Abstract

It is a truth universally acknowledged that India is one of the most corrupt emerging economies across the globe in terms of political/bureaucratic corruption. This paper tries to explain how political/bureaucratic corruption in India affects households preferences of consumption – leisure, consumption – saving (inter-temporal consumption) and consumption – demand of real balances decisions in a typical economy, dominated to informal sector, modeled in an Open Economy New Keynesian Dynamic Stochastic General Equilibrium style (NK DSGE Model) with micro-foundations. The study incorporates enormously important informal sector as the lion’s share of Indian workforce works in this sector and does not keep the degree of political/bureaucratic corruption out as thriving corruption has engulfed whole of the nation. A theoretical model based on a representative household’s utility function comprising of consumption, public consumption, real balances and labour supply (production) subject to its budget constraint is developed and solved. Paper shows, theoretically, that households preferences of optimal consumption-saving decision (optimal inter-temporal consumption decision), optimal consumption-leisure decision (optimal consumption-labour supply decision) and optimal consumption-demand of real balances decision do not have an influence of public spending on consumption, of government transfer, of political/bureaucratic corruption/embezzlement in public spending on consumption and of political/bureaucratic corruption/embezzlement in government transfer.

JEL Classification: D73, D11, E21, E26, E31, E41

Keywords: NK-DSGE Model, Household Utility, Informal Economy, Corruption
1. Introduction

It is a truth universally acknowledged that India is one of the most corrupt emerging economies across the globe in terms of political/bureaucratic corruption. At the same time Indian economy has relatively very large informal sector which accommodates its ninety percent workforce and contributes around half of its GDP. In such an informal economic environment this paper attempts to study the preferences of households in the presence of political/bureaucratic corruption. The related issues has been framed in an Open Economy New Keynesian Dynamic Stochastic General Equilibrium Model with micro-foundations to find out in which way the political/bureaucratic corruption has an impact on households preferences of consumption – leisure, consumption – saving (inter-temporal consumption) and consumption – demand of real balances decisions.

1.1 Corruption in India

Corruption in India is a major issue and adversely affects its economy. In 2012 India has ranked 94th out of 176 countries in Transparency International's Corruption Perceptions Index. Most of the largest sources of corruption in India are entitlement programs and social spending schemes enacted by the Indian government. Indian media has widely published allegations of corrupt Indian citizens stashing trillions of dollars in Swiss banks. India has seen many of the biggest scandals since 2010 have involved very high levels of government, including Cabinet Ministers and Chief Ministers, such as in 2G Spectrum Scam, 2010 Commonwealth Games Scam, Adarsh Housing Society Scam, Coal Mining Scam, Mining Scandal in Karnataka and Cash for Vote Scam. A November 2010 report from the Washington based Global Financial Integrity estimates that over a 60 year period, India lost US$213 billion in illicit financial flows beginning in 1948; adjusted
for inflation, this is estimated to be 462 billion in 2010 dollars, or about $8 billion per year ($7 per capita per year). The report also estimated the size of India's underground economy at approximately US$640 billion at the end of 2008 or roughly 50% of the nation's GDP. According to a 2010 The Hindu article, unofficial estimates indicate that Indians had over US$1456 billion in black money stored in Swiss Banks (approximately USD 1.4 trillion). While some news reports claimed that data provided by the Swiss Banking Association Report (2006) showed India has more black money than the rest of the world combined, a more recent report quoted the SBA's Head of International Communications as saying that no such official Swiss Banking Association statistics exist. Another report said that Indian-owned Swiss bank account assets are worth 13 times the country's national debt Wikipedia (2012).

### 1.2 Informal Sector in Indian Economy

The structure of emerging market economies is somewhat differ than that of advance economies due to existence of large informal sector. The structure of goods, labour and credit markets are pretty dissimilar in formal and informal sectors of the economy as agents have different endowments and constraints. In the advance economies the relative size of informal sector is much smaller to that of formal sector; therefore, it is reasonable to ignore the informal sector in advanced economies as it has negligible impact on the aggregates. But in the emerging market economies where the informal sector is relatively large and plays an important role in the economy then neglecting the informal sector would not be justified; Schneider et al. (2010). Informal sector plays a major role in employment generation, especially for the developing world; Agenor and Montiel (1996); Harris-White and Sinha (2007); Marjit and Kar (2011) and Dutta et al. (2011). The informal sector is always complex to deal with as most of the activities of this sector are gone unrecorded.
Unorganised or informal sector constitutes a pivotal part of the Indian economy. More than 90 per cent of workforce and about 50 per cent of the national product are accounted for by the informal economy. A high proportion of socially and economically underprivileged sections of society are concentrated in the informal economic activities. The high level of growth of the Indian economy during the past two decades is accompanied by increasing informalisation. There are indications of growing interlinkages between informal and formal economic activities. There has been new dynamism of the informal economy in terms of output, employment and earnings. Faster and inclusive growth needs special attention to informal economy. Sustaining high levels of growth are also intertwined with improving domestic demand of those engaged in informal economy, and addressing the needs of the sector in terms of credit, skills, technology, marketing and infrastructure (NSC, 2012).

2. Review of Literature

Batini et al. (2010) explore the costs and benefits of informality associated with the informal sector lying outside the tax regime in a two-sector New Keynesian model. The informal sector is more labour intensive, has a lower labour productivity, is untaxed and has a classical labour market. The formal sector bears all the taxation costs, produces all the government services and capital goods, and wages are determined by a real wage norm.

Batini et al. (2011) construct a two-sector, formal-informal new Keynesian closed-economy model. The informal sector is more labour intensive, is untaxed, has a classical labour market, faces high credit constraints in financing investment and is less visible in terms of observed output.

Blackburn et al. (2004) present a dynamic general equilibrium analysis of public sector corruption and economic growth. In an economy with government intervention and capital accumulation, state-appointed bureaucrats are charged with the responsibility for procuring public goods which contribute to productive
efficiency. Corruption arises because of an opportunity for bureaucrats to appropriate public funds by misinforming the government about the cost and quality of public goods provision. The incentive for each bureaucrat to do this depends on economy-wide outcomes which, in turn, depend on the behaviour of all bureaucrats.

Bridji and Charpe (2011) develop a model of an economy with dual labour markets to understand the dynamics of the informal sector over the business cycle, as well as to analyze the implication of duality for the volatility of output and the persistence of employment. The informal labour market is competitive while the formal labour market is characterized by search costs. The size of each labour market segment depends on labour demand by firms as well as participation decisions of households. Authors show that the informal sector plays the role of a buffer, expanding in periods of recessions and shrinking when recovery sets in. Authors also show that workers switching between the two labour market increases the volatility of output. Finally, labour market segmentation modifies the properties of the search model, as the competitive labour market segment reduces the volatility of employment, unless transition costs are high.

Castillo and Montoro (2009) analyze the effects of informal labor markets on the dynamics of inflation and on the transmission of aggregate demand and supply shocks. In doing so, authors incorporate the informal sector in a modified New Keynesian model with labor market frictions as in the Diamond-Mortensen-Pissarides model. Authors show that the informal economy generates a “buffer” effects that diminish the pressure of demand shocks on aggregate wages and inflation.

Cordis (2012) investigates the relation between public corruption and the composition of state government expenditures in the United States. The results suggest that the United States is not immune to the adverse effects of corruption.

Delavallade (2006) empirically examines the impact of corruption on the structure of government spending by sector. Using the three-stage least squares method on 64 countries between 1996 and 2001, author shows that public
corruption distorts the structure of public spending by reducing the portion of social expenditure (education, health and social protection) and increasing the part dedicated to public services and order, fuel and energy, culture and defense. However, civil and political rights seem to be a stronger determinant of expense on defense than corruption.

Gabriel et al. (2011) develop a closed-economy DSGE model of the Indian economy and estimate it by Bayesian Maximum Likelihood methods using Dynare. Authors build up in stages to a model with a number of features important for emerging economies in general and the Indian economy in particular: a large proportion of credit-constrained consumers, a financial accelerator facing domestic firms seeking to finance their investment and an informal sector.

Goyal (2007) represents an optimizing model of a small open emerging market economy (SOEME) with dualistic labour markets and two types of consumers, delivers a tractable model for monetary policy.

Goyal (2008) develops a simplified version of a typical dynamic stochastic open economy general equilibrium models used to analyze optimal monetary policy. Author outlines the chief modifications when dualism in labour and in consumption is introduced to adapt the model to a small open emerging market such as India. The implications of specific labour markets, and the structure of Indian inflation and its measurement are examined.

Haider et al. (2012) develop an open economy dynamic stochastic general equilibrium (DSGE) model based on New-Keynesian micro-foundations. Alongside standard features of emerging economies, such as a combination of producer and local currency pricing for exporters, foreign capital inflow in terms of foreign direct investment and oil imports. Authors also incorporate informal labor and production sectors. This customization intensifies the exposure of a developing economy to internal and external shocks in a manner consistent with the stylized facts of Business Cycle Fluctuations.

Korneliussen (2009) hints to a possible weakness of the empirical literature on corruption and government spending. Corruption affects the composition of
government spending and in particular it affects education and health spending adversely.

Mauro (1998) asks whether predatory behavior by corrupt politicians distorts the composition of government expenditure. Corruption is found to reduce government spending on education in a cross section of countries.

Monte and Papagni (2001) show that public services and goods can provide relevant inputs to private productive activities. Modern States organize the production of these inputs on the basis of taxes collected from the community. When this process is affected by bureaucrats’ corruption the efficiency of public expenditure decreases. Authors deal with the long-run consequences of this form of corruption.

3. **Underpinning of Theoretical Formulization of the Model**

The world economy is modeled as a continuum of small open economies with identical preferences, technology, and market structure, indexed by a unit interval [0,1], so as it does not have any impact of policy decisions of any economy as in Gali and Monacelli (2005). Again, the home economy is divided in to two sectors, namely, formal and informal following Conesa, et al. (2002); Ihrig and Moe (2004); Batini et al. (2010) and Batini et al. (2011) and has together a unit mass which spreads on the interval [0, Ϝ], [Ϝ, 1], respectively, moreover, both of them consume/produce continuum of differentiated goods as their population size indexed on the unit interval [0, Ϝ], [Ϝ, 1], respectively.

The home economy is inhabited by an infinitely lived representative household who derives its utility from additively separable utility function comprising of consumption, public consumption, real balances and from leisure (negative utility from working/production) as \( U(C_t, \eta G_t, \frac{M_t}{P_t}, L_t) \) and wishes to maximize the utility as under following Walsh (2003) and Woodford (2003).
Max $E_0 \sum_{t=0}^{\infty} \beta^t U \left( C_t, \eta G_t, \frac{M_t}{P_t}, L_t \right)$

The period utility is given by as in Gali (2008).

Max $E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{C_t^{1-\varepsilon}}{1-\varepsilon} + \eta \frac{G_t^{1-\kappa}}{1-\kappa} + \frac{(M_t/P_t)^{1-\tau}}{1-\tau} - L_t^{1+\nu} \right\}$

Subject to

$C_t P_t + M_t + Q_t B_t = M_{t-1} + B_{t-1} + L_t W_t + \Omega_t + \eta G_t^T - T_t^d$

Where $C_t, \eta G_t, \frac{M_t}{P_t}, L_t$ are, respectively, consumption, public consumption, real balances and labour supply indices. $U(\cdot)$ is utility function. $\varepsilon, \kappa, \tau$ and $\nu$ are intertemporal elasticities of substitution of consumption, public consumption, holding real balances and that of labour supply between periods. $\beta$ is discount factor, $E_0$ is expectational operator, $M_t$ is nominal money stock, $P_t$ is general price level, $B_t$ are domestic bonds, $G_t^T$ is government transfer, $T_t^d$ is distorted tax and $\Omega_t = \int_0^1 \Omega_{i,t} \, di$ is nominal profit of the firms, again $\Omega_{i,t}$ is nominal profit of the firm producing $i$ type of good. $\eta = (1 - \zeta)$, where, $\zeta$ is a degree of political/bureaucratic corruption/embezzlement in public spending on consumption and in government transfer. $Q_t = \frac{1}{1+i_t}$, where, $i_t$ is nominal interest rate.

$C_t P_t = \int_0^\gamma [C_t^{HF}(i)][P_t^{HF}(i)] \, di + \int_0^1 [C_t^{HI}(i)][P_t^{HI}(i)] \, di + \int_0^1 [F_{j,t}(i)][P_{j,t}(i)] \, di$ \hspace{1cm} (5)

$L_t W_t = \int_0^\gamma [L_t^{HF}(k)][W_t^{HF}(k)] \, dk + \int_0^1 [L_t^{HI}(k)][W_t^{HI}(k)] \, dk$ \hspace{1cm} (6)

The domestic composite consumption aggregator $C_t$ can be given following Dixit and Stiglitz (1977) as:
Where $qgj1z2 qgJ'L3 qgJ''2$ and $qgj1z2 qgJ'L3 qgJ''3$ are indices of domestic consumption of domestically and foreign produced goods, respectively and $qgz'J7 qgJ'z1$ is intratemporal elasticity of substitution of consumption between domestically and foreign produced goods. $qgz''2$ is degree of openness while $1 - qgz''2$ is home biasness. The analogous CES aggregator of domestically produced goods $qgj1z2 qgJ'L3 qgJ''2$ can be given as:

$$C_t = \left[ (1 - \alpha) \frac{1}{\varphi_a} (C_t^H)^{\varphi_a-1} \frac{\varphi_a-1}{\varphi_a} + (\alpha) \frac{1}{\varphi_a} (C_t^F)^{\varphi_a-1} \right]^{\frac{\varphi_a}{\varphi_a-1}}$$

(7)

Where $C_t^H$ and $C_t^F$ are indices of domestic consumption of domestically and foreign produced goods, respectively and $\vartheta_a$ is intratemporal elasticity of substitution of consumption between domestically and foreign produced goods. $\alpha$ is degree of openness while $1 - \alpha$ is home biasness. The analogous CES aggregator of domestically produced goods $C_t^H$ can be given as:

$$C_t^H = \left[ (1 - \gamma) \frac{1}{\varphi_b} (C_t^{HF})^{\varphi_b-1} \frac{\varphi_b-1}{\varphi_b} + (\gamma) \frac{1}{\varphi_b} (C_t^{H})^{\varphi_b-1} \right]^{\frac{\varphi_b}{\varphi_b-1}}$$

(8)

Where $C_t^{HF}$ and $C_t^{HI}$ are indices of domestic consumption of domestic formal and domestic informal sectors produced goods, respectively and $\vartheta_b$ is intratemporal elasticity of substitution of consumption between formal and informal sector produced goods. $\gamma$ and $1 - \gamma$ are share of domestic consumption of formal and informal sector produced goods, respectively. The CES function of consumption of domestic formal sector produced goods $C_t^{HF}$ can be given as following Woodford (2003).

$$C_t^{HF} = \left[ \frac{1}{\varphi_c} \frac{\gamma}{1 - \gamma} \int \left[ C_t^{HF}(i) \right]^{\varphi_c-1} \varphi_c^{\varphi_c-1} \right]^{\frac{\varphi_c}{\varphi_c-1}}$$

(9)

Where $[C_t^{HF}(i)]$ is the quantity of good $i$ produced in the domestic formal sector consumed in period $t$ and $\vartheta_c$ is intratemporal elasticity of substitution of consumption between varieties of formal sector produced goods. The CES function of consumption of domestic informal sector produced goods $C_t^{HI}$ can be given as:

$$C_t^{HI} = \left[ \frac{1}{\varphi_c} \frac{1}{1 - \gamma} \int \left[ C_t^{HI}(i) \right]^{\varphi_c-1} \varphi_c^{\varphi_c-1} \right]^{\varphi_c}$$

(10)

Where $[C_t^{HI}(i)]$ is the quantity of good $i$ produced in the domestic informal sector consumed in period $t$ and $\vartheta_c$ is intratemporal elasticity of substitution of consumption between varieties of informal sector produced goods. The CES function of consumption of foreign produced goods $C_t^F$ can be given as:
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\[ C_t^F = \left[ \int_0^1 \left[ C_{j,t}^F \frac{\theta_{d}^{-1}}{\theta_{d}} \right]^{\frac{\theta_{d}}{\theta_{d}-1}} \, dj \right]^{\frac{\theta_{d}}{\theta_{d}-1}} \]  \tag{11}

Where \( C_{j,t}^F \) is the index of domestic consumption of country \( j \) produced goods and \( \theta_d \) is intratemporal elasticity of substitution of consumption of goods produced in different countries of the world. The CES function of consumption of country \( j \) produced goods \( C_{j,t}^F \) can be given as:

\[ C_{j,t}^F = \left[ \int_0^1 \left[ C_{j,t}^F(i) \right]^{\frac{\theta_{c}^{-1}}{\theta_{c}} \theta_{c}^{-1}} \, di \right]^{\frac{\theta_{c}}{\theta_{c}-1}} \]  \tag{12}

Where \( C_{j,t}^F(i) \) is the quantity of good \( i \) produced in country \( j \) and consumed in period \( t \) and \( \theta_c \) is intratemporal elasticity of substitution of consumption between varieties of country \( j \) produced goods. The corresponding consumption based price indices of (7) to (12) are given by (13) to (18), respectively as under following Benigno and Benigno (2003) and Benigno (2004).

\[ P_t = [(1 - \alpha)(P_t^H)^{1-\theta_a} + (\alpha)(P_t^F)^{1-\theta_a}]^{\frac{1}{1-\theta_a}} \]  \tag{13}

\[ P_t^H = [\gamma(P_t^{HF})^{1-\theta_b} + (1 - \gamma)(P_t^{HL})^{1-\theta_b}]^{\frac{1}{1-\theta_b}} \]  \tag{14}

\[ P_t^{HF} = \left[ \frac{1}{\gamma} \int_0^\gamma [P_t^{HF}(i)]^{1-\theta_c} \, di \right]^{\frac{1}{1-\theta_c}} \]  \tag{15}

\[ P_t^{HL} = \left[ \frac{1}{(1 - \gamma)} \int_0^{1-\gamma} [P_t^{HL}(i)]^{1-\theta_c} \, di \right]^{\frac{1}{1-\theta_c}} \]  \tag{16}

\[ P_t^F = \left[ \int_0^1 [P_{j,t}^F]^{1-\theta_d} \, dj \right]^{\frac{1}{1-\theta_d}} \]  \tag{17}

\[ P_{j,t}^F = \left[ \int_0^1 [P_{j,t}^F(i)]^{1-\theta_c} \, di \right]^{\frac{1}{1-\theta_c}} \]  \tag{18}
Optimal allocation of goods derives the following demand functions in each category for given level of expenditure.

\[ C_t^H = (1 - \alpha) \left( \frac{P_{t, t}^H}{P_t} \right)^{-\theta_a} C_t \]  \hspace{1cm} (19)

\[ C_t^F = (\alpha) \left( \frac{P_{t, t}^F}{P_t} \right)^{-\theta_a} C_t \]  \hspace{1cm} (20)

\[ C_t^{HF} = \gamma \left( \frac{P_{t, t}^{HF}}{P_t} \right)^{-\theta_b} C_t^H \]  \hspace{1cm} (21)

\[ C_t^{HI} = (1 - \gamma) \left( \frac{P_{t, t}^{HI}}{P_t} \right)^{-\theta_c} C_t^H \]  \hspace{1cm} (22)

\[ [C_t^{HF}(i)] = \frac{1}{\gamma} \left( \frac{\left[ P_{t, t}^{HF}(i) \right]}{P_{t, t}^{HF}} \right)^{-\theta_c} C_t^{HF} \]  \hspace{1cm} (23)

\[ [C_t^{HI}(i)] = \frac{1}{1 - \gamma} \left( \frac{\left[ P_{t, t}^{HI}(i) \right]}{P_{t, t}^{HI}} \right)^{-\theta_c} C_t^{HI} \]  \hspace{1cm} (24)

\[ [C_{j,t}(i)] = \left( \frac{P_{j,t}^F(i)}{P_{j,t}^F} \right)^{-\theta_c} C_{j,t}^F \]  \hspace{1cm} (25)

\[ C_{j,t}^F = \left( \frac{P_{j,t}^F}{P_t} \right)^{-\theta_d} C_t^F \]  \hspace{1cm} (26)

Economy-wide and sector-wise expenditure on consumption can be given as:

\[ \int_0^\gamma [C_t^{HF}(i)][P_{t, t}^{HF}(i)] di + \int_0^1 [C_t^{HI}(i)][P_{t, t}^{HI}(i)] di + \int_0^1 [C_{j,t}(i)][P_{j,t}^F(i)] di + \int_0^1 [C_{j,t}(i)][P_{j,t}^F(i)] di = C_t P_t \]  \hspace{1cm} (27)

\[ \int_0^\gamma [C_t^{HF}(i)][P_{t, t}^{HF}(i)] di = C_t^{HF} P_t^{HF} \]  \hspace{1cm} (28)

\[ \int_0^1 [C_t^{HI}(i)][P_{t, t}^{HI}(i)] di = C_t^{HI} P_t^{HI} \]  \hspace{1cm} (29)

\[ \int_0^1 [C_{j,t}(i)][P_{j,t}^F(i)] di = C_t^F P_t^F \]  \hspace{1cm} (30)

Where
\[ C_t^{HF} P_t^{HF} + C_t^{HI} P_t^{HI} = C_t^H P_t^H \]  
(31)  
\[ C_t^{H} P_t^H + C_t^{F} P_t^F = C_t P_t \]  
(32)  

Households’ Government counterparts of (7) to (32) are, analogously, given by (33) to (58) as under:

\[
\eta G_t = \left[ (1 - \alpha) \frac{1}{\sigma_a} (\eta G_t^H) \frac{\sigma_{a-1}}{\sigma_a} + (\alpha) \frac{1}{\sigma_a} (\eta G_t^F) \frac{\sigma_{a-1}}{\sigma_a} \right] \frac{\sigma_{a}}{\sigma_{a-1}}
\]

\[ = \eta \left[ (1 - \alpha) \frac{1}{\sigma_a} (G_t^H) \frac{\sigma_{a-1}}{\sigma_a} + (\alpha) \frac{1}{\sigma_a} (G_t^F) \frac{\sigma_{a-1}}{\sigma_a} \right] \frac{\sigma_{a}}{\sigma_{a-1}} \]  
(33)

\[
\eta G_t^H = \left[ (\gamma) \frac{1}{\sigma_b} (\eta G_t^{HF}) \frac{\sigma_{b-1}}{\sigma_b} + (1 - \gamma) \frac{1}{\sigma_b} (\eta G_t^{HI}) \frac{\sigma_{b-1}}{\sigma_b} \right] \frac{\sigma_{b}}{\sigma_{b-1}}
\]

\[ = \eta \left[ (\gamma) \frac{1}{\sigma_b} (G_t^{HF}) \frac{\sigma_{b-1}}{\sigma_b} + (1 - \gamma) \frac{1}{\sigma_b} (G_t^{HI}) \frac{\sigma_{b-1}}{\sigma_b} \right] \frac{\sigma_{b}}{\sigma_{b-1}} \]  
(34)

\[
\eta G_t^{HF} = \left[ \frac{1}{\gamma} \int_0^1 [\eta G_t^{HF}(i)] \frac{\sigma_{c-1}}{\sigma_c} di \right] \frac{\sigma_c}{\sigma_{c-1}}
\]

\[ = \eta \left[ \frac{1}{\gamma} \int_0^1 [G_t^{HF}(i)] \frac{\sigma_{c-1}}{\sigma_c} di \right] \frac{\sigma_c}{\sigma_{c-1}} \]  
(35)

\[
\eta G_t^{HI} = \left[ \frac{1}{1 - \gamma} \int_0^1 [\eta G_t^{HI}(i)] \frac{\sigma_{c-1}}{\sigma_c} di \right] \frac{\sigma_c}{\sigma_{c-1}}
\]

\[ = \eta \left[ \frac{1}{1 - \gamma} \int_0^1 [G_t^{HI}(i)] \frac{\sigma_{c-1}}{\sigma_c} di \right] \frac{\sigma_c}{\sigma_{c-1}} \]  
(36)

\[
\eta G_t^F = \left[ \frac{1}{\sigma_a} \int_0^1 [\eta G_{t,F}(i)] \frac{\sigma_{d-1}}{\sigma_d} di \right] \frac{\sigma_d}{\sigma_{d-1}}
\]

\[ = \eta \left[ \frac{1}{\sigma_a} \int_0^1 [G_{t,F}(i)] \frac{\sigma_{d-1}}{\sigma_d} di \right] \frac{\sigma_d}{\sigma_{d-1}} \]  
(37)

\[
\eta G_{t,F} = \left[ \frac{1}{\sigma_c} \int_0^1 [\eta G_{t,F}(i)] \frac{\sigma_{c-1}}{\sigma_c} di \right] \frac{\sigma_c}{\sigma_{c-1}}
\]

\[ = \eta \left[ \frac{1}{\sigma_c} \int_0^1 [G_{t,F}(i)] \frac{\sigma_{c-1}}{\sigma_c} di \right] \frac{\sigma_c}{\sigma_{c-1}} \]  
(38)

\[
P_t = \left[ (1 - \alpha)(P_t^H)^{1-\theta_a} + (\alpha)(P_t^F)^{1-\theta_a} \right] \frac{1}{\sigma_a}
\]

(39)
\[ P_t^H = \left[ \gamma (P_t^{HF})^{1-\theta_b} + (1-\gamma)(P_t^{HI})^{1-\theta_b} \right]^{1/(1-\theta_b)} \]  

(40)

\[ P_t^{HF} = \left[ \frac{1}{\gamma} \int_0^1 \left[ P_t^{HF}(i) \right]^{1-\theta_c} di \right]^{1/(1-\theta_c)} \]  

(41)

\[ P_t^{HI} = \left[ \frac{1}{\gamma} \int_0^1 \left[ P_t^{HI}(i) \right]^{1-\theta_c} di \right]^{1/(1-\theta_c)} \]  

(42)

\[ P_F = \left[ \int_0^1 \left[ P_{F,i} \right]^{1-\theta_d} di \right]^{1/(1-\theta_d)} \]  

(43)

\[ P_{F,i} = \left[ \int_0^1 \left[ P_{F,i}(i) \right]^{1-\theta_c} di \right]^{1/(1-\theta_c)} \]  

(44)

\[ \eta G_t^H = \eta (1-\alpha) \left( \frac{P_t^H}{P_t} \right)^{-\theta_a} G_t \]  

(45)

\[ \eta G_t^F = \eta (\alpha) \left( \frac{P_t}{P_t} \right)^{-\theta_a} G_t \]  

(46)

\[ \eta G_{t}^{HF} = \eta \left( \frac{P_t^{HF}}{P_t} \right)^{-\theta_b} G_t^H \]  

(47)

\[ \eta G_{t}^{HI} = \eta (1-\gamma) \left( \frac{P_t^{HI}}{P_t} \right)^{-\theta_b} G_t^H \]  

(48)

\[ \eta [G_t^{HF}(i)] = \eta \left( \frac{1}{\gamma} \right) \left( \frac{[P_t^{HF}(i)]}{P_t^{HF}} \right)^{-\theta_c} G_t^{HF} \]  

(49)

\[ \eta [G_t^{HI}(i)] = \eta \left( \frac{1}{1-\gamma} \right) \left( \frac{[P_t^{HI}(i)]}{P_t^{HI}} \right)^{-\theta_c} G_t^{HI} \]  

(50)

\[ \eta [G_{j,t}(i)] = \eta \left( \frac{P_{j,t}(i)}{P_{j,t}} \right)^{-\theta_c} G_{j,t} \]  

(51)

\[ \eta G_{j,t} = \eta \left( \frac{P_{j,t}}{P_t} \right)^{-\theta_d} G_t^F \]  

(52)
Economy-wide and sector-wise public spending on consumption can be given as:

\[
\eta \int_0^1 [G_t^H(i)][P_t^H(i)]di \\
+ \eta \int_0^1 [G_t^H(i)][P_t^H(i)]di + \eta \int_0^1 [G_t^F(i)][P_t^F(i)]didj = \eta G_t P_t
\]

(53)

\[
\eta \int_0^1 [G_t^H(i)][P_t^H(i)]di = \eta G_t^H P_t^H
\]

(54)

\[
\eta \int_0^1 [G_t^F(i)][P_t^F(i)]di = \eta G_t^H P_t^H
\]

(55)

\[
\eta \int_0^1 \int_0^{1/2} [G_j(i)][P_j(i)]didj = \eta G_t^F P_t^F
\]

(56)

Where

\[
\eta G_t^H P_t^H + \eta G_t^H P_t^H = \eta G_t^H P_t^H
\]

(57)

\[
\eta G_t^H P_t^H + \eta G_t^F P_t^F = \eta G_t P_t
\]

(58)

The domestic labour supply aggregator \( L_t \), analogous to (8) can be given following Dixit and Stiglitz (1977) as:

\[
L_t = \left[ \frac{1}{(1 - \gamma)\partial_e(L_t^H)} \frac{\partial_e - 1}{\partial_e} + \frac{1}{\gamma\partial_e(L_t^H)} \frac{\partial_e - 1}{\partial_e} \right]^{\frac{1}{\partial_e - 1}}
\]

(59)

Where \( L_t^H \) and \( L_t^I \) are indices of domestic labour supply in domestic formal and informal sectors, respectively and \( \partial_e \) is intratemporal elasticity of substitution of labour supply between formal and informal sectors. \( \gamma \) and \( 1 - \gamma \) are share of domestic labour supply in formal and informal sectors, respectively. The CES function of labour supply in domestic formal sector \( L_t^F \) can be given as under:

\[
L_t^F = \left[ \frac{1}{(1 - \gamma)\partial_f(L_t^F)} \frac{\partial_f - 1}{\partial_f} \right]^{\frac{1}{\partial_f - 1}}
\]

(60)
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Where \([L^H_t(k)]\) is the quantity of type \(k\) labour supplied in domestic formal sector in period \(t\) and \(\vartheta_f\) is intratemporal elasticity of substitution between varieties of labour supplied to formal sector. The CES function of labour supply in domestic informal sector \(l_t^{HI}\) can be given as:

\[
l_t^{HI} = \left[ \left( \frac{1}{1 - \gamma} \right) \int_{\gamma}^{1} \left[ L_t^{HI}(k) \right]^{\frac{\vartheta_f - 1}{\vartheta_f}} \, di \right]^{\vartheta_f - 1}
\]

(61)

Where \([L_t^{HI}(k)]\) is the quantity of type \(k\) labour supplied in domestic informal sector in period \(t\) and \(\vartheta_f\) is intratemporal elasticity of substitution between varieties of labour supplied to informal sector. The corresponding labour supply based wage indices of (59) to (61) are given by (62) to (64), respectively as under:

\[
W_t = [\gamma(W_t^{HF})^{1-\vartheta_e} + (1 - \gamma)(W_t^{HI})^{1-\vartheta_e}]^{\frac{1}{1-\vartheta_e}}
\]

(62)

\[
W_t^{HF} = \left[ \left( \frac{1}{\gamma} \right) \int_{0}^{1} [W_t^{HF}(k)]^{1-\vartheta_f} \, di \right]^{\frac{1}{1-\vartheta_f}}
\]

(63)

\[
W_t^{HI} = \left[ \left( \frac{1}{1 - \gamma} \right) \int_{\gamma}^{1} [W_t^{HI}(k)]^{1-\vartheta_f} \, di \right]^{\frac{1}{1-\vartheta_f}}
\]

(64)

Optimal allocation of labour derives the following supply functions in each category for given level of wage income.

\[
[L_t^{HF}(k)] = \left( \frac{1}{\gamma} \right) \left( \frac{[W_t^{HF}(k)]}{W_t^{HF}} \right)^{\vartheta_f} L_t^{HF}
\]

(65)

\[
[L_t^{HI}(k)] = \left( \frac{1}{1 - \gamma} \right) \left( \frac{[W_t^{HI}(k)]}{W_t^{HI}} \right)^{\vartheta_f} L_t^{HI}
\]

(66)

\[
L_t^{HF} = \gamma \left( \frac{W_t^{HF}}{W_t} \right)^{-\vartheta_f} L_t
\]

(67)

\[
L_t^{HI} = (1 - \gamma) \left( \frac{W_t^{HI}}{W_t} \right)^{-\vartheta_f} L_t
\]

(68)

Economy-wide and sector-wise wage income can be given as:

[137]
\[ \gamma \int_0^1 [L_t^{HF}(k)][W_t^{HF}(k)] \, dj + \int_0^1 [L_t^{HI}(k)][W_t^{HI}(k)] \, dj = L_t W_t \]  
\[ \gamma \int_0^1 [L_t^{HF}(k)][W_t^{HF}(k)] \, dj = L_t^{HF} W_t^{HF} \]  
\[ \int_0^1 [L_t^{HI}(k)][W_t^{HI}(k)] \, dj = L_t^{HI} W_t^{HI} \]  

Where

\[ L_t^{HF} W_t^{HF} + L_t^{HI} W_t^{HI} = L_t W_t \]  

Formulization of Lagrangian by (2) and (4)

\[ L = \max \left\{ c_t, l_t, \frac{M_t}{P_t} \right\} \sum_{t=0}^{\infty} \beta^t \left\{ \frac{C_t^{1-\varepsilon}}{1-\varepsilon} + \eta \frac{G_t^{1-\kappa}}{1-\kappa} + \frac{\left( \frac{M_t}{P_t} \right)^{1-\tau}}{1-\tau} - \frac{L_t^{1+v}}{1+v} \right\} \]

\[ - \lambda_t \{ c_t P_t + M_t + Q_t B_t - M_{t-1} - B_{t-1} - L_t W_t - \Omega_t - \eta G_t^T + T_t^d \} \]  

Kuhn-Tucker conditions:

\[ C_t : \beta^t C_t^{-\varepsilon} - \lambda_t P_t = 0 \]  
\[ L_t : -\beta^t L_t^{-\nu} + \lambda_t W_t = 0 \]  
\[ M_t \quad P_t : \beta^t \left( \frac{M_t}{P_t} \right)^{-\tau} - \lambda_t P_t + E_t \lambda_{t+1} P_t = 0 \]  
\[ B_t : -\lambda_t Q_t + E_t \lambda_{t+1} = 0 \]  

(74) and (77) collapse to (78)

\[ \frac{\beta^t C_t^{-\varepsilon}}{\beta^{t+1} E_t C_t^{-\varepsilon}} = \frac{\lambda_t P_t}{E_t \lambda_{t+1} E_t P_{t+1}} \]

\[ \Rightarrow 1 = E_t \left\{ \frac{P_t}{P_{t+1}} \left( \frac{C_{t+1}^{1-\varepsilon}}{C_t^{1-\varepsilon}} \right) \right\} \beta \frac{Q_t}{Q_t} \]  

(74) and (75) yield (79)

\[ \frac{\beta^t L_t^\nu}{\beta^t C_t^{-\varepsilon}} = \frac{\lambda_t W_t}{\lambda_t P_t} \]

\[ \Rightarrow C_t^\varepsilon L_t^\nu = \frac{W_t}{P_t} \]

(79)
Since \( Q_t = \frac{1}{1+i_t} \)

(78) is optimal consumption-saving decision (optimal inter-temporal consumption decision), (79) is optimal consumption-leisure decision (optimal consumption-labour supply decision) and (80) is optimal consumption-demand of real balances decision of households. Households’ preferences, (78), (79) and (80) do not have any influence of actual public consumption, \( \eta G_t \) and of government transfers, \( G^T_t \). Thus, public spending on consumption, government transfer, political/bureaucratic corruption/embezzlement in public spending on consumption and in government transfer do not affect optimal consumption-saving decision, optimal consumption-leisure decision and optimal consumption-demand of real balances decision of households.

4. Conclusion

In this study the Indian economy, dominated to informal sector, has been modeled in such a way to maximize integrated utility of all of its inhabited households through maximizing the utility of a representative household. Households maximize their utility by making their consumption-saving, consumption-leisure and consumption-demand of real balances decisions optimal. Again how these decisions of households are affected by public spending on consumption, by government transfer, by political/bureaucratic corruption/embezzlement in public spending on consumption and by political/bureaucratic corruption/embezzlement in government transfer. With the
help of complex algebra and calculus the paper shows households decisions of consumption-saving, consumption-leisure and consumption-demand of real balances are not affected by public spending on consumption, by government transfer, by political/bureaucratic corruption/embezzlement in public spending on consumption and by political/bureaucratic corruption/embezzlement in government transfer. This result is completely based on pure theory. The paper provides opportunities for further empirical research on the topic.

5. References