theoretically evaluates the effects of alternative investment policies on sectoral return to capital, sectoral wage rates, output and employment composition, and growth in a developing economy consisting of a vast informal sector in a general equilibrium framework. With formal sector being capital intensive, investment in formal sector causes sectoral rates of return and wages to be equalized in the long run. Though rates of return are equalized with investment in informal sector, formal-informal wage gap continue to exist in the long run. Further, investment in formal sector causes informal sector to shrink, but not vice versa. The paper also highlights existence of ‘turning point’ in growth *à la* Lewis.

Keywords

Developing economy, Formal and informal sector, Growth, Investment, General equilibrium

1. Introduction

Informal sector occupies a significant proportion of economic activities in developing economies both in terms of GDP and employment. On an average, more than seventy per cent of the working population in developing economies is employed in the informal sector (Agenor, 1996). The role of informal sector in growth of developing economies is not well investigated in literature. Theories of dual economies (Lewis, 1954; Kalecki, 1955; Harris-Todaro, 1970) characterize the path of economic development from agrarian to urbanized society, where informal sector emerges as a sub-market. As Marjit and Kar (2009, 2011) note, the informal sector can be more dynamic than the formal sector provided they have the right opportunities to flourish. Informal sector is not necessarily an entity that is trapped in low level equilibrium. In

fact both informal manufacturing units and self-employed units accumulate fixed assets, invest and grow. However, limited literature is available on theoretical explanation to growth path of developing economies when capital accumulation takes place in informal sector.

In India, size of informal sector is large both in terms of employment and value added (Kannan, 2008; Chandrasekhar & Ghosh, 2013). Table 1 provides data on share of employment and gross value added (GVA) by informal sector in India. It is evident that the share of employment in informal sector has increased. Accumulation of capital and wage of labour have also shown a positive growth during 1995-2000 (Marjit & Kar, 2011; NSSO). Therefore, India's informal sector is large and growing. However, the mammoth informal economy is yet to be studied and assessed properly (Kaushik, 2014).

There has been a renewed emphasis on the role of informal sector after economic crisis of 2008. India's informal sector played a major role in maintaining steady growth rate of GDP in post-crisis recovery period. But after 2011, there was a sudden fall of growth rate of GDP in India. Average growth rate of GDP in India came down to 4.6 per cent (2012-14) from 8.3 per cent (2004-2011). Falling investments were found to be the cause for deceleration of GDP growth rate (RBI annual report, 2011-12; Economic Survey, 2014-15).

The newly elected government of India has put forth the policies to increase investment in pursuit of higher economic growth (Economic Survey, 2014-15; The Economist, May 2014). Standard neo-classical growth theories (Solow, 1956; Swan, 1956) analyze the impact of investment on long-run growth. Focus of these theories remain on 'steady state'. Developed economies can be viewed as having 'homogenous' characteristics which have shown features of 'steady state' (Kaldor, 1957). Whereas, developing economies cannot be treated as homogenous because of prevalence of structural features. One such structural feature is captured through existence of 'informal sector' that is a sub-market of dual economy model of developing economies (Basu, 2013). Given the structure of developing economies, having vast informal sector, the impact of policies to increase investments must be theoretically examined.

This paper theoretically evaluates the effects of alternative investment policies on sectoral wage rates, output and employment composition, and growth in a developing economy like India consisting of a vast informal sector through a general equilibrium framework. We find that when investment goods are allocated to formal sector, the impact on overall growth in long run is

ambiguous because output of formal sector increases whereas output of informal sector decreases. Growth depends on relative increase and decrease in output of formal and informal sector respectively. In such scenario, economy will get formalized in long run. It is similar to second ‘turning point’ of Lewis (1954) model. For that to happen and to attain equilibrium in capital market, formal sector must be capital intensive. On the other hand, when investment goods are allocated to informal sector, growth increases and equilibrium in capital market is reached on its own in the long run. In this case, there is a possibility that economy will continue to have structural features with wage differential across sectors. We build our argument in the context of India, but our results are generalized in nature.

2. Structural Features of Developing Economies

Developing economies have structural features that leads to fragmentation of market (Basu, 2013). This type of fragmentation in market is captured through ‘dualism’ which exist more prominently in developing economies. India being a developing economy have structural features of ‘dual sector economy’ (Ray, 1998) (Basu, 2012). Theoretical explanation to growth of developing economies having structural features of dual sectors was first given by Lewis (1954). ‘Traditional/ agrarian sector’ is slowly absorbed in ‘modern/ urbanized sector’ in the long run through cycle of reinvestment of capital (Lewis W. 1954, 1979). In short run, labour migrate from traditional sector to modern sector with expectation of higher wage (Harris & Todaro, 1970). Employment opportunities in ‘modern sector’ is constrained by availability of capital. Capital is sector specific in short run (Mahalanobis, 1955), hence, only a part of migrated labour is employed in ‘modern sector’. Rest of labour remains unemployed (Harris & Todaro, 1970) but, in developing economies, this unemployed labour force find jobs urban informal sector (Basu, 2013). It was empirically validated for Latin American and Asian countries that labour who do not get employed in formal sector find jobs in informal sector (Joshi & Joshi, 1976). In developing economies, with very low level of income, labour cannot sit idle and wait for getting employment opportunities in formal sector, hence, they would engage themselves in informal sector (Marjit & Kar, 2003, 2007, 2009, 2011).

Literature on informal sector for developing economies deals with the effects of trade liberalization on factor payments in a dual sector economy with formal and informal sectors. Marjit and Kar investigate comparative statistic effects of changes in trade policy on informal

sector in a static framework. However, there is scant literature on growth theoretic framework of developing economies having enormous informal sector. Structural features of developing economies continue to exist due to wage rigidity across sectors (Chaudhuri, 2007, 08; Chaudhuri & Banerjee, 2010). Hence, for theoretical analysis, Marjit and Kar (2009, 11) defined informal sector based on 'wage determination mechanism'. Wage of labour employed in formal sector is determined through bargaining by trade union. Rest of labour is absorbed in informal sector where wage is determined through market mechanism. Urban-rural wage gap exist endogenously because there is a labour turnover cost associated with exit of each labour when wage of labour in modern sector is lowered (Stiglitz, 1974). This study adopts the definition of informal sector given by Marjit and Kar (2011) and trace the path of economic development when exogenous investments are made in developing economies with structural features.

In this paper we make the distinction between two sectors as Marjit and Kar do. The distinction primarily rests on the legality and method of determination of wages in these sectors. They argue that developing economies have dual labour market where wage of labour employed in 'formal' sector is determined through bargaining by trade union. Formal sector labour is protected through various regulations with minimum wage law, health benefits etc. Motivation for firm to operate in 'informal' sector often lies in avoiding such labour laws and regulations. Further, firms in 'formal' sector cannot escape tax payment, which also serves as a motivation to operate in informal sector.

Models by Marjit and Kar (2009, 2011) assume that sectoral physical capital stocks, though different in nature, are mobile between sectors instantaneously (within same period). However, in an economy having significant informal sector, physical capital may not be transferrable in the short run. In developing economies, non-shiftability of the physical capital may well be permanent (Mahalanobis, 1955). Physical capital is more likely to be immobile across sectors as the machines that are used in the informal sector cannot be remodeled to be used in formal sector at all or vice-versa. One might ask: after all, what is difference between investing in a 'car' and in a 'tractor'? While car has well established 'formalised' resale market, it is extremely difficult to sale a tractor in a developing economy through formal market. Even if there is a resale market, because of well-known information asymmetry problems in developing economies, a resale market may not function well. Absence of resale market makes investment 'irreversible' or may cause the 'adjustment cost' of investment to become too high. Therefore, this paper treats capital

stock as sector specific in the *short run*, i.e., sectoral capital stocks are not transferrable in the *same* period.

3. The Model

We consider a three sector closed economy. The first one is Investment goods sector (I) which is sort of a self-contained system. Investment goods sector is installed with capital to produce goods that are used in either formal or informal sector as capital input. Economy is concerned with how best to allocate current output of I -goods to other (i.e. formal or informal) sectors. Capital is not accumulated in investment goods sector and hence output of investment goods sector remains constant over time. Second and third sectors are formal (X) and informal (M) respectively. Both the sectors have constant returns to scale production function with labour and capital as factors of production having diminishing marginal productivity. There is smooth factor substitution in each of the sectors and factors can be substituted depending on relative prices i.e. wage and return to capital respectively.

There is no joint production in these sectors which implies that formal/informal sector is involved in production of only formal/informal goods and none of the sectors produce both type of output. Assumption of no joint production is valid for two sector economy (Chang, Ethier, & Kemp, 1980) where both the sectors use more than one input as factor of production and a single factor is not used for production of multiple output (Jones & Scheinkman, 1977). We are differentiating between formal and informal sector based on wage determination mechanism, type of output produced and not on the basis of technology.

2.1 Assumptions of the Model

Following are the assumptions of the model.

(i) Markets are competitive and technology exhibits CRS and diminishing marginal productivity for both formal and informal sectors. Coefficients for factor of production are flexible and depends on relative factor prices.

(ii) Labour is homogenous and is *perfectly mobile* across sectors. Sectoral capital is *immobile in the short-run* but is transferrable between sectors in the medium to long run.

(iii) Because capital is immobile in the short-run, returns to capital across sectors are not equalized (capital markets are not in equilibrium) in the short-run, inducing investment to flow to higher return sector in a private enterprise economy.

(iv) Output prices are fixed. Endogenous changes in prices require explicit demand conditions. We do not bring in such condition in this paper.

(v) The primary distinction between formal and informal sectors in this model is in terms of how wages are negotiated and paid to labour in both sectors. In formal sector wages are negotiated by bargaining (formal sector is 'unianised'), specifically it is the 'nominal' wage that is negotiated in formal sector. This essentially means that there exists factor market distortion in the labour market (Jones, 1971; Neary, 1978). One may also recall such underlying assumption in standard Keynesian 'sticky wage' model that seeks to explain upward sloping aggregate supply curve (Mankiw, 2010). Such wage rigidity is also amongst one of the prominent reasons for existence of structural features in developing economies.

(vi) Wage in the formal sector is not fixed permanently. In a fixed price model, there is one-to-one relation between nominal and real wage. Wage in formal sector is determined in a manner such that, nominal wage (and real wage) in stays at its level until nominal wage (and real wage) of informal sector catches up from below. Once the catching up happens, nominal wage in formal sector gets indexed to informal sector, *i.e.*, they move with equality.

(vii) There is no 'open unemployment' in 'Harris-Todaro' sense in this model. Given the level of capital stock in formal sector and fixed bargained wage in the short run, marginal productivity determines the labour requirement. What happens to the rest of labour? Since income levels of labour in developing economies is usually low, they cannot wait for getting employed in formal sector. Unlike developed economies, unemployed labour in developing economies are not entitled to unemployment benefits provided by government. So, unemployed labour force would find job in informal sector. Therefore, rest of the available (residual) labour is absorbed in the informal sector. The level of residual labour level determines wage rate in the informal sector. These condition ensures full employment of labour.

(viii) We make the standard and realistic assumption that the formal sector is capital intensive and informal sector is labour intensive (Marjit & Kar, 2009, 2011).

2.2 Equilibrium Conditions

We use the following notations.

\bar{w} : Formal unionized wages

w : Informal (flexible) wage

r_i : Return to capital in sectors $i = X, M$ and I

Y_X : Output of Formal goods sector

Y_I : Output of Formal Investment goods sector

Y_M : Output of Informal goods sector

\bar{L} : Total supply of labour (fixed for this model)

\bar{K} : Total supply of Capital

K_i : Supply of capital in sectors $i = X, M$ and I

P_i = Price of goods $i = X, M$ and I (fixed for this model)

a_{LX}, a_{LM} : Per unit labour use in X and M (inverse of average productivity of labour)

a_{KX}, a_{KM}, a_{KI} : Per unit capital use in X, M and I (inverse of average productivity of capital)

There are three sets of equilibrium conditions:

Competitive price equilibrium:

- Competitive price of investment goods sector: $r_I a_{KI} = P_I$ (1)

- Competitive price of informal sector: $r_M a_{KM} + w a_{LM} = P_M$ (2)

- Competitive price of formal sector: $r_X a_{KX} + \bar{w} a_{LX} = P_X$ (3)

Full Employment of factors:

- Full employment of labour: $a_{LX} Y_X + a_{LM} Y_M = \bar{L}$ (4)

- Full employment of capital in formal sector: $a_{KX} Y_X = K_X$ (5)

- Full employment of capital in informal sector: $a_{KM}Y_M = K_M$ (6)

- Full employment of capital in investment goods sector: $a_{KI}Y_I = K_I$ (7)

- Full employment of capital: $\bar{K}_X + \bar{K}_M + \bar{K}_I = \bar{K}$ (8)

Factor substitution equations:

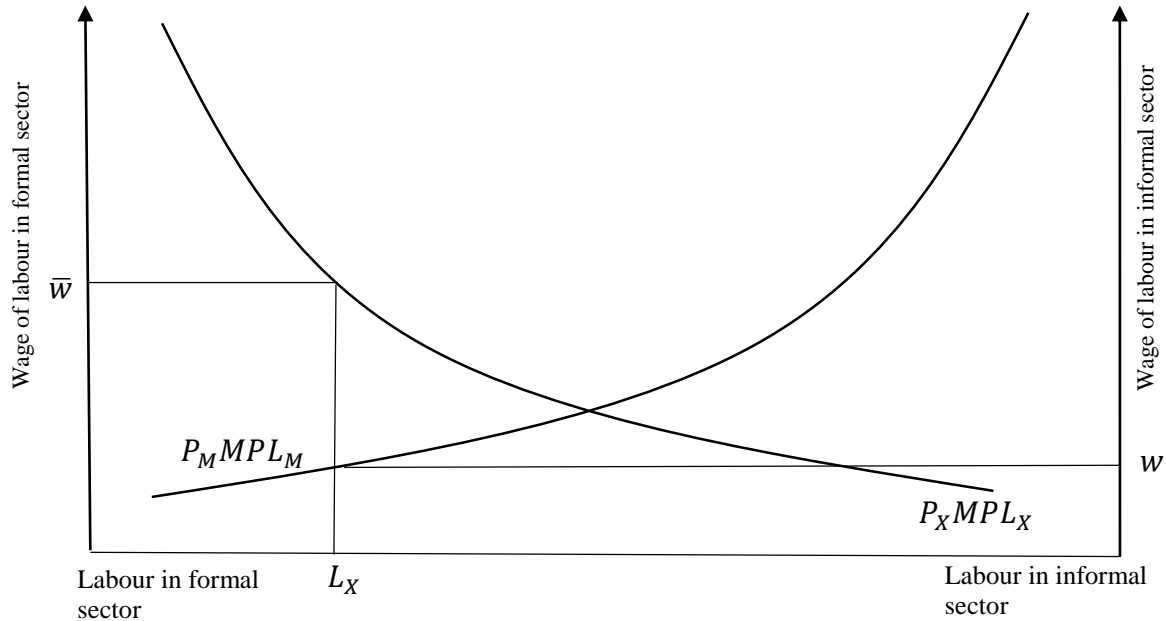
- Factor substitution of labour: $a_{Li} = a_{Li}(w_i/r_i); i = X, M$ and $\hat{a}_{LX} / \hat{w} < 0$ (9)

- Factor substitution of capital $a_{Ki} = a_{Ki}(w_i/r_i); i = X, M$ and $\hat{a}_{KX} / \hat{w} > 0$ (10)

2.3 Determination of Variables

We have to determine seven unknowns, $w, r_X, r_M, r_I, Y_X, Y_M,$ and Y_I and we have seven equations. The known values are $K_X, K_M, K_I, \bar{w}, P_X, P_M, P_I$. Thus, we have seven equations involving seven unknowns, so the system is exactly determined. Value of marginal product of labour curve for formal and informal sectors are shown in figure 1. Given \bar{w} , L_X is determined from marginal productivity curve. Remaining $\bar{L} - L_X = L_M$ is employed in informal sector, so, w is determined. Then, from equation (2) and (3), one can determine r_X and r_M . Y_X, Y_M and Y_I are determined from equations (5), (6) and (7) respectively.

Figure 1: Determination of allocation of labour and wage rate



3. Investment and Growth

The economy is concerned with allocation of available investment goods in formal and informal sector. Due to capital specificity in the short run, return to capital will not be equalized across sectors. We assume that capital owners respond to this return differential by allocating entire output of I -goods to the higher return sector. However, in order to rule out self-accumulation in I -sector, we assume that for all feasible range of r_X , r_M and r_I , $r_X > r_I$ and $r_M > r_I$. Next, we analyze the impact on growth and return to factors due to investment in formal and informal sectors.

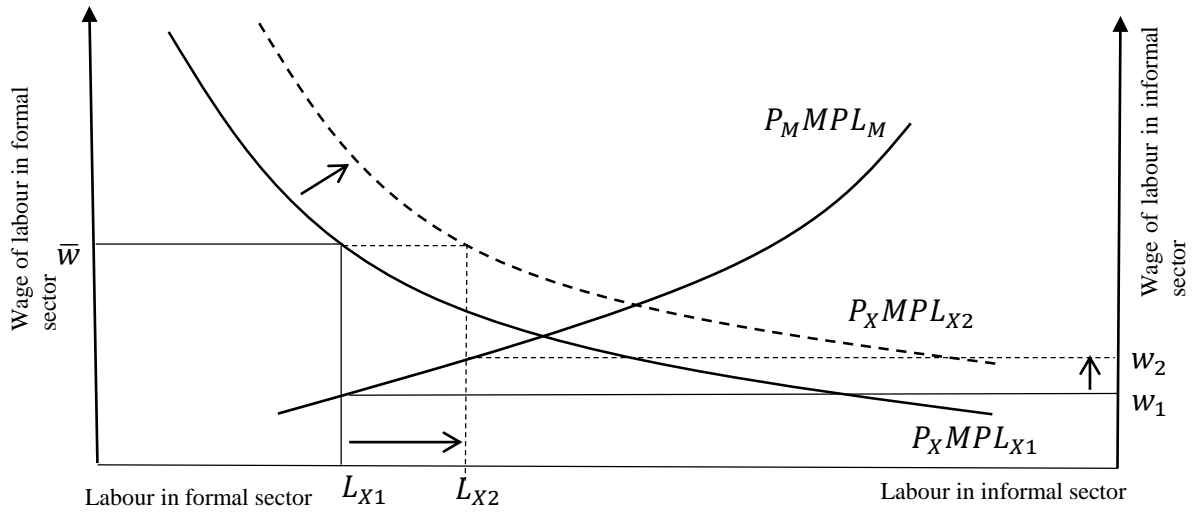
3.1 Investment and Growth in Formal Sector

Suppose that starting from a given (K_X/K_M) in the short run, it happens that $r_X > r_M$. What are the effects on r_X and r_M (and therefore on the return differential $r_X - r_M$), sectoral wage rates, employment and outputs if *entire* output of investment goods is directed to increase K_X ?

For clarity of exposition we divide each period into two sub-periods. In the first sub-period, investment causes K_X and therefore $P_X MPL_X$ to increase at the initial L_X (with fixed P_X), *i.e.*, $P_X MPL_X$ curve shifts up. It is then immediate from the labour allocation equilibrium that (since \bar{w} is given), L_X rises and L_M falls accompanied by a rise in w . Now, higher return should also reallocate some capital from informal sector, but this does not happen immediately; it happens in the second sub-period. This causes $P_X MPL_X$ curve to shift up once more and $P_M MPL_M$ curve to shift down resulting in a fall in w . Since reallocation is slow (because of reasons given in section 2), it is highly likely that with investment *and* reallocation w will *rise*.

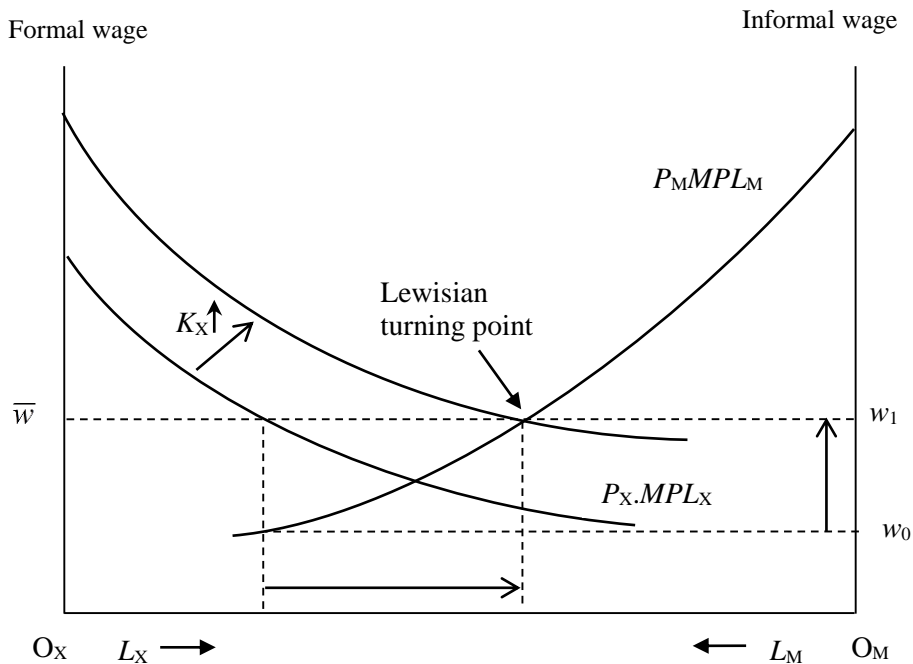
For attaining capital market equilibrium in the long run, the gap $(r_X - r_M)$ should close as K_X goes up. An increase in capital leads to rightward shift of value of marginal productivity curve (Figure 2). Formal sector will absorb labour from informal sector. It will result in increase in L_X and decrease in L_M . Decrease in labour in informal sector leads to increase in wage and decrease in r_M (equation 2). The gap $(r_X - r_M)$ will increase further as r_M falls with constant r_X .

Figure 2: Effect of Investment in Formal Sector



Output of formal sector increases at an increasing rate (CRS) due to increase in both factors. On the other hand, output of informal sector decreases due to decrease in L_M and constant K_M . As per well-known ‘wage productivity axiom’ (Leibenstein, 1958), increase in wage of labour must lead to increase in productivity of informal sector. But, when increase in wage is accompanied with decrease in labour, then, there is a decrease in total productivity and output (Basu, 2013), which explains decrease in output of informal sector even though there is an increase in wage of labour.

Figure 3: Reaching the Turning point



Capital owners will keep on allocating capital in formal sector due to increase in return differential. Wage of labour in informal sector will also keep on increasing and it will catch up with the wage of labour in formal sector (Figure 3). Subsequently, wage of labour in formal sector will be determined through market mechanism. It can be compared to ‘second turning point’ of Lewis surplus employment model when wage of both ‘capitalist/modern’ and ‘non-capitalist/traditional’ sectors is determined through marginal productivity of labour (Lewis W. A., 1968). In this case, ‘turning point’ will be observed in a *full employment* model.

After turning point, wage of labour in both sectors will rise. Increase in wage of labour in formal sector will lead to decrease in return to capital. As a result, the return differential ($r_X - r_M$) starts closing down if the rate of decrease of return to capital in formal sector is higher than that of informal sector. This implies that formal sector must be capital intensive.

3.1.1 Equations of Change before ‘Turning Point’

What happens to return differential ($r_X - r_M$) when investment goes to formal sector?

From equation (3), with constant P_X and \bar{w} , r_X is also constant. Thus, there is no change in wage of labour and return to capital in formal sector till wages are determined through bargaining till the turning point.

Totally differentiation of equation (2) at with constant P_M yields:

$$wda_{LM} + a_{LM}dw + r_M da_{KM} + a_{KM}dr_M = 0$$

$$\frac{wa_{LM}}{P_M} \frac{da_{LM}}{a_{LM}} + \frac{a_{LM}w}{P_M} \frac{dw}{w} + \frac{r_M a_{KM}}{P_M} \frac{da_{KM}}{a_{KM}} + \frac{a_{KM}r_M}{P_M} \frac{dr_M}{r_M} = 0$$

$$\theta_{LM} \hat{a}_{LM} + \theta_{LM} \hat{w} + \theta_{KM} \hat{a}_{KM} + \theta_{KM} \hat{r}_M = 0$$

where θ_{ij} is factor distributive share and $\theta_{LM} + \theta_{KM} = 1$. Similarly for informal sector

$$\theta_{LX} + \theta_{KX} = 1.$$

Since $\theta_{LM}\hat{a}_{LM} + \theta_{KM}\hat{a}_{KM} = 0$, so $\theta_{LM}\hat{w} + \theta_{KM}\hat{r}_M = 0$. Thus, $\hat{w} = -\frac{\theta_{KM}}{\theta_{LM}}\hat{r}_M$ or $\hat{w} = -\frac{(1-\theta_{LM})}{\theta_{LM}}\hat{r}_M$.

Now, $\theta_{LM} + \theta_{KM} = 1$, therefore '1 - θ_{LM} ' is positive implying \hat{w} is negatively related to \hat{r}_M . An increase in wage of labour in informal sector leads to decrease in return to sectoral capital.

Hence, due to investment in formal sector, r_X will be constant and r_M will decline. As a result, return differential of two sectors increases.

3.1.2 Equations of Change after 'Turning Point'

After 'turning point', wage of labour in both sectors starts increasing. Total differentiation of equation (3) yields,

$$\frac{\bar{w}a_{LX}}{P_X} \frac{da_{LX}}{a_{LX}} + \frac{a_{LX}\bar{w}}{P_X} \frac{d\bar{w}}{\bar{w}} + \frac{r_X a_{KX}}{P_X} \frac{da_{KX}}{a_{KX}} + \frac{a_{KX}r_X}{P_X} \frac{dr_X}{r_X} = 0$$

$$\theta_{LX}\hat{a}_{LX} + \theta_{LX}\hat{\bar{w}} + \theta_{KX}\hat{a}_{KX} + \theta_{KX}\hat{r}_X = 0$$

Since, $\theta_{LX}\hat{a}_{LX} + \theta_{KX}\hat{a}_{KX} = 0$, $\theta_{LX}\hat{\bar{w}} + \theta_{KX}\hat{r}_X = 0$

Thus, $\hat{\bar{w}} = -\frac{\theta_{KX}}{\theta_{LX}}\hat{r}_X$ or $\hat{\bar{w}} = -\frac{(1-\theta_{LX})}{\theta_{LX}}\hat{r}_X$ and $(1-\theta_{LX})$ is positive which implies that $\hat{\bar{w}}$ is

negatively related to \hat{r}_X . An increase in wage of labour in formal sector leads to decrease in return to capital.

Note also that there is no change in the return to capital in investment goods sector, which is evident from equation (1).

3.1.3 Equation of change due to increase in K_X

Full employment conditions implies $a_{LX}Y_X + a_{LM}Y_M = \bar{L}$ which can be rewritten as

$$a_{LX} \frac{\bar{K}_X}{a_{KX}} + a_{LM} \frac{\bar{K}_M}{a_{KM}} = \bar{L}$$

When there is an increase in \bar{K}_X , with constant \bar{K}_M and \bar{L} , we have

$$\frac{\bar{K}_X}{a_{KX}} da_{LX} - \frac{\bar{K}_X a_{LX}}{(a_{KX})^2} da_{KX} + \frac{a_{LX}}{a_{KX}} d\bar{K}_X + \frac{\bar{K}_M}{a_{KM}} da_{LM} + \frac{a_{LM}}{a_{KM}} d\bar{K}_M - \frac{\bar{K}_M a_{LM}}{(a_{KM})^2} da_{KM} = 0$$

$$\frac{\bar{K}_X a_{LX}}{a_{KX}} \hat{a}_{LX} - \frac{\bar{K}_X a_{LX}}{a_{KX}} \hat{a}_{KX} + \frac{\bar{K}_M a_{LM}}{a_{KM}} \hat{a}_{LM} + \frac{\bar{K}_X a_{LX}}{a_{KX}} \hat{\bar{K}}_X - \frac{\bar{K}_M a_{LM}}{a_{KM}} \hat{a}_{KM} = 0$$

$$Y_X a_{LX} \hat{a}_{LX} - Y_X a_{LX} \hat{a}_{KX} + Y_M a_{LM} \hat{a}_{LM} + Y_X a_{LX} \hat{\bar{K}}_X - Y_M a_{LM} \hat{a}_{KM} = 0$$

$$L_X \hat{a}_{LX} - L_X \hat{a}_{KX} + L_M \hat{a}_{LM} + L_X \hat{\bar{K}}_X - L_M \hat{a}_{KM} = 0$$

$$\frac{L_X}{L} \hat{a}_{LX} - \frac{L_X}{L} \hat{a}_{KX} + \frac{L_M}{L} \hat{a}_{LM} + \frac{L_X}{L} \hat{\bar{K}}_X - \frac{L_M}{L} \hat{a}_{KM} = 0$$

Defining ' λ_i ' as fraction of labour force used in each sector,

$$\lambda_{LX} \hat{a}_{LX} - \lambda_{LX} \hat{a}_{KX} + \lambda_{LM} \hat{a}_{LM} + \lambda_{LX} \hat{\bar{K}}_X - \lambda_{LM} \hat{a}_{KM} = 0$$

$$\lambda_{LX} (\hat{a}_{LX} - \hat{a}_{KX}) + \lambda_{LM} (\hat{a}_{LM} - \hat{a}_{KM}) + \lambda_{LX} \hat{\bar{K}}_X = 0$$

Defining elasticity of substitution between capital and labour in formal sector (wage of labour in both sectors are equal) as

$$\sigma_X = -\frac{(\hat{a}_{LX} - \hat{a}_{KX})}{\hat{w} - \hat{r}_X}$$

Defining elasticity of substitution between capital and labour in informal sector as

$$\sigma_M = -\frac{(\hat{a}_{LM} - \hat{a}_{KM})}{\hat{w} - \hat{r}_M}$$

Putting the values for elasticity in above equation, we get

$$\lambda_{LX} \hat{\bar{K}}_X - \lambda_{LX} \sigma_X (\hat{w} - \hat{r}_X) - \lambda_{LM} \sigma_M (\hat{w} - \hat{r}_M) = 0$$

$$\lambda_{LX} \hat{\bar{K}}_X - \hat{w} (\lambda_{LX} \sigma_X + \lambda_{LM} \sigma_M) + \lambda_{LX} \sigma_X \hat{r}_X + \lambda_{LM} \sigma_M \hat{r}_M = 0$$

$$\frac{\lambda_{LX} \hat{\bar{K}}_X}{(\lambda_{LX} \sigma_X + \lambda_{LM} \sigma_M)} - \hat{w} + \frac{\lambda_{LX} \sigma_X}{(\lambda_{LX} \sigma_X + \lambda_{LM} \sigma_M)} \hat{r}_X + \frac{\lambda_{LM} \sigma_M}{(\lambda_{LX} \sigma_X + \lambda_{LM} \sigma_M)} \hat{r}_M = 0$$

Defining $\sigma = \lambda_{LX} \sigma_X + \lambda_{LM} \sigma_M$ as economy wide weighted average of elasticity of formal and informal sector

$$\frac{\lambda_{LX} \hat{\bar{K}}_X}{\sigma} - \hat{w} + \beta_X \hat{r}_X + \beta_M \hat{r}_M = 0$$

Where $\beta_X = \frac{\lambda_{LX} \sigma_X}{\sigma}$ and $\beta_M = \frac{\lambda_{LM} \sigma_M}{\sigma}$

Therefore, we have $\hat{w} = \frac{\lambda_{LX} \hat{\bar{K}}_X}{\sigma} + \beta_X \hat{r}_X + \beta_M \hat{r}_M$

Increase in \bar{K}_X leads to increase in wage of formal and informal sector after ‘turning point’.

However, increase in wage is less if economy wide elasticity of substitution between capital and labour in ‘ σ ’ is larger. Change in wage rate is a weighted average of change in return to capital

of both sectors. After ‘turning point’, we have $-\frac{\theta_{KX}}{\theta_{LX}} \hat{r}_X = -\frac{\theta_{KM}}{\theta_{LM}} \hat{r}_M$, which implies that

$$\frac{\theta_{KX}/\theta_{LX}}{\theta_{KM}/\theta_{LM}} = \frac{\hat{r}_M}{\hat{r}_X}. \text{ Starting with } r_X > r_M, \text{ fall in } r_X \text{ must be higher than fall in } r_M. \text{ So, } \hat{r}_M/\hat{r}_X > 1 \text{ and}$$

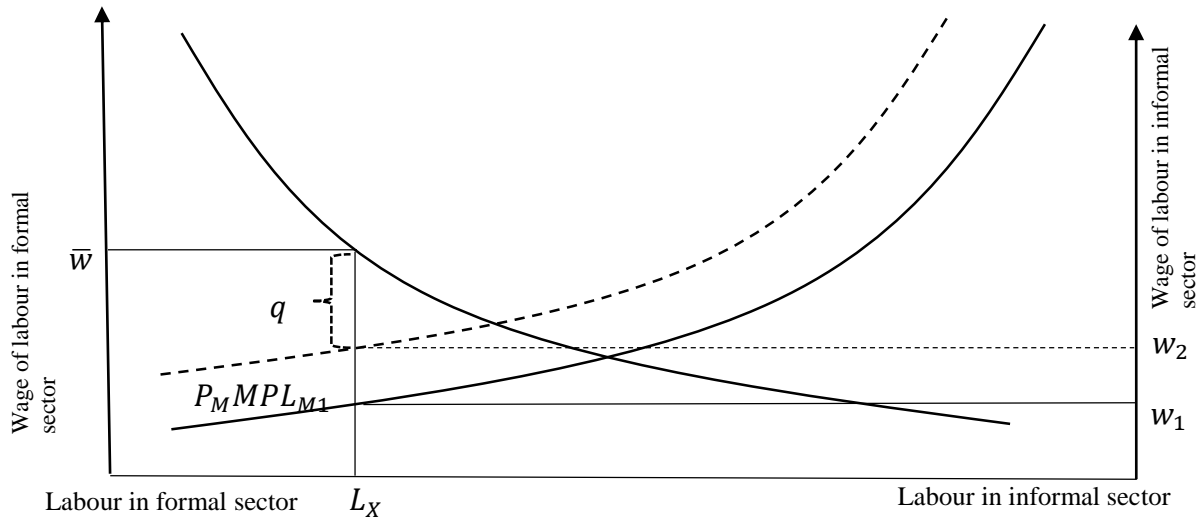
$\theta_{KX}/\theta_{LX} > \theta_{KM}/\theta_{LM}$, hence, formal sector must be capital intensive. An increase in endowment of capital leads to an absolute increase in output of formal sector that uses capital more intensively and absolute decrease in output of informal sector. This may be called ‘Rybczynski’ effect for formal-informal economy. Impact on growth is ambiguous because output of formal sector will increase and output of informal sector will decrease in long run.

3.2 Investment and Growth in Informal Sector

Now consider the other case, that $(r_M - r_X)$ is positive to begin with. Increase in K_M leads to leftward shift of $P_M MPL_M$ curve (Figure 4). Wage of labour w in informal sector will increase and r_M decreases (equation 2). There is no impact on \bar{w} and r_X . So, return differential $(r_M - r_X)$

closes over time and it will equalize across sectors in the long run. Output of informal sector increases due to increase in ' Y_M/L_M ', but, increase in output is lesser than increase in capital due to diminishing marginal productivity. On the other hand, output of formal sector will remain constant because there is no change in supply of either of the factors. The question is whether wages also get equalized over long run.

Figure 4: Effects of investment in Informal sector



3.2.1 Equation of change

From equation (2) it is straight forward that, at constant P_M , as w increases, r_M decreases. Once again, there will be no change in return to capital in the formal sector as P_X and \bar{w} are constant before turning point. Therefore, return differential ($r_M - r_X$) decreases over time. The gap closes completely if the rate of decrease of ' r_M ' is higher than the rate of increase of ' w '. Now,

$$\hat{w} = -\frac{\theta_{KM}}{\theta_{LM}} \hat{r}_M, \text{ and informal sector being labour intensive, } \theta_{LM} > \theta_{KM}; \text{ implying that rate of rise}$$

of wage is *less* than rate of fall in ' r_M '. Therefore, formal-informal wage gap will continue to exist even in the long run. It is important to note that, for wage gap to exist, formal sector can either be capital or labour intensive. Unlike the previous case, 'turning point' does not exist with investment in informal sector. The wage gap is marked by ' q ' in figure 4.

4. Policy Implications and Conclusion

This paper has examined the impact of augmenting exogenous investment on long run growth of developing economies having structural features of dual economy. We captured structure of dual economy in terms of formal and informal sectors. Using general equilibrium in a fixed price scenario, we found that the economy will get formalized in long run when investment goods are allocated to formal sector. Impact on overall growth in long run is ambiguous because output of formal sector increases at an increasing rate whereas output of informal sector decreases. Also, formal sector must be capital intensive for attaining equilibrium in capital market.

In second case, when investment goods are allocated to informal sector, then economy will continue to have structural features with wage differential across sectors. Growth will increase because output of informal sector increases and output of formal sector remains constant. Equilibrium in capital market is reached on its own in long run.

The major policy implications drawn from this study are as follows: Policies to allocate investment in formal sector will help to overcome the structural rigidities of developing economies. Contrary to popular belief, growth of formal sector will improve conditions of informal labour. Investment in informal sector will improve wage of labour employed in informal sector in the short run but structural rigidities will prevail and a majority of population will continue to work in informal sector. They will be deprived of any legal benefits. So, government of developing economies may come up with policies to attract investments in formal sector.

We build our case by taking the context of India, but our results can be generalized for developing economies with significant informal sector. The model can be made more robust by analyzing demand side of the economy too.

5. References

- Agenor, P. (1996) "The labour market and economic adjustment", IMF Staff Papers, 32, pp. 261-355.
- Basu, K. (2012) "The Rise of the Indian Economy: Fiscal, Monetary and Other Policy Challenges", *Rivista italiana degli economisti*, 17(2), pp. 169-190.

Basu, K. (2013) *Analytical development economics: the less developed economy revisited* (Oxford University Press: New Delhi).

Chandrasekhar, C., & Ghosh, J. (2013, October 28). "India still a vast informal economy" (India: Business Line, The Hindu), <http://www.thehindubusinessline.com/opinion/columns/c-p-chandrasekhar/india-still-a-vast-informal-economy/article5282078.ece>

Chang, W., W. Ethier and M. Kemp (1980) "The theorems of international trade with joint production", *Journal of International Economics*, 10(3), pp. 377-394.

Chaudhuri, S., and S. Yabuuchi (2007) "Economic liberalization and wage inequality in the presence of labour market imperfection", *International Review of Economics and Finance*, pp. 592-603.

Chaudhuri, S (2008) "Wage inequality in a dual economy and international mobility of factors: Do factor intensities always matter?" *Economic Modelling*, 25, pp. 1155-1164.

Chaudhuri, S., and D. Banerjee (2010) "Foreign capital inflow, skilled–unskilled wage inequality and unemployment of unskilled labour in a fair wage model", *Economic Modelling*, 27, pp. 477-486.

Economic Survey. (2015). GoI, Ministry of Finance.

Harris, J. R. and M. P. Todaro (1970) "Migration, unemployment and development: A two-sector analysis", *American Economic Review*, pp. 126-42.

Jones, R.W. (1971) "Distortions in factor markets and the general equilibrium model of production", *The Journal of Political Economy*, pp. 437-459.

Jones, R. and J. Scheinkman (1977) "The relevance of the two-sector production model in trade theory", *The Journal of Political Economy*, pp. 905-935.

Joshi, H., and V. Joshi (1976). *Surplus Labour and the city* (Oxford University Press: Delhi).

Kaldor, N. (1957) "A Model of Economic Growth", *The Economic Journal*, Vol. 67, No. 268, pp. 591-624.

Kalecki, M. (1955) "The Problem of Financing of Economic Development", *Indian Economic Review*, Vol. 2, No. 3, pp. 1-22.

Kannan, K. P. (2008, September 1) "Around half the GDP comes from the informal sector", (India: The Financial Express), <http://archive.financialexpress.com/news/-around-half-the-gdp-comes-from-the-informal-sector-/355611/3>

Kaushik, P. (2014, December 11) "Is The Humongous Contribution Of The Informal Sector To GDP Assessed Properly?", (India: Business Insider), <http://www.businessinsider.in/Is-The-Humongous-Contribution-Of-The-Informal-Sector-To-GDP-Assessed-Properly/articleshow/45474962.cms>

Kolli, R., S. Sharma and A. Sinharay (2008) "Estimates of workforce from the NSS-61st round, 2004–05", *The Journal of Income and Wealth*, 30(1), pp. 34-58.

- Leibenstein, H. (1958) "Underemployment in backward economies: Some additional notes", *Journal of Political Economy*, pp. 256-58.
- Lewis, W. A. (1979) "The dual economy revisited", *The Manchester School*, 47(3), pp. 211-229.
- Lewis, W. A. (1954) "Economic development with unlimited supplies of labour", *The Manchester School*, 22(2), pp. 139-191.
- Lewis, W. A. (1968) "Reflections on unlimited labour", *Woodrow Wilson School of Public and International Affairs*.
- Mahalanobis, P. C. (1955) "The Approach of Operational Research to Planning in India", *Sankhyā: The Indian Journal of Statistics (1933-1960)*, Vol. 16, No. 1/2, pp. 3-130.
- Marjit, S. (2003) "Economic reform and informal wage—a general equilibrium analysis", *Journal of Development Economics*, 72(1), pp. 371-378.
- Marjit, S., and S. Kar (2007) "The Urban Informal Sector and Poverty: Effects of Trade Reform and Capital Mobility in India", *MPIA Working Paper*.
- Marjit, S., and S. Kar (2009) "A contemporary perspective on the informal labour market: theory, policy and the Indian experience", *Economic and Political weekly*, pp. 60-71.
- Marjit, S., and S. Kar (2011) *The outsiders: economic reform and informal labour in a developing economy (OUP Catalogue)*.
- Neary, J.P. (1978) "Short-run capital specificity and the pure theory of international trade", *The Economic Journal*, pp. 488-510.
- Ray, D. (1998) *Development economics (Princeton University Press)*.
- Reserve Bank of India. (2011-12). *Annual Report*.
- Rybczynski, T. (1955) "Factor Endowment and Relative Commodity Prices", *Economica, New Series*, Vol. 22, No. 88, pp. 336-341.
- Solow, R. M. (1956) "A Contribution to the Theory of Economic Growth", *The Quarterly Journal of Economics*, Vol. 70, No. 1, pp. 65-94.
- Stiglitz, J. (1974) "Alternative theories of wage determination and unemployment in LDCs: The labour turnover model", *Quarterly Journal of Economics*, pp. 194-227.
- Swan, T., (1956) "Economic growth and capital accumulation", *Economic Record*, 32, pp. 334–361
- The Economist. (2014, May 24). *Reviving India's economy: Modi's mission*.

Table 1: Informal Sector in India

Year	Employment (in %)		GVA (in %)	
	Informal	Formal	Informal	Formal

1999-2000	91.5	8.5	55.42	44.58
2004-05	91.83	8.17	49.94	50.06
2006-07	92.07	7.93		
<i>Source for employment: National commission for enterprises in the unorganised sector, 2009</i>				
<i>Source for GVA: Kolli- Sinharay from 15th ICLS old series (1999-2000 base year) estimates</i>				

Figure 5: Determination of allocation of labour and wage rate

Figure 6: Effect of Investment in Formal Sector

Figure 7: Reaching the Turning point

Figure 8: Effects of investment in Informal sector