Chapter 4

Formal-Informal Sectors’ Linkages and Economic Growth

4.1. Introduction

In the previous chapter, we have focused on the measurement of the impact of liberalization on the informal sector’s growth. In addition, we have also explored production linkages between the formal and informal sectors and its impact on the informal sector’s growth. Production linkages between formal and informal sectors have been measured empirically through subcontracting in terms of the vertical inter-firm relationship between informal and formal firms. In addition to sub-contracting, the formal and informal sectors are linked through other ways such as, consumption linkages (i.e., one sector’s products being consumed by the other), technological linkages (i.e., technology transfer from one sector to the other), informal marketing chain (i.e., a disorganized mass of street vendors and merchants being well coordinated by a group of middle men dependent on the formal firms), informal supply chain (i.e., informal workers serving as suppliers of inputs to the local buyers who, in turn, sell the products to the formal industry through wholesalers). The objective of this chapter is to empirically measure the combined impact of the linkages between the formal and informal sectors on economic growth, using the theoretical framework of Feder (1982).

The chapter is organized as follows. Section-4.2 outlines the theoretical framework. Econometric specifications are discussed in section-4.3. Sections-4.4 and 4.5 highlight the estimated results and simulation analysis respectively. Sources of growth are estimated in section-4.6. This is followed by a summary in Section-4.7.

4.2. Theoretical Framework

Consider an economy comprising two sectors: informal and formal sectors. Total GDP is defined by sum of output of both the sectors.

\[ Y = N + X , \]  

(4.1)
where $Y = \text{GDP}$, $N = \text{Informal sector’s output}$, $X = \text{Formal sector’s output}$.

The informal and formal sectors’ output is a function of the factors allocated to the respective sector. Along with these factors of production, the linkage between the two sectors is another explanatory variable of the sector’s production function.

Sources of growth are of three types: growth of inputs, allocation of resources and technological progress. Feder (1982) considers the allocation of resources as a source of growth by way of incorporating the possibility of differences in marginal factor productivities between export and non-export sectors. Through his empirical framework, he measures the beneficial externalities of the export sector. This chapter extends Feder’s framework by incorporating three different possibilities of externalities of one sector to the other. The externality may be either uni-directional i.e., one sector having its impact on other but not vice-versa or bi-directional i.e., both the sectors being interdependent. Feder considers that externalities are created by the more productive sector only. However, in practice, externalities are created by the less productive sector as well. In our case, the less productive (informal) sector creates externalities through supply chain (cheap inputs), consumption linkages (formal sector’s products being consumed by the informal sector’s workers), informal marketing chain etc. While most of the studies based on Feder model concentrate on the uni-directional externalities, Espana (1992) argues that the aggregate model is useful in analyzing the impact of exports on the aggregate output as the output of one sector becomes an input of the other.

Thus, the first case in our study takes into account the externality of the formal sector on the informal sector, whereas, the second case considers the externality of the informal sector on the formal sector. Bi-directional linkages between the two sectors are incorporated in the third case. As for the first case, the theoretical framework is based on and draws heavily from Feder (1982). In other cases, Feder’s framework has been modified by introducing the externalities created by the less productive sector and inter-dependency between the sectors. In addition, we consider the relationship between foreign capital inflows and economic growth continues to remain an important debatable issue. Although Feder (1982) did not distinguish between foreign capital and domestic capital, the theories of endogenous economic growth stress the
point that the opening up of investment opportunities under a liberalised market-friendly economy results in high economic growth (Mallick and Moore, 2006). Thus, we have made an attempt to measure the impact of foreign capital and domestic capital on economic growth separately. Demurger (1996) argues that foreign investment is a crucial mechanism for the transfer of technology and foreign management methods, because it allows for direct contacts between domestic and foreign entrepreneurs through joint ventures or co-operation agreements. In order to capture the effects of foreign investment, Demurger (1996) and Zang (2006) have introduced both domestic and foreign capital in the production function, which allows for differing marginal productivities depending on the origin of capital.

Taking the differentiation of eq. (4.1) we get

\[ \dot{Y} = \dot{N} + \dot{X} \]  

(4.2)

where the dot over the variables indicates the differentiation of the variables with respect to time.

**Case-1: Externality of the formal sector**

Considering the case of dependency of the informal sector’s output on the formal sector’s output, the production functions of both the sectors can be written as follows.

\[ N = F (K_{dn}, K_{fn}, L_n, X), \]  

(4.1.1)

\[ X = G (K_{dx}, K_{fx}, L_x), \]  

(4.1.2)

where \( K_{dn}, K_{dx} = \) Respective sector’s gross domestic capital formation,  
\( K_{fn}, K_{fx} = \) Respective sector’s foreign direct investment,  
\( L_n, L_x = \) Respective sector’s labour forces,

Foreign capital inflow generally entails advantages in terms of technology transfers, technology upgradation, labour mobility and training. A part of the informal sector (modern informal sector) uses capital intensive technology with a fair scope for upgrading its technology due to technology transfers. Moreover, global competition strengthens the inter-firm vertical linkages between the formal and informal sectors.
through sub-contracting and outsourcing. It is generally expected that the marginal factor productivities of the formal sector are higher than those of the informal sector mainly due to the fact that the formal sector prevails several advantages, such as, accessibility to improved technology, various facilities from the government, better market, information availability, skilled labour etc. Thus, like Feder (1982), this study also considers the issue of non-optimality of resource allocation between the formal and informal sectors. The ratio of respective marginal productivities of the two sectors deviates from unity\(^4\) by a factor \(\delta\), i.e.,

\[
(G_{dK} / F_{dK}) = (G_{fK} / F_{fK}) = (G_L / F_L) = 1 + \delta, \tag{4.1.3}
\]

where \(G_{dK}\) and \(F_{dK}\) represent the marginal productivities of domestic capital with regard to the formal and informal sectors respectively. Similarly, \(G_{fK}\) and \(F_{fK}\) represent the marginal productivities of foreign capital invested in the formal and informal sectors respectively. \(G_L\) and \(F_L\) denote the marginal productivities of labour in the formal and informal sectors respectively. \(\delta\) measures the deviation from the optimal allocation of resources. If \(\delta = 0\), equation (4.1.3) shows the optimal allocation, while \(\delta > 0\) indicates the non-optimal allocation such that the marginal factor productivities of the formal sector are higher than those of the informal sector.

In this context, it is imperative to mention that the marginal productivity differences

\footnotesize*

\(^4\) The optimization problem relates to the maximization of total output \(Y = (N + X)\) subject to resource constraint \(K_d^0 = K_{dn} + K_{dx}, K_f^0 = K_{fn} + K_{fx}\) and \(L^0 = L_n + L_x\).

The Lagrangian function is

\[
\mathcal{L} = F(K_{dn}, K_{fn}, L_n, X) + G(K_{dx}, K_{fx}, L_x) - \lambda_1[K_d^0 - (K_{dn} + K_{dx})] - \lambda_2[K_f^0 - (K_{fn} + K_{fx})] - \lambda_3[L^0 - (L_n + L_x)].
\]

First order conditions are as follows.

\[
\begin{align*}
\delta \mathcal{L} / \delta K_{dn} &= \delta F / \delta K_{dn} + \lambda_1 = 0 \quad (a) \\
\delta \mathcal{L} / \delta K_{fn} &= \delta F / \delta K_{fn} + \lambda_2 = 0 \quad (b) \\
\delta \mathcal{L} / \delta L_n &= \delta F / \delta L_n + \lambda_3 = 0 \quad (c) \\
\delta \mathcal{L} / \delta K_{dx} &= \delta G / \delta K_{dx} + \lambda_1 = 0 \quad (d) \\
\delta \mathcal{L} / \delta K_{fx} &= \delta G / \delta K_{fx} + \lambda_2 = 0 \quad (e) \\
\delta \mathcal{L} / \delta L_x &= \delta G / \delta L_x + \lambda_3 = 0 \quad (f)
\end{align*}
\]

From (a) and (d) we can write

\[
\delta F / \delta K_{dn} = \delta G / \delta K_{dx}
\]

Therefore, \((\delta N / \delta K_{dn}) / (\delta G / \delta K_{dx}) = 1\)

From (b) and (e) we can write

\[
(\delta F / \delta K_{fn}) / (\delta G / \delta K_{fx}) = 1
\]

From (c) and (f) we can write

\[
(\delta F / \delta L_n) / (\delta G / \delta L_x) = 1
\]
are not the same by domestic capital, foreign capital and labour. Thus, it is important to consider $\delta_1$, $\delta_2$ and $\delta_3$ separately in respect of the marginal productivity differences between the formal and informal sectors for domestic capital, foreign capital and labour. However, for the sake of simplicity, we consider $\delta$ as a representative of $\delta_1$, $\delta_2$ and $\delta_3$, and use the TFP difference just to capture the average differences in marginal productivities of domestic capital, foreign capital and labour together between the formal and informal sectors.

Next, by total differentiation of equations (4.1.1) and (4.1.2), we get

$$N = F_dK \cdot I_{dn} + F_fK \cdot I_{fn} + F_L \cdot L_n + F_x \cdot X$$

(4.1.4)

$$X = G_dK \cdot I_{dx} + G_fK \cdot I_{fx} + G_L \cdot L_x$$

(4.1.5)

Where $I_{dn}$ and $I_{dx}$ represent the gross domestic investment in the informal and formal sectors respectively, while $I_{fn}$ and $I_{fx}$ represent the foreign investment in the informal and formal sectors respectively; $L_n$ and $L_x$ stand for changes in the labour force in the informal and formal sectors respectively, and $F_x$ represents the marginal externality effect of the formal sector’s output on the informal sector’s output.

Using eqs. (4.1.4) and (4.1.5), eq. (4.2) can be reframed as

$$Y = F_dK \cdot I_{dn} + F_fK \cdot I_{fn} + F_L \cdot L_n + F_x \cdot X + G_dK \cdot I_{dx} + G_fK \cdot I_{fx} + G_L \cdot L_x$$

$$= F_dK \cdot I_d + F_fK \cdot I_f + F_L \cdot L + F_x \cdot X + (1 + \delta) F_dK \cdot I_{dx} + (1 + \delta) F_fK \cdot I_{fx} + (1 + \delta) F_L \cdot L_x$$

$$= F_dK \cdot I_d + F_fK \cdot I_f + F_L \cdot L + F_x \cdot X + \delta (F_dK \cdot I_{dx} + F_fK \cdot I_{fx} + F_L \cdot L_x)$$

(4.1.6)

Where $I_d (\equiv I_{dn} + I_{dx})$ represents the total domestic investment, $I_f (\equiv I_{fn} + I_{fx})$ represents the total foreign investment and $L (\equiv L_n + L_x)$ represents the growth of aggregate labour.

From eqs. (4.1.3) and (4.1.5) we can write

$$(1 + \delta) F_dK \cdot I_{dx} + (1 + \delta) F_fK \cdot I_{fx} + (1 + \delta) F_L \cdot L_x = X$$

Or, $F_dK \cdot I_{dx} + F_fK \cdot I_{fx} + F_L \cdot L_x = X / (1 + \delta)$

(4.1.7)
Using eqs. (4.1.6) and (4.1.7), we get
\[ \dot{Y} = F_{dK} \cdot I_d + F_{fK} \cdot I_f + F_L \cdot \dot{L} + \left[ \frac{\delta}{(1+\delta)} + F_x \right] \dot{X} \] (4.1.8)

Considering the linear relationship\(^5\) between the marginal productivity of labour in a sector and the average output per labourer in an economy i.e., \( F_L = \beta. \) (Y/L) (Bruno, 1968), and denoting \( F_{dK} \equiv \alpha_1 \) and \( F_{fK} \equiv \alpha_2 \), we get
\[ \dot{Y} / Y = \alpha_1 (I_d / Y) + \alpha_2 (I_f / Y) + \beta (\dot{L} / L) + \left[ \frac{\delta}{(1+\delta)} + F_x \right] (\dot{X} / X). (X / Y) \] (4.1.9)

If the allocation of resources is optimal (i.e., \( \delta = 0 \)), and if there are no externality effects of the formal sector on the informal sector’s output (i.e., \( F_x = 0 \)), then equation (4.1.9) turns to the following form.
\[ \dot{Y} / Y = \alpha_1 (I_d / Y) + \alpha_2 (I_f / Y) + \beta (\dot{L} / L) \] (4.1.10)

If we consider domestic and foreign investments together, equation (4.1.10) resembles the familiar formulation of a neo-classical growth model for an open economy since it includes both domestic and foreign capital.

It is important to estimate empirically eqs. (4.1.9) and (4.1.10) to test whether or not the coefficient of \( (\dot{X} / X). (X / Y) \) is significantly different from zero. A positive coefficient implies that marginal factor productivities in the formal sector are higher than those of the informal sector and that the formal sector has an externality effect on the informal sector’s output. Since the coefficient of \( (\dot{X} / X). (X / Y) \) represents the combined effect of the differences in the marginal factor productivities and the externality effect of the formal sector, the effect of each specification needs to be estimated separately. It could be done by estimating the coefficient of the combined effect and then decomposing the coefficient into the effect due to the differences in the marginal factor productivities and externality effect using simulation technique.

\(^5\) Feder also assumes a linear relationship between the marginal productivity of labour in a sector and the average output per labourer in the economy i.e., \( F_L = \beta. \) (Y/L).
Case-2: Externality of the informal sector

For considering the dependency of the formal sector’s output on the informal sector’s output, the production functions of both the sectors can be written as follows.

\[ N = F(K_{dn}, K_{fn}, L_n), \]  
\[ X = G(K_{dx}, K_{fx}, L_x, N), \]

(4.2.1) \hspace{1cm} (4.2.2)

Like case-1, the marginal factor productivities in the formal sector are higher as compared to those in the informal sector, i.e.,

\[ \frac{G_{dk}}{F_{dk}} = \frac{G_{fk}}{F_{fk}} = \frac{G_{L}}{F_{L}} = 1 + \delta, \]

(4.2.3)

Taking the total differentiation of equations (4.2.1) and (4.2.2), we get

\[ \dot{N} = F_{dk}. I_{dn} + F_{fk}. I_{fn} + F_{L}. L_n \]
\[ \dot{X} = G_{dk}. I_{dx} + G_{fk}. I_{fx} + G_{L}. L_x + G_N. N \]

(4.2.4) \hspace{1cm} (4.2.5)

Where \( G_N \) represents the marginal externality effect of the informal sector on the formal sector’s output.

Using eqs. (4.2.4) and (4.2.5) in eq. (4.2) yields

\[ \dot{Y} = F_{dk}. I_{dn} + F_{fk}. I_{fn} + F_{L}. L_n + G_{dk}. I_{dx} + G_{fk}. I_{fx} + G_{L}. L_x + G_N. N \]
\[ = F_{dk}. I_{dn} + F_{fk}. I_{fn} + F_{L}. L_n + (1+\delta) F_{dk}. I_{dx} + (1+\delta) F_{fk}. I_{fx} + (1+\delta) F_{L}. L_x + G_N. N \]
\[ = F_{dk}. I_{d} + F_{fk}. I_{f} + F_{L}. L + \delta (F_{dk}. I_{dx} + F_{fk}. I_{fx} + F_{L}. L_x) + G_N. N \]

(4.2.6)

From eqs. (7.2.3) and (7.2.5) we can write

\[ (1 + \delta) F_{dk}. I_{dx} + (1 + \delta) F_{fk}. I_{fx} + (1 + \delta) F_{L}. L_x = \dot{X} - G_N. N \]

Or, \( F_{dk}. I_{dx} + F_{fk}. I_{fx} + F_{L}. L_x = (\dot{X} - G_N. N)/(1 + \delta) \)

(4.2.7)
Using this result in eq. (4.2.6) finally yields

\[
\dot{Y} = F_{dK}. I_d + F_{fK}. I_f + F_{L}. L + \delta([\dot{X} - G_N. \dot{N}]/(1 + \delta)] + G_N. N
\]

\[
= F_{dK}. I_d + F_{fK}. I_f + F_{L}. L + [\delta/(1 + \delta)]. X + [1/(1 + \delta)]. G_N. N
\]  

(4.2.8)

As before, considering the linear relationship between the marginal productivity of labour in a sector and the average output per labourer in the economy i.e., \(F_L = \beta. (Y/L)\), and denoting \(F_K \equiv a\), eq. (4.2.9) can be reframed as

\[
\dot{Y}/Y = a_1 (I_d/Y) + a_2 (I_f/Y) + \beta (L/L) + [\delta/(1+\delta)].(X/X).X/Y + [1/(1+\delta)].G_N.(N/N). \]

(4.2.9)

The formulation in eq. (4.2.9) captures the effect of productivity differential (\(\delta\)) and the externality effect of the informal sector on the formal sector (\(G_N\)). The main difference between this equation and equation (4.1.9) is that this equation provides the coefficients separately for productivity difference and externality effect, while equation (4.1.9) provides the joint effects of productivity difference and externality effect. Specifically, from the coefficient of \((X/X).X/Y\) we get the value of \(\delta\). Using the \(\delta\) in the coefficient of \((N/N). (N/Y)\), we get \(G_N\).

**Case-3: Formal and informal sectors are interdependent**

Considering the case of interdependency between the formal and informal sectors, the production functions of both the sectors can be written as follows.

\[
N = F (K_{dn}, K_{fn}, L_n, X), \quad (4.3.1)
\]

\[
X = G (K_{dx}, K_{fx}, L_x, N), \quad (4.3.2)
\]

Like cases-1 and 2, here also the marginal factor productivities in the formal sector is higher than those in the informal sector, i.e.,

\[
(G_{dK} / F_{dK}) = (G_{fK} / F_{fK}) = (G_L / F_L) = 1 + \delta, \quad (4.3.3)
\]
Taking total differentiation of equations (4.3.1) and (4.3.2), we get

\[ \dot{N} = F_{dK}. I_d + F_{fK}. I_f + F_{L}. L_n + F_x. \dot{X} \] (4.3.4)

\[ \dot{X} = G_{dK}. I_d + G_{fK}. I_f + G_L. L_x + G_N. \dot{N} \] (4.3.5)

Using eqs. (4.3.4) and (4.3.5) in eq. (4.1.7) yields

\[ \dot{Y} = F_{dK}. I_d + F_{fK}. I_f + F_{L}. L_n + F_x. \dot{X} + G_{dK}. I_d + G_{fK}. I_f + G_L. L_x + G_N. \dot{N} \]

\[ = F_{dK}. I_d + F_{fK}. I_f + F_{L}. L_n + F_x. \dot{X} + (1+\delta) F_{dK}. I_d + (1+\delta) F_{fK}. I_f + (1+\delta) F_{L}. L_x + G_N. \dot{N} \]

(4.3.6)

From eqs. (4.3.3) and (4.3.5) we can write

\[ (1 + \delta) F_{dK}. I_d + (1 + \delta) F_{fK}. I_f + (1 + \delta) F_{L}. L_x = \dot{X} - G_N. \dot{N} \] (4.3.7)

Using this result in eq. (4.3.6) finally yields

\[ \dot{Y} = F_{dK}. I_d + F_{fK}. I_f + F_{L}. L + \delta [(\dot{X} - G_N. \dot{N})/(1 + \delta)] + F_x. \dot{X} + G_N. \dot{N} \] (4.3.8)

Like case-1 and 2, considering the linear relationship between the marginal productivity of labour in a sector and the average output per labourer in the economy i.e., \( F_L = \beta. (Y/L) \), and denoting \( F_K = \alpha \), eq. (4.3.8) can be reframed as

\[ \dot{Y}/Y = \alpha_1 (I_d/Y) + \alpha_2 (I_f/Y) + \beta (L/L) + [\delta/(1+\delta)+F_x]. (\dot{X}/X).(X/Y) + [1/(1+\delta)].G_N. (\dot{N}/N).(/N) \] (4.3.9)
The formulation of eq. (4.3.9) brings out the effect of productivity differential (δ) and the inter-linkages between the formal and informal sectors \[ F_x\left(\frac{\dot{X}}{X}\right)(X/Y) + G_N\left(\frac{\dot{N}}{N}\right)(N/Y) \].

It is important to note that equations 4.2.9 and 4.3.9 have included the externality effect of the informal sector (\(G_N\)) and bi-directional externalities of both the sectors (\(F_x\) and \(G_N\)), respectively. Specifically, equations 4.2.9 and 4.3.9 are two different models. For instance, the coefficient of \(\left(\frac{\dot{X}}{X}\right)(X/Y)\) in the first equation incorporates only the productivity differential (δ), while the later equation includes both the externality effect of the formal sector (\(F_x\)) and productivity differential (δ).

### 4.3. Empirical Analysis

In this empirical analysis, the impact of the formal and informal sectors’ linkages on economic growth is estimated on the basis of the abovementioned theoretical framework. Equations 4.1.9, 4.2.9 and 4.3.9 have been estimated using the thirty-five years (1971-72 to 2005-06) data. The entire dataset is converted into constant prices (1999-00 as the base year). In order to accomplish the task, the independent variables used for estimation include the share of domestic investment in the Net Domestic Product (NDP), the share of foreign investment in the Net Domestic Product (NDP), instantaneous growth of labour force, instantaneous growth of the formal sector’s NDP multiplied by the formal sector’s share in the NDP and instantaneous growth of the informal sector’s NDP multiplied by the informal sector’s share in the NDP, and the dependent variable for all the equations is instantaneous growth of the total NDP. The predicted signs of all the variables are positive. The detailed description of the variables used is given in table-4.1.
Table-4.1: Description of variables, their measurements and data sources.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Description</th>
<th>Data sources</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) $I_d/Y$</td>
<td>The share of domestic investment [gross domestic capital formation (GDCF)] in the Net Domestic Product (NDP)</td>
<td>National Accounts Statistics (NAS) and Global Investment Report (2008).</td>
<td>Global Investment Report provides the information on inward FDI flows as a percentage of GFCF, by the host region and economy, over the period 1970-2007. By subtracting the FDI share from GFCF, we have calculated the share of domestic investment (GDCF) in GFCF. Using the percentage share of GDCF in the GFCF (as given by NAS), the GDCF is estimated.</td>
</tr>
<tr>
<td>2) $I_f/Y$</td>
<td>The share of foreign direct investment in the NDP.</td>
<td>NAS and Global Investment Report (2008).</td>
<td>Global Investment Report provides data on inward FDI flows as a percentage of GFCF, by the host region and economy, over the period 1970-2007. Applying this percentage share to FDI in the GFCF (as given by NAS), annual FDI is estimated.</td>
</tr>
<tr>
<td>3) $L/L$</td>
<td>Instantaneous growth of work force.</td>
<td>Different rounds of NSSO reports on ‘employment and unemployment’ and manpower profile.</td>
<td>NSSO provides quinquennial based survey round of total employment data. For the years in between the two quinquennial rounds, estimation of workforce is obtained by using CAGR.</td>
</tr>
<tr>
<td>4) $(X/X)$. $(X/Y)$</td>
<td>Instantaneous growth of formal sector’s NDP multiplied by the formal sector’s share in NDP.</td>
<td>National Accounts Statistics.</td>
<td>Organized sector’s NDP (as provided by NAS) is used as a proxy of formal sector’s NDP.</td>
</tr>
<tr>
<td>5) $(N/N)$. $(N/Y)$</td>
<td>Instantaneous growth of the informal sector’s NDP multiplied by the informal sector’s share in the NDP.</td>
<td>National Accounts Statistics</td>
<td>Unorganized sector’s NDP (provided by NAS) is used as a proxy for the informal sector’s NDP.</td>
</tr>
</tbody>
</table>
The descriptive statistics of variables used for the time series regression analysis are given in table 4.2 in appendix.

Table 4.2: Descriptive statistics of the variables.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Y/Y$</td>
<td>0.054864</td>
<td>0.040609</td>
<td>0.135</td>
<td>-0.0591</td>
</tr>
<tr>
<td>$I_d/Y$</td>
<td>0.26398</td>
<td>0.022555</td>
<td>0.346571</td>
<td>0.229239</td>
</tr>
<tr>
<td>$I_f/Y$</td>
<td>0.003537</td>
<td>0.004391</td>
<td>0.013604</td>
<td>3.02E-05</td>
</tr>
<tr>
<td>$L/L$</td>
<td>-0.00064</td>
<td>0.007761</td>
<td>0.0281</td>
<td>-0.0324</td>
</tr>
<tr>
<td>$(X/X) (X/Y)$</td>
<td>0.000679</td>
<td>0.018678</td>
<td>0.044954</td>
<td>-0.02801</td>
</tr>
<tr>
<td>$(N/N) (N/Y)$</td>
<td>0.031545</td>
<td>0.036051</td>
<td>0.127897</td>
<td>-0.06156</td>
</tr>
</tbody>
</table>

4.4. Estimation Results

To check the stationarity in time series, all the variables of the estimable equations are subject to correlogram specification (autocorrelation and partial correlation) and Augmented Dickey-Fuller test (ADF). $I_d/Y$, $I_f/Y$, $(X/X) (X/Y)$ and $L/L$ series are stationary at the first differences i.e., these series are integrated of order 1 [$I(1)$]. Thus, we have made $I(0)$ series of all these series to run the regression. Regression results of the different models are given in table 4.3.

Table 4.3: Regression results under different specifications.

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_d/Y$</td>
<td>0.136</td>
<td>0.219</td>
<td>0.199**</td>
</tr>
<tr>
<td>(</td>
<td>(0.307)</td>
<td>(0.235)</td>
<td>(0.076)</td>
</tr>
<tr>
<td>$I_f/Y$</td>
<td>1.151</td>
<td>0.746</td>
<td>0.481</td>
</tr>
<tr>
<td>(</td>
<td>(1.708)</td>
<td>(1.522)</td>
<td>(0.401)</td>
</tr>
<tr>
<td>$L/L$</td>
<td>-0.347</td>
<td>-1.047**</td>
<td>-0.824***</td>
</tr>
<tr>
<td>(</td>
<td>(0.293)</td>
<td>(0.449)</td>
<td>(0.123)</td>
</tr>
<tr>
<td>$(X/X)(X/Y)$</td>
<td>0.929**</td>
<td>(0.445)</td>
<td>0.631***</td>
</tr>
<tr>
<td>(</td>
<td>(</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>$(N/N)(N/Y)$</td>
<td>0.982***</td>
<td></td>
<td>(0.877)</td>
</tr>
<tr>
<td>(</td>
<td></td>
<td></td>
<td>(</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.015</td>
<td>-0.007</td>
<td>-0.031</td>
</tr>
<tr>
<td>(</td>
<td>(0.078)</td>
<td>(0.06)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.04</td>
<td>0.20</td>
<td>0.94</td>
</tr>
<tr>
<td>D-W stat</td>
<td>2.33</td>
<td>2.60</td>
<td>1.19</td>
</tr>
<tr>
<td>No. of observation</td>
<td>34</td>
<td>34</td>
<td>34</td>
</tr>
</tbody>
</table>

Note: ***, ** and *** indicate 1%, 5% and 10% level of significance respectively. Figures in parentheses represent standard errors.
Source: Model 1 is based on equation 4.1.10; model 2 on 4.1.9; model 3 on 4.2.9 and 4.3.9.
In respect of models-1 and 2, $R^2$ is found very low and almost all the variables are insignificant. However, $R^2$ is sufficiently high (0.94) in model 3, i.e., more than three times of the earlier two cases, while excepting the share of FDI all variables are found significant. Further, it can be argued that model 3 has a superior explanatory power in comparison to the other two models. Moreover, in the model-1, none of the variables are significant. In model-2, only two variables are significant.

Model-1 is a traditional neo-classical growth model and assumes no linkages between the formal and informal sectors (i.e, $F_X = 0$) and resources are optimally allocated (i.e, $\delta =0$). If we incorporate the linkages between the formal and informal sectors, the coefficient turns out to be positive and significant (model-2) which implies that the combined effect of externality of the formal sector and differences in marginal factor productivity are positive. Later, equations 4.2.9 and 4.3.9 (model 3) in respect of cases-2 and 3 include the externality effect of the informal sector ($G_N$) and bi-directional externalities of both the sectors ($F_x$ and $G_N$), respectively. Specifically, 4.2.9 and 4.3.9 are two different models with the same specifications of variables of an estimable equation. Although the variables incorporated in equations 4.2.9 and 4.3.9 are the same, the interpretations are different. The coefficient of $(\dot{X}/X).((X/Y)$ in the first equation incorporates only the productivity differential ($\delta$), while the later equation includes both the externality effect of the formal sector ($F_x$) and productivity differential ($\delta$).

It can be argued from the actual and predicted growth rates (figure-4.1) that only four times across a period of 35 years the residual plots outside the range. Results of model 3 show that domestic investment and externality of both formal and informal sectors have statistically significant and positive impact on economic growth. However, labour growth has negative impact on growth. Feder (1982) mentions that the parameter of labour growth is positive if there is no surplus labour prevailing in the sample countries. Since in India a large proportion of surplus labour does exist, the growth of labour force may not always have a positive impact on output. While Feder (1982) found the coefficient $(\dot{X}/X).((X/Y)$ insignificant for the externality of export sector, we find positive and significant coefficient of externalities of both the formal and informal sector.
4.5. Simulation Analysis

Values of $F_x$, $G_N$ and $\delta$ are not separable from the estimated coefficients in model 3. Thus, $F_x$ and $G_N$ are computed by simulating approximate values of $\delta$.

Using NSSO data on the unorganized manufacturing sector and ASI data on the organized manufacturing sector, we have estimated the total factor productivity differences between these two sectors for the years 2000-01 and 2005-06. Following Ray (2004), we have estimated total factor productivity (through a positive measurement) dividing the total value of output by the total value of inputs. The total factor productivity differences between the organized and unorganized sectors are presented in table-4.4.

Table-4.4: Total factor productivity (TFP) differences between the organized and unorganized sectors.

<table>
<thead>
<tr>
<th>Year</th>
<th>TFP of the organized manufacturing sector</th>
<th>TFP of the unorganized manufacturing sector</th>
<th>TFP differences ($\delta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-01</td>
<td>1.238</td>
<td>0.515</td>
<td>0.723</td>
</tr>
<tr>
<td>2005-06</td>
<td>1.236</td>
<td>0.497</td>
<td>0.739</td>
</tr>
</tbody>
</table>

Source: Author’s estimation using NSSO and ASI data on the unorganized and organized manufacturing sectors respectively.
Based on estimated values of $\delta$, we have simulated the values of $F_x$ and $G_N$. These are presented in table-4.5.

<table>
<thead>
<tr>
<th>$\delta$</th>
<th>$F_x$</th>
<th>$G_N$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.723</td>
<td>0.211</td>
<td>1.692</td>
</tr>
<tr>
<td>0.731</td>
<td>0.209</td>
<td>1.7</td>
</tr>
<tr>
<td>0.739</td>
<td>0.206</td>
<td>1.708</td>
</tr>
</tbody>
</table>

Table-4.5 depicts the relationship between $\delta$, $F_x$ and $G_N$. It shows that with an increase in the marginal productivity differences ($\delta$) between formal and informal sectors, the impact of formal sector on the informal sector’s output decreases, while the impact of the informal sector on the formal sector’s output increases. Assuming that the formal sector always has a higher productivity, the results imply that an increase in $\delta$ the market share of informal sector decreases. This happens because an increase in the marginal productivity differences implies the movement of relative prices in favour of formal sector.

### 4.5. Sources of Growth

We can decompose the economic growth into its different components. Using the estimated parameter of model 3 and the mean of variables, we have computed the contribution of each variable to the total economic growth (table-4.6).

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Coefficient</th>
<th>Contribution to total economic growth (mean X coefficient)</th>
<th>Contribution to total economic growth (Percentage share)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_d/Y$</td>
<td>0.264</td>
<td>0.199</td>
<td>0.0525</td>
<td>67.33</td>
</tr>
<tr>
<td>$I_f/Y$</td>
<td>0.0035</td>
<td>0.481</td>
<td>0.0017</td>
<td>2.18</td>
</tr>
<tr>
<td>$L/L$</td>
<td>-0.0006</td>
<td>-0.824</td>
<td>0.0005</td>
<td>0.67</td>
</tr>
<tr>
<td>$(X/X). (X/Y)$ For $\delta$</td>
<td>0.0007</td>
<td>0.731</td>
<td>0.0005</td>
<td>0.64</td>
</tr>
<tr>
<td>$(X/X). (X/Y)$ For $F_X$</td>
<td>0.0007</td>
<td>0.209</td>
<td>0.0001</td>
<td>0.18</td>
</tr>
<tr>
<td>$(N/N). (N/Y)$</td>
<td>0.0315</td>
<td>1.7</td>
<td>0.0536</td>
<td>68.73</td>
</tr>
<tr>
<td>Intercept</td>
<td>1</td>
<td>-0.031</td>
<td>-0.031</td>
<td>-39.73</td>
</tr>
</tbody>
</table>

Source: Estimated by using the model-3 in table-4.2.

The above table shows that the externality effect of the informal sector contributes 68.73 percent to economic growth, while the contribution of the formal sector’s
externality is very small at 0.18 percent. Moreover, the contribution of productivity differences between formal and informal sectors constitutes about 0.64 percent. As is expected, both domestic and foreign investments have positive contribution to economic growth.

4.6. Summary

This chapter measures the impact of formal and informal sectors’ linkages on economic growth using Feder’s framework. Moreover, we have extended Feder’s framework in that with regard to the measurement of inter-sectoral linkages considering four different possibilities of linkages. The linkages may be unidirectional i.e., one sector having its impact on other but not vice-versa or it may be bi-directional i.e., both the sectors having impact on each other. The associated advantages of our theoretical framework are as follows: 1) the formal and informal sectors are linked in several ways, such as, consumption linkages, technological linkages, sub-contracting, informal marketing chain, informal supply chain, etc. In view of the fact that all the linkages are not easily identifiable and measurable separately, this framework can be used for capturing the aggregate impact of all the linkages without defining each one separately; 2) Even if data in respect of all the variables are not available for the formal and informal sectors separately, we can use this model for capturing the linkage effect using aggregate data; 3) The framework concerning the productivity differentials across the sectors provides a very realistic picture of the economy.

Results show that domestic investment and externality of both formal and informal sectors have statistically significant and positive impact on economic growth. Further, with an increase in the marginal productivity differences between the formal and informal sectors, the externality effect of the formal sector decreases, while the externality effect of the informal sector increases. Based on the estimation of sources of economic growth, results show that even if the informal sector is less productive, it still has a large externality effect besides making a significant contribution to economic growth. At the same time, we can’t ignore the externality issue of the more productive sector (here, it is the formal sector). Although the formal sector’s externality impact is lower than the informal sector, it is positive and significant.
Further, as is expected, both domestic and foreign investments make a positive contribution to economic growth.

However, the framework has the following limitations. First, it is not possible to identify all the linkages separately and measured empirically using this framework. Second, marginal productivity differences between formal and informal sector are not the same by domestic capital, foreign capital and labour. Thus, it is important to consider $\delta_1$, $\delta_2$ and $\delta_3$ separately in respect of the marginal productivity differences between the formal and informal sectors for domestic capital, foreign capital and labour. However, for the sake of simplicity, we have considered $\delta$ as a representative of $\delta_1$, $\delta_2$ and $\delta_3$, and have used TFP difference just to capture the average differences in marginal productivities of the formal and informal sectors by domestic capital, foreign capital and labour together.
Appendix

Model-3 can be further extended by dividing informal sector into traditional and modern informal sectors. The extended model can be formulated as follows.

Informal is sub-divided into traditional and modern informal sector. Traditional informal sector produces mainly consumer goods, while modern informal sector produces intermediate products and simple capital goods.

\[ Y = T + M + X \]  
\[ (4.4.1) \]

Where \( T \) and \( M \) represent traditional and modern informal sectors’ output.

Here, we make the assumption that modern informal sector and formal sector are interdependent, while the traditional informal sector is isolated from the rest of the economy. Moreover, foreign capital does not have any influence in the traditional informal sector. The production functions of the sectors can be written as follows.

\[ T = E (K_{de}, L_e), \]  
\[ (4.4.2) \]

\[ M = F (K_{dm}, K_{fm}, L_m, X), \]  
\[ (4.4.3) \]

\[ X = G (K_{dx}, K_{fx}, L_x, N), \]  
\[ (4.4.4) \]

where \( K_{de}, K_{dm}, K_{dx} = \) Respective sector’s gross domestic capital formation,

\( K_{fm}, K_{fx} = \) Respective sector’s foreign direct investment,

\( L_e, L_m, L_x = \) Respective sector’s labour forces,

Like earlier cases, here also the marginal factor productivities in formal sector is higher than those in the informal sector, i.e.,

\[ \left( \frac{G_{dK}}{F_{dK}} \right) = \left( \frac{G_{fK}}{F_{fK}} \right) = \left( \frac{G_{L}}{F_{L}} \right) = 1 + \delta, \quad \delta > 0 \]  
\[ (4.4.5) \]

\[ \left( \frac{E_{dK}}{F_{dK}} \right) = \left( \frac{E_{L}}{F_{L}} \right) = 1 + \gamma, \quad \gamma < 0 \]  
\[ (4.4.6) \]
Taking total differentiation of equations (4.4.2), (4.4.3) and (4.4.4), we get

\[ T = E_{dk}. I_{de} + E_{L}. L_e \]  

(4.4.7)

\[ M = F_{dk}. I_{dm} + F_{IK}. I_{fm} + F_{L}. L_m + F_x. X \]  

(4.4.8)

\[ X = G_{dk}. I_{dx} + G_{IK}. I_{fx} + G_{L}. L_x + G_M. M \]  

(4.4.9)

Using eqs. (4.3.4) and (4.3.5) in eq. (4.1.7) yields

\[ \dot{Y} = F_{dk}. I_d + F_{IK}. I_I + F_{L}. L + F_x. X + G_N. N + \gamma (F_{dk}. I_{dx} + F_{L}. L_x) + \delta (F_{dk}. I_{dx} + F_{IK}. I_{fx} + F_{L}. L_x) \]  

(4.4.10)

From eqs. (4.4.6) and (4.4.7) we can write

\[ F_{dk}. I_{dx} + F_{L}. L_x = \frac{T}{(1 + \gamma)} \]  

Similarly, from (4.4.5) and (4.4.8) we can write

\[ F_{dk}. I_{dx} + F_{IK}. I_{fx} + F_{L}. L_x = (X - G_M. M)/(1 + \delta) \]  

Finally, eq. (4.4.10) can be written as,

\[ \dot{Y} = F_{dk}. I_d + F_{IK}. I_I + F_{L}. L + [\gamma/(1 + \gamma)]T + [G_M/(1 + \delta)]M + [\delta/(1 + \delta) + F_x]X \]  

(4.4.11)

Like case-1, considering the linear relationship between the marginal productivity of labour in a sector and the average output per labourer in the economy i.e., \( F_L = \beta \). (Y/L), and denoting \( F_K = \alpha \), eq. (4.3.8) can be reframed as

\[ \dot{Y} / Y = \alpha_1(I_d/Y) + \alpha_2(I_d/Y) + \beta (L/L) + [\gamma/(1 + \gamma)](T/T).(T/Y) + [G_M/(1 + \delta)] 

(M /M).(M/Y) + [\delta/(1 + \delta) + F_x].(X/X).X/Y \]  

(4.4.12)

The formulation of eq. (4.4.12) clearly brings out the effect of productivity differentials between formal sector and modern informal sector (\( \delta \)), traditional informal sector and modern informal sector (\( \gamma \)) and the inter-linkages between the formal sector and modern informal sector.
Since NAS does not provide the data by modern and traditional informal sector, it is not possible to estimate empirically eq. (4.4.12). However, one can measure the share of modern and traditional sectors in total informal sector using NSSO (2001) unit level data. Since this is also available for only one year, it is difficult to capture time series variation in terms of the size of the modern and traditional sectors.