Investment and Evolution of an Informal Economy

Abstract

In this paper we analyzed the impact of allocation of investment goods sector on formal and informal sector in a scenario of three sector economy i.e. formal, informal and investment goods sectors. We found that intensity condition is not required when investment goods are allocated to informal sector and equilibrium in capital market is reached on its own in long run. However, when investment goods are allocated to formal sector, then formal sector must be capital intensive for achieving balanced growth.
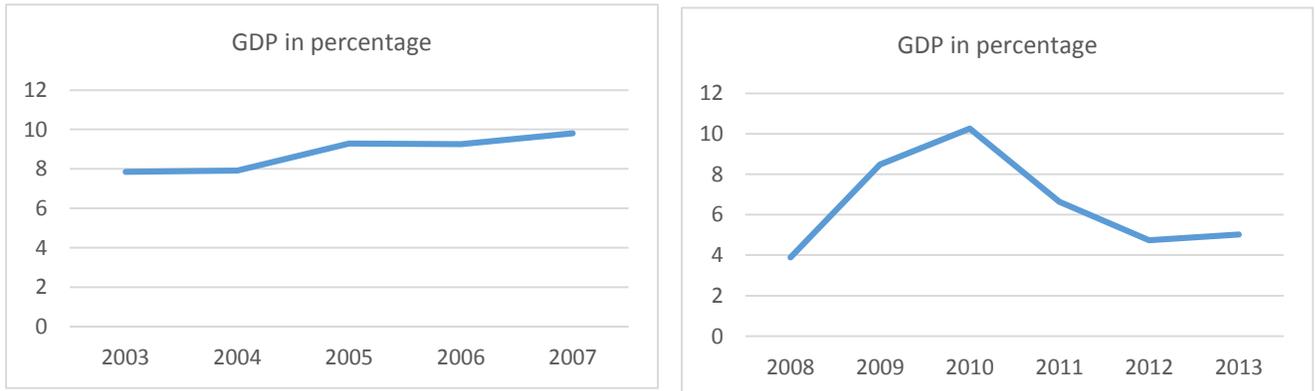
Keywords

Investment, Formal sector, Informal sector, growth

Motivation

GDP in India was growing steadily at an average of 8.8 per cent rate during 2003-2007. Whereas after 2007, the pattern of growth in GDP was irregular (see Figure 1). One of the primary reasons

Figure 2: GDP in India 2003-2013

source: *Central Statistics Office (CSO), 2012-13*

for sudden decrease in growth rate is attributed to sub-prime crisis in 2008. Subsequently, a constant decline in growth rate was observed after 2010. Exogenous causes for this phenomena were attributed to Euro zone crisis. Endogenous factors that are responsible for lower growth rate include lower rate of investment, reduced exports etc among others. The new government has put investment dynamics on forefront for increasing growth. So, we would take a look into the investment scenario for past decade. During 2003 to 2007, investment to GDP ratio was rising
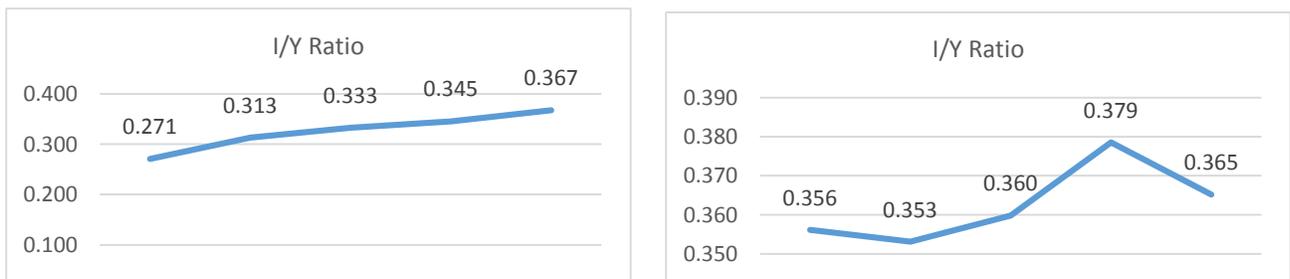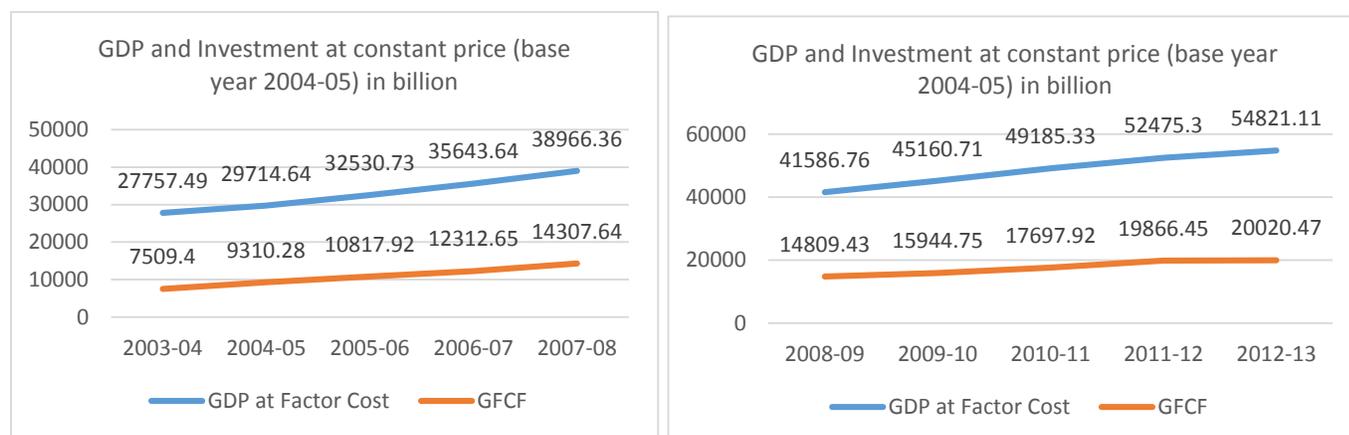

Figure 1: I/Y Ratio 2003-2013

source: *Author's calculation from data given by Central Statistics Office (CSO), 2012-13*

continuously (Figure 2) accompanied with high growth rate (Figure 1: GDP in India 2003-2013. Therefore, we can say that the contribution of Investment in GDP was on a rise. The same can be

Figure 3: GDP and Investment in India (2003-2013)

source: Central Statistics Office (CSO), 2012-13

reinforced from Figure 3 showing actual values of GDP and gross fixed capital formation. Turning to second half of the decade i.e. after sub-prime crisis (2008-2013), we can see that the pattern of investment to GDP ratio is opposite to growth rate (while the growth rate is increasing but I/Y ratio is declining). Consequently, it can be said that the increase of investment to GDP ratio was not at par with growth rate during 2009 to 2011. After 2011, there is an increase in investment to GDP ratio with almost constant absolute values of investment (see Figure 3). So, the rise in investment to GDP ratio is attributed to lower rate of GDP growth. Also, the fall in rate of investment is higher than fall in growth rate.

Hence, we can comment that investment behavior among other demand side determinants of growth is not able to explain the asymmetric growth pattern because it has remained almost constant over three years. Whereas, this was not the case during 2003-07, when an increasing rate of investment was contributing to increasing growth rate. Therefore, the present government is taking major policy decisions in order to boost growth and revamp the investment scenario. It targeted 8 per cent growth rate in its 12th five year plan (2012-17). Many sectors like multi-brand retail and civil aviation etc were liberalized for attracting investment from foreign investors for accomplishing target growth rates. But now the question is, which sectors should attract investment in order to achieve long term balanced growth. In this study, we would explore this issue, for that first we need to understand the nature of Indian economy.

Literature review

To understand the nature of economy for attaining balanced growth, economists gave the concept of two sector model i.e investment goods and consumption goods sector with labour and capital as factors of production (Uzawa, 1961). Arthur Lewis, 1955 defined 'dual economy' in terms of 'modern sector' and 'traditional sector'. Differentiation between these two sectors was made on the basis of amount of labour employed and wages provided to them in these two sectors. Modern sector grows by hiring labour from traditional sector and pay them more wages as compared to traditional sector. Therefore, supply of labour to modern sector exceeds its demand, so supply is

infinitely elastic. Supply of factors of production i.e. labour and capital depends upon growth of population and investment respectively (Lewis, 1979).

Afterwards, many studies were done to define 'dual' nature of economy. International Labour Organization, 1972 defined formal and informal sector as two sectors of economy. These two sectors were differentiated on the basis of following criteria. Informality is defined as a "way of doing things characterized by (a) ease of entry; (b) reliance on indigenous resources; (c) family ownership; (d) small scale operations; (e) labor intensive and adaptive technology; (e) skills acquired outside of the formal sector; (g) unregulated and competitive markets". Scope of informal sector was broadened thereafter to include activities performed by two different groups. The first group consist of individuals and families who adopt 'coping/ survival strategies' and the second group consist of entrepreneurs who adopt 'unofficial earning strategies' to avoid regulations etc.

(Frey & Schneider, 2000) defined 'dual nature' in terms of formal and shadow economy. Shadow economy constitute 'not recorded productive (i.e. value-adding) activities which should be in the national product (GNP)'. Household activities that are not covered under purview of legal framework are a part of shadow economy. However, legality of formal activities is not the sole criteria for differentiation. Monetary and non-monetary transactions undertaken by legal formal entities to avoid and evade tax are also categorized under shadow economy (Schneider, Chaudhuri, & Chatterjee, 2003).

(Marjit & Kar, 2011) differentiated between formal and informal sector on the basis of legality and method of determination of wage in these sectors. They elaborated on the concept of dual labour market where wage of labour employed in formal sector is determined through bargaining by trade union. They are protected through various regulations with minimum wage criteria, health benefits etc. Rest of labour is absorbed in informal sector where wages are determined through market mechanism i.e. marginal productivity of labour in that sector. Thus, many authors provided different concepts and definitions of dual economy.

These sectors of economy are interdependent on each other and informal sector plays a role in facilitating formal sector (Lewis, 1979). The two approaches on role of informal and formal sector explained by (Tokman, 1978) are composed of 'duality approach' and 'complementary approach'. Duality approach treat informal sector as independent of formal sector. Informal sector operates parallely to formal sector and it is involved in production of goods similar to that of formal sector. Behavior of informal economy corresponds to theory of 'comparative advantage' because it uses higher proportion of that factor of production in which the country is more endowed with. The factor proportions in informal sector are adequately used with more dependence on labour and less on capital requirements if a country is endowed with more labour. The complementary approach treats informal sector as a link with formal sector (Weeks, 1971) (McGee, 1974) and the goods produced in informal sector are used in mainstream economy. Therefore, informal sector plays a greater role in promoting growth. Also, it grows along with growth in formal sector. Now, we would look into the nature of Indian economy.

India is a developing nation and it represents the characters of 'dual economy' (Ray, 1998) (Krugman & Obstfeld, 2009). Therefore, we would focus on definitions for two-sector model given in Indian context. In India, National Commission for Enterprises in the Unorganized Sector, 2007 divided economy into formal and informal sector. It defined informal sector as 'unorganised sector consists of all unincorporated private enterprises owned by individuals or households engaged in sale and production of goods and services operated on a proprietary or partnership basis

and with less than ten total workers'. Informal labours work at low level of organization, with little division between factors of production. So, it would be interesting to study the impact of investment decisions on formal and informal sector and their contribution in economic growth. For this, we are confining our definition of formal and informal sector given by (Marjit & Kar, 2011).

Keeping the above in mind we would like to look into scenario of informal sector in India. National Sample Survey Office (NSSO) conduct socio-economic surveys and based on it (Kolli, Sharma, & Sinharay, 2008) estimated the contribution of informal sector. Gross value added by informal sector declined to 53.9 per cent in 2004-05 from 55.42 in 1999-2000. An increase in growth rate of GDP was observed in the same period from 7.59 per cent in1999-2000 to 8.06 per cent in 2003-04. Therefore, we can see that an increase in GDP growth rate is accompanied with decrease in its contribution from informal sector. Whereas the labour share in informal sector has increased by 1 per cent to 95.5 per cent in 2004-05 since 1999-2000. Subsequently, it can be observed that although the contribution of informal sector in GDP is declining but the labour share in the sector is increasing.

As per report on Unorganized sector statistics by National Statistical Commission (2012), 17.8% of total GDP in 2004-05 is contributed by Informal sector in agriculture. Informal employment in agricultural sector constituted of 60.9 per cent of job share. Agricultural sector was followed by 'trade and hotels' i.e. service sector where 12.5 per cent of GDP and 9.5 per cent of employment is contributed by informal sector. In manufacturing, 5.8 per cent of GDP and 10.1 per cent of employment is contributed by informal sector.

Figure 4: Share of different sectors in GDP in India (2003-13)
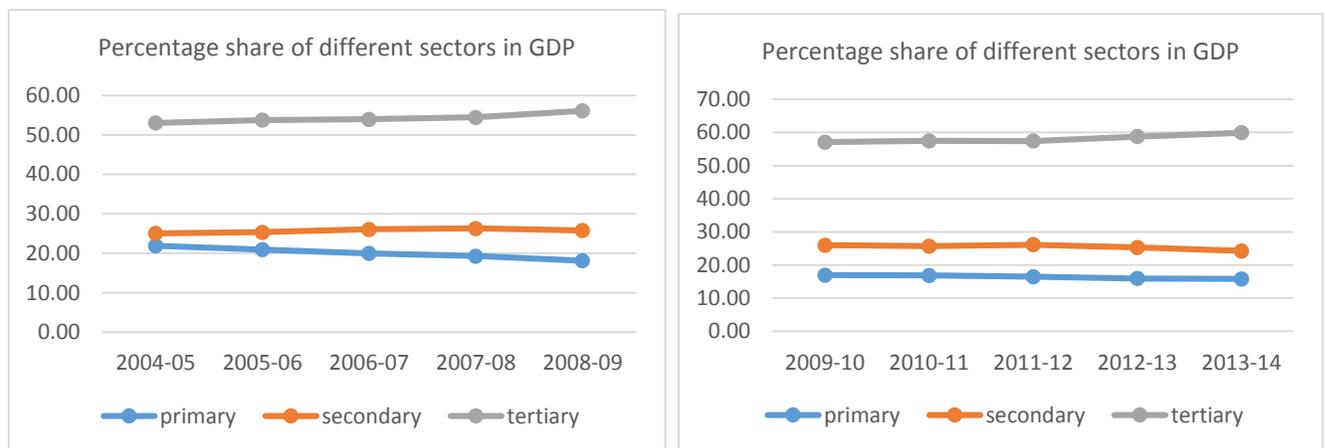
source: Central Statistics Office (CSO), 2012-13

Growth of formal and informal sector depends on supply side economy constituting of labour and capital as factors of production. Rybczynski's theorem states that 'the maintenance of same rates of substitution in production after quantity of one factor has increased must lead to an absolute expansion in production of the commodity using relatively much of that factor, and to an absolute curtailment of production of the commodity using relatively little of the same factor' (Rybczynski, 1955). Thus, the intensity with which capital and labour is used in production determines growth of formal and informal sector. Present economic scenario in India with a focus to boost investment

provides a platform to analyze intensity conditions of factors required by formal and informal sector for achieving balanced growth.

For above, let use first understand what does investment theory say about capital formation in two sector model. Investment facilitates capital formation which is used for production purpose. In a two sector model, mobility of capital between sectors play an important role in determining long term growth (Stolper & Samuelson, 1941) but in short run capital is immobile between sectors (Mussa, 1974). Both Rybczynski and Stopler-Samuelson theorems talk about long run impact of changes in factor endowments and factor prices respectively on two sector economy by taking both labour and capital as mobile between these sectors. But investment function can only be defined when capital is immobile between sectors in short run i.e. capital is locked in a specific sector and cannot be adjusted instantaneously (Mayer, 1974). So, while analyzing impact of investment on formal and informal sector, we must understand the nature of capital used in these sectors. Capital used in formal sector is different than that used in informal sector and it is very difficult to ensure mobility of capital between them in even in long run. But the rent of capital may equalize between these sectors for achieving equilibrium in capital market. So, while modeling impact of investment in formal and informal sector, capital shall be considered as immobile.

Now, it would be interesting to study the changes in supply side of factors of production in Indian economy. First, let's look at the scenario of labour in India. Population in working age group is increasing in India and it is in verge of demographic dividend. As per the report of Working Group on Labour Force & Employment Projections constituted by Planning Commission of India in 2008, 80.3 per cent of population is projected to fall under the age group of 15-59 in 2017. Regarding the other factor of production i.e. capital, we know that capital inflows through Foreign Direct Investment and Foreign Institutional Investments are encouraged through policy initiatives in various sectors like infrastructure, multi-brand retail etc. So, endowment of both labour capital is expected to increase in long run. In this study, we would take total labour supply in economy as constant (but labour is mobile between sectors) in short run and endowment of capital can increase only after allocation of investment goods (capital is specific to sector).

Recent theories on two sector model of formal and informal sector by (Marjit S. , 2003) (Marjit & Kar, 2009) and (Marjit & Kar, 2011) contributes significantly in understanding the role of tariff liberalization policies on wage of informal labour. Interestingly, in contrast to conventional wisdom, it was found that liberalization of formal sector leads to increase in employment and wage of labour in informal sector. They found above results by considering capital as mobile between two sectors. In capital immobility situations too, they found that downsizing of capital intensive informal sector leads to escalation of wages in labour intensive informal sector. (Marjit & Kar, 2007) found that in India real wages of informal labour rose by 15-20 percent during the post-reform period (1994-95 to 1999-2000). They also found that real fixed assets and real value added in informal sector also increased in the same period. But they have not taken demand side into consideration while concluding about wages of informal labour. Thus, prices are taken exogenous in this model. Considering the above, I will discuss research gap in next section.

Research gap

We propose to study the impact of investment on wage of labour and rent of capital in formal and informal sector in continuation with the two sector model given by Marjit & Kar. Given the diverse nature of capital in these sectors, it is considered to be immobile in long run in this study. This is

contrary to previous theories of investment and capital formation. Price of goods produced in formal and informal sector is endogenously determined through demand conditions. Since none of the studies on formal and informal sectors addressed this issue, we propose to analyze both supply and demand conditions for changes in factor and output prices. Also, we will derive intensity condition required by formal and informal sector for achieving balanced growth.

Research questions

In this study we intend to answer the following research questions:

1) Considering supply side of economy we would find what would be impact of investment on wage, rentals and output in formal and informal sector when prices are fixed (real and nominal prices are same)?
2) What intensity condition is required for formal and informal sector in order to achieve balanced growth?

Introduction

As per Harrod-Domar model of economic growth, warranted rate of growth depends on savings and investment behavior of households. Harrod-Domar growth model do not take financial market in account for facilitating investment. In the proposed two sector model of formal and informal economy we are also working on the same grounds and assuming that savings from profit income of formal and informal sector is the only source of investment and it is accessible to both sectors. There is no role of financial markets. This is accordance with recent studies of formal and informal sector by (Marjit & Kar, 2011). One of the major criticism of Harrod-Domar model is that it takes factor proportions as constant. Neo-classical model of economic growth given by Solow-Swan relax assumptions of Harrod-Domar model and take variable factor proportions with a production function of constant returns to scale (Solow, 1956). However, time lag is very long for adjustment process between substitution of factors (Sato, 1964). In short run, only labour is mobile between sectors but capital is locked in. Instantaneous immobility of capital in short run causes rent differential between sectors and capital is transferred from low rent sector to high rent sector to reach equilibrium in capital market in long run (Mayer, 1974) (Mussa, 1974). In this study, we assume capital to be sector specific even in long run due to nature of formal and informal sector but factors of production are substitutable. Capital stock in these sectors can change only after allocation of investment goods. So, we are working in a three sector economy comprising of formal, informal and investment goods sector. We have taken the definition of formal and informal sector given by (Marjit & Kar, 2011). So, wages for formal sector are unionized and is determined by bargaining whereas wages of informal sector are determined by demand-supply conditions. Thus, wage of labour in formal sector is higher than wage of informal sector. First, we would analyze impact of exogenous change in prices of formal/ informal goods and allocation of investment goods in above sectors on supply side of economy. Then, we will move to fixed price scenario (with real prices and wages) and derive intensity condition required for attaining balanced growth.

A three-sector Economy

The first one is Investment goods sector (I) with no labour requirement. This is a formal sector. Investment goods sector uses only capital as input for producing output.

The second sector is Luxury goods sector (X) with a production function consisting of capital and labour. Luxury goods are produced in formal good sector.

The third sector is Mass consumption goods sector (M) with a production function consisting of both capital and labour. Mass consumption goods are produced in informal sector. In absence of employment opportunities in formal sector, labours find employment in informal sector (Marjit & Kar, 2011) so there is no open unemployment in our model. 'Luxury goods sector' and 'Mass consumption goods sector' exhibit constant returns to scale and production function with diminishing marginal productivity. So the competitive economic profit is zero. Capital and labour are fully employed. Firms are price takers so prices are given. Coefficients for factor of production are not fixed. They can be substituted depending on factor prices i.e. wages and rents respectively. But capital is immobile and specific to each sector even in long run, so substitution of labour for capital in each sector can be done only after allocation of investment goods. For determining allocation of Investment goods in either formal Luxury goods sector or informal Mass consumption goods sector, the rent of formal investment goods sector must be lower than the rent of other two sectors. Otherwise investment goods will keep on getting accumulated to investment goods sector. So, $r_I < r_X$ and $r_I < r_M$ is a necessary condition for feasible ranges of r_I, r_X and r_M.

$\overline{w}$ = Formal unionized wages

w = Informal (flexible) wage

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

Y_X = Output of Formal Luxury goods sector

Y_I = Output of Formal Investment goods sector

Y_M = Output of Informal Mass consumption goods sector

$\overline{L}$ = Total supply of labour (fixed in short run)

$\overline{K}$ = 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

a_{LX}, a_{LM} = Per unit labour use in X and M

a_{KX}, a_{KM}, a_{KI} = Per unit capital use in X, M and I

Competitive price equilibrium implies:

$$r_I a_{KI} = P_I \tag{1}$$

$$wa_{LM} + r_M a_{KM} = P_M \qquad (2)$$

$$\overline{w}a_{LX} + r_X a_{KX} = P_X \qquad (3)$$

Full Employment of factors:

$$a_{LX}Y_X + a_{LM}Y_M = \overline{L} \qquad (4)$$

$$a_{KX}Y_X = \overline{K}_X \qquad (5)$$

$$a_{KM}Y_M = \overline{K}_M \qquad (6)$$

$$a_{KI}Y_I = \overline{K}_I \qquad (7)$$

$$\overline{K}_X + \overline{K}_M + \overline{K}_I = \overline{K} \qquad (8)$$

Let $\hat{\overline{w}}$ i.e. percentage change for wages is given by $\hat{\overline{w}} = \alpha \hat{P}_X + \beta \hat{P}_M$, $0 < \alpha, \beta < 1$ (9)
(Marjit & Kar, 2011)

Determination of variables

Capital is specific to different sectors as can be observed from (5), (6) and (7). From above it can be said that the known values are $\overline{K}_M, \overline{K}_X, \overline{K}_I, \overline{w}, P_I, P_M, P_X$. We have to determine the values of seven unknowns i.e. w, r_x, r_M, r_I, Y_x, Y_M, and Y_I. Thus, we have seven equations involving the knowns and unknowns, so the system can be determined.

Figure 5
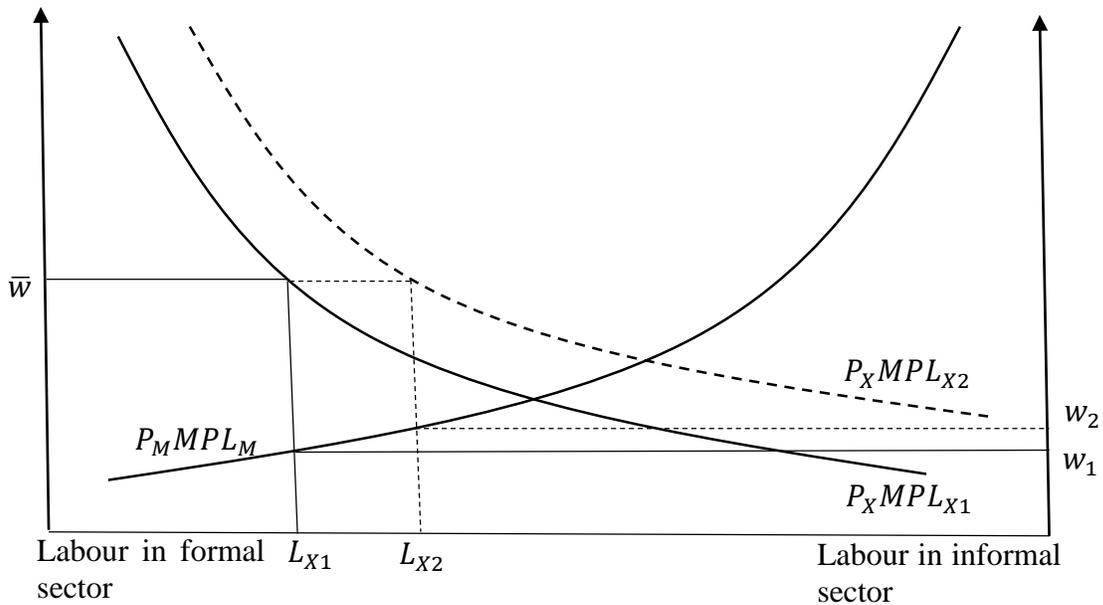
The value of marginal product of labour for 'luxury goods' and 'mass consumption goods' are given by curves shown in Figure 5. Thus, with given value of $\overline{w}$, we can determine the amount of labour formal sector can hire i.e. $\overline{L}_X$. Remaining $\overline{L} - \overline{L}_X = \overline{L}_M$ is employed in informal sector. Then w i.e. wage of informal labour is determined from value of marginal productivity of labour employed in informal sector. After $\overline{w}$, r_X can be estimated from equation (3) as P_X is known. Similarly, r_I can be estimated from equation (1) as P_I is given. r_M can be estimated from equation (2) as w is already estimated and P_M is known. Y_X, Y_M and Y_I can be estimated from equations (5), (6) and (7) respectively because input-output coefficients depend upon factor prices.

Allocation of Investment goods to different sectors with fixed prices (Investment goods sector uses capital as factor input)

From here, we will analyze impact on rent of capital and wage of labour in formal and informal sector after allocation of investment goods in any of the two sectors. In this model, prices are fixed i.e. nominal and real prices are same. We will make assumption about rent differential of formal and informal sector and will also derive intensity condition required for attaining balanced growth.

Case 1: Assuming $r_M > r_I$ and $r_M > r_X$, all investment goods are allocated to informal sector (mass consumption goods sector)

In this case we assume that $r_M > r_X > r_I$, so all investment goods are allocated to informal sector. This assumption ensures that there is no self-accumulation of investment goods in that sector. With allocation of investment goods in informal sector, there is an increase in capital ($\overline{K}_M$) which leads to increase in marginal productivity of labour. Therefore, value of MPL_M increases and the curve shifts left as shown in Figure 6. This results in increase of wage of informal labour. Subsequently, there is a decrease in rent of informal sector because prices are constant (see equation 2). There is no impact on wages and rentals of formal sector till 'turning point' (i.e. equalization of wages across formal and informal sector) because increase in wage of informal sector does not lead to any change in wage of labour in formal sector.

Figure 6
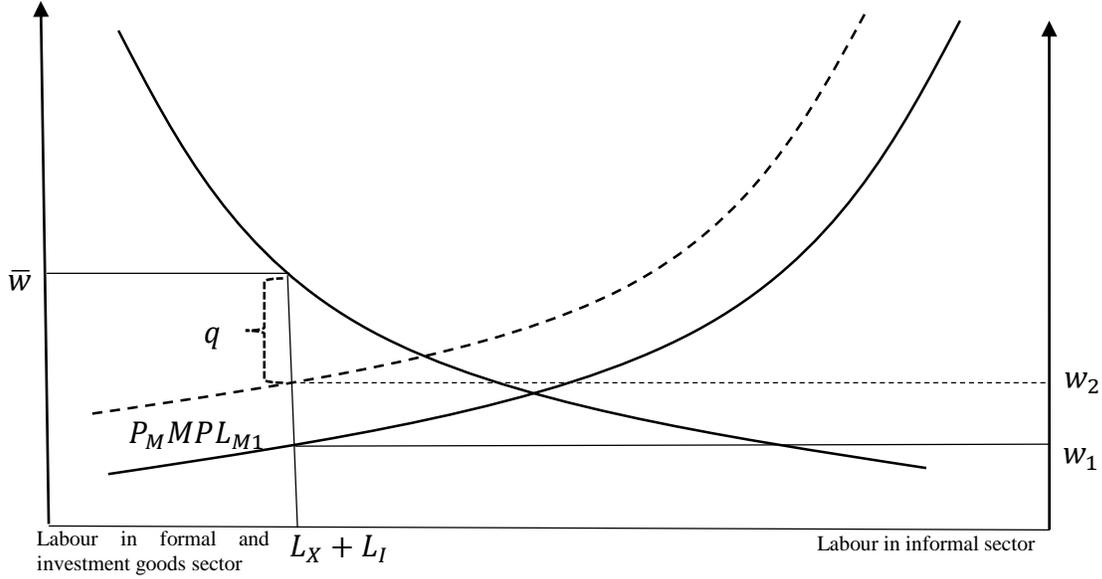
Figure 6

An increase in wage of informal labour does not influence labour supply for both the sectors before 'turning point' (see Figure 6). Therefore, increase in capital of informal sector leads to increase in 'K_M / L_M' as labour supply is constant. Consequently, output of informal sector increases. However, an increase in Y_M / L_M is lesser than K_M / L_M due to diminishing marginal productivity of capital. There is no impact on rent and output of investment goods sector because prices are constant. Rent of formal sector is also constant because there is no change in wage of labour in formal sector due to increase in K_M. Output of formal sector also remains constant because there is no change in either factors of production or factor incomes.

Equation of change before 'turning point':

Competitive price equations for informal mass consumption goods sector is given by

$$wa_{LM} + r_M a_{KM} = P_M$$

Impact on wage of labour and rent of capital in informal sector due to allocation of investment goods with constant prices, we get:

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

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

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

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 $\hat{w} = -\frac{(1-\theta_{LM})}{\theta_{LM}}\hat{r}_M$ and

we have $\theta_{LM} + \theta_{KM} = 1$, therefore '$1-\theta_{LM}$' is positive which implies that $\hat{w}$ is negatively related

to $\hat{r}_M$. Therefore, an increase in wage of labour in informal sector leads to decrease in rent of capital in that sector.

Impact on rent of investment goods sector: Competitive price equilibrium of investment goods sector implies $r_I a_{KI} = P_I$. Investment goods sector uses only capital as factor of production, so there is no change in rent of capital until we allow for increase in prices.

$$\frac{a_{KI} r_I}{P_I} \frac{dr_I}{r_I} = 0$$

$\theta_{KI} \hat{r}_I = 0$, here $\theta_{KI} = 1$ because only one factor of production is used, so $\hat{r}_I$ is zero.

Impact on rent of formal luxury goods sector: Competitive price equations for formal sector is given by

$$\overline{w} a_{LX} + r_X a_{KX} = P_X$$

$$\overline{w} da_{LX} + r_X da_{KX} + a_{KX} dr_X = 0$$

$d\overline{w}$ is zero because $\overline{w}$ is determined by bargaining and thus it does not change till 'turning point'

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

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

Since $\theta_{LX} \hat{a}_{LX} + \theta_{KX} \hat{a}_{KX} = 0$, So $\theta_{KX} \hat{r}_X = 0$, but $0 < \theta_{KX} < 1$ as formal sector uses both capital and labour as factors of production. This implies that $\hat{r}_X = 0$.

Since we started with a condition that $r_M > r_X > r_I$, so decrease in r_M with constant r_X ensures equalization of rent across informal and formal goods sector before 'turning point' if rate of decrease in rent is higher than rate of increase in wage of informal labour. For that to happen, from $\hat{w} = -\frac{\theta_{KM}}{\theta_{LM}} \hat{r}_M$, we can infer that $\theta_{LM} > \theta_{KM}$ i.e. informal sector must use higher share of labour factor distributive share. But we cannot comment of factor distributive shares used in formal sector and it may use higher share of either capital or labour. Usage of higher share of either factor in formal sector does not have any impact on change of rent and wage in informal sector. Thus, we do not need intensity condition of informal sector for equalization of rents across both sectors. However, in above case rent will equalize but wages will not and there will always be a difference in wages of labour in formal and informal sector denoted by 'q' in Figure 6. On the other hand, if wage of informal labour increases at a higher rate than decrease in rent of capital then wage of informal and formal labour equalize. This would lead to determination of formal wages through market mechanism and its increase in both sectors.

Equation of change for formal sector:

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

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

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

Thus, $\hat{\bar{w}} = -\dfrac{\theta_{KX}}{\theta_{LX}}\hat{r}_X$ or $\hat{\bar{w}} = -\dfrac{(1-\theta_{LX})}{\theta_{LX}}\hat{r}_X$ and we have $\theta_{LX} + \theta_{KX} = 1$, therefore '$1-\theta_{LX}$' is positive

which implies that $\hat{\bar{w}}$ is negatively related to $\hat{r}_X$. An increase in wage of formal sector leads to decrease of rent. After 'turning point' wages across formal and informal sector equalizes but rent of both the sectors start falling. There is no impact on rent of investment goods sector. Now, the question is whether rent of informal or formal sector falls at a higher rate.

From full employment conditions:

$a_{LX}Y_X + a_{LM}Y_M = \bar{L}$ can be rewritten as $a_{LX}\dfrac{\bar{K}_X}{a_{KX}} + a_{LM}\dfrac{\bar{K}_M}{a_{KM}} = \bar{L}$

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

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

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

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

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

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

Defining λ as fraction of labour force used in each sector

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

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

Defining elasticity of labour's marginal product curve for formal sector (wages of both sectors are equal) as

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

Defining elasticity of labour's marginal product curve for 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

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

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

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

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

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

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

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

An increase in $\bar{K}_M$ would lead to increase in wage of formal and informal sector after 'turning point'. However, increase in wage is less if economy wide elasticity of marginal product of labour 'σ' is higher. Also, change in wage rate is a weighted average of change in rents of both formal and informal sector. After 'turning point' we have $-\dfrac{\theta_{KX}}{\theta_{LX}}\hat{r}_X = -\dfrac{\theta_{KM}}{\theta_{LM}}\hat{r}_M$, which implies that

$\dfrac{\theta_{KM}/\theta_{LM}}{\theta_{KX}/\theta_{LX}} = \dfrac{\hat{r}_X}{\hat{r}_M}$ and starting with $r_M > r_X$, fall in r_M must be higher than fall in r_X when capital in informal sector increases. This is ensured if informal sector is capital intensive because then $\theta_{KM}/\theta_{LM} > \theta_{KX}/\theta_{LX}$ and higher fall in rent of informal sector ensure the condition $\hat{r}_X/\hat{r}_M > 1$. Thus, in this scenario informal sector must be capital intensive to achieve balanced growth.

Case 2: Assuming $r_X > r_I$ and $r_X > r_M$, all investment goods are allocated to formal sector (luxury goods sector)

In this case we assume that $r_X > r_I$ and $r_X > r_M$, so all investment goods are allocated to formal sector. With allocation of investment goods in formal sector, there is an increase in capital ($\bar{K}_X$) which leads to increase in marginal productivity of labour. Therefore, value of MPL_X increases and the curve shifts right as shown in Figure 5. There is no impact on rent of capital and wages of labour in formal sector before 'turning point'. Whereas there is an increase in wage of labour in informal sector before and after 'turning point' which leads to decrease in rent of capital. Also, there is no impact on rent of capital in investment goods sector before and after 'turning point'. Thus, the gap between rents of formal and investment goods sector is constant whereas the gap between rent of formal and informal sector increases. As a result, capital market cannot reach equilibrium before labour market and the economy will specialize in formal sector only. After

'turning point', wages of labour in formal sector starts increasing due to increase in $\overline{K}_X$ and resultant rightward shift of $P_X MPL_X$ curve. An increase in both factors of production i.e. K_X and L_X will lead to increase in output i.e. Y_X.

Equations of change before 'turning point':

Impact on rent of formal sector (r_X): Competitive price equations for formal sector is given by

$$\overline{w} a_{LX} + r_X a_{KX} = P_X$$

As discussed above, $\overline{w}$ is determined by bargaining and thus it does not change till 'turning point' and thus $\theta_{KX}\hat{r}_X = 0$, but $0 < \theta_{KX} < 1$ as formal sector uses both capital and labour as factors of production. This implies that $\hat{r}_X = 0$ and thus, there is no change in wage of labour and rent of capital in formal sector till wages are determined through bargaining. However, as discussed due to increase in value of marginal productivity of labour in formal sector, wages in informal sector increases accompanied with decrease in rent of capital. We have already seen that $\hat{w} = -\dfrac{\theta_{KM}}{\theta_{LM}}\hat{r}_M$

or $\hat{w} = -\dfrac{(1-\theta_{LM})}{\theta_{LM}}\hat{r}_M$ and we have $\theta_{LM} + \theta_{KM} = 1$, therefore '$1-\theta_{LM}$' is positive which implies that $\hat{w}$ is negatively related to $\hat{r}_M$. So, we have proved that while r_X is constant whereas r_M continues to decline. As a result, gap between rents of both sectors increases.

Equations of change after 'turning point':

Once 'turning point' is reached and wages of both formal and informal sectors are determined through marginal productivity of labour, an increase in wage is observed across these sector due to allocation of investment goods in formal sector. Thereafter, as discussed above we have $\hat{\overline{w}} = -\dfrac{\theta_{KX}}{\theta_{LX}}\hat{r}_X$ or $\hat{\overline{w}} = -\dfrac{(1-\theta_{LX})}{\theta_{LX}}\hat{r}_X$ and since $\theta_{LX} + \theta_{KX} = 1$, so '$1-\theta_{LX}$' is positive which implies that $\hat{\overline{w}}$ is negatively related to $\hat{r}_X$. So, rent of capital decreases due to increase in wage of labour in formal sector. We have already discussed in case 3 that there is no change in rent of capital in investment goods sector.

Equation of change due to increase in $\overline{K}_X$

From full employment conditions implies $a_{LX} Y_X + a_{LM} Y_M = \overline{L}$ which can be rewritten as $a_{LX}\dfrac{\overline{K}_X}{a_{KX}} + a_{LM}\dfrac{\overline{K}_M}{a_{KM}} = \overline{L}$

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

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

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

Solving the above in a similar manner as section 3, we get $\hat{\bar{w}} = \dfrac{\lambda_{LX}\hat{\bar{K}}_X}{\sigma} + \beta_X \hat{r}_X + \beta_M \hat{r}_M$

An increase in $\bar{K}_X$ leads to increase in wage of formal and informal sector. However, increase in wage is less if economy wide elasticity of marginal product of labour 'σ' is higher. Also, change in wage rate is a weighted average of change in rents of both formal and informal sector. After 'turning point' we have $-\dfrac{\theta_{KX}}{\theta_{LX}}\hat{r}_X = -\dfrac{\theta_{KM}}{\theta_{LM}}\hat{r}_M$, which implies that $\dfrac{\theta_{KX}/\theta_{LX}}{\theta_{KM}/\theta_{LM}} = \dfrac{\hat{r}_M}{\hat{r}_X}$, so if formal sector is capital intensive then $\theta_{KX}/\theta_{LX} > \theta_{KM}/\theta_{LM}$ and $\hat{r}_M/\hat{r}_X > 1$. Starting with $r_X > r_M$, fall in r_X must be higher than fall in r_M when capital in informal sector increases. Thus, formal sector must be capital intensive for achieving balanced growth.

Conclusion

Economy of developing nations like India represents the character of dual economy where informal sector plays an important role in growth. In India, there is focus on increasing investment for achieving long term growth. In this paper we discussed that capital is specific to formal and informal sector and capital in these sectors can change after allocation of investment goods. Therefore, we worked in a scenario of three sector economy i.e. formal, informal and investment goods sector and analyzed the impact of allocation of investment goods sector in formal and informal sectors. We found that intensity condition is not required when investment goods are allocated to informal sector and equilibrium in capital market is reached on its own in long run. However, when investment goods are allocated to formal sector, then formal sector must be capital intensive for achieving balanced growth.

Bibliography

Frey, B., & Schneider, F. (2000). Informal and underground economy (No. 0004). *Working Paper, Department of Economics, Johannes Kepler University of Linz.*

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

Krugman, P. R., & Obstfeld, M. (2009). *International Economics Theory and Policy.* Pearson Education India.

Lewis, W. (1979). The dual economy revisited. *The Manchester School, 47(3)*, 211-229.

Marjit, S. (2003). Economic reform and informal wage—a general equilibrium analysis. *Journal of Development Economics, 72(1)*, 371-378.

Marjit, S., & Kar, S. (2007). The Urban Informal Sector and Poverty: Effects of Trade Reform and Capital Mobility in India. *MPIA Working Paper.*

Marjit, S., & Kar, S. (2009). A contemporary perspective on the informal labour market: theory, policy and the Indian experience. *Economic and Political weekly*, 60-71.

Marjit, S., & Kar, S. (2011). *The outsiders: economic reform and informal labour in a developing economy.* OUP Catalogue.

Mayer, W. (1974). Short-Run and Long-Run Equilibrium for a Small Open Economy. *Journal of Political Economy, Vol. 82, No. 5*, 955-967.

McGee, T. (1974). The Persistence of the Proto Proletariat: Occupational Structures and Pktnning for the Future of Third World Cities. Los Angeles.

Mussa, M. (1974). Tariffs and the Distribution of Income: The Importance of Factor Specificity,Substitutability, and Intensity in the Short and Long Run. *Journal of Political Economy, Vol. 82, No. 6*, 1191-1203.

Ray, D. (1998). *Development economics.* Princeton University Press.

Rybczynski, T. (1955). Factor Endowment and Relative Commodity Prices. *Economica, New Series, Vol. 22, No. 88*, 336-341.

Sato, R. (1964). The Harrod-Domar Model vs the Neo-Classical Growth Model. *The Economic Journal, Vol. 74, No. 294*, 380-387.

Schneider, F., Chaudhuri, K., & Chatterjee, S. (2003). *The Size and Development of the Indian Shadow Economy and a Comparison with other 18 Asian Countries: An Empirical Investigation.* Linz: Johannes Kepler Universität Linz.

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics, Vol. 70, No. 1*, 65-94.

Stolper , W., & Samuelson, P. (1941). Protection and real wages. *The Review of Economic Studies, 9(1)*, 58-73.

Tokman, V. E. (1978). An Exploration into the Nature of Informal-Formal Sector Relationships. *World Development Vol. 6, No. 9/10,*, 1065-1075.

Uzawa, H. (1961). On a Two-Sector Model of Economic Growth. *The Review of Economic Studies, Vol. 29, No. 1*, 40-47.

Weeks, J. (1971). An exploration into the nature of the problem of urban imbalance in Africa. *Conference on Urban Employment in Africa*.