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Demand for Forest Products in India-Role of Institutions

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***Abstract*:** In the present study, demand for forest products are projected incorporating the influence of forest institutions (FCA, 1980 and NFP 1988) and economic institution (economic liberalization) in the institutional consumption framework. The framework establishes functional relation between consumption of forest products, gross national income and institutions captured through intercept dummy and slope dummy. Secondary data on consumption of forest products and gross national income at constant prices were collected from FAO and RBI websites from the year 1971 to 2009. The relative strength of autonomous consumption and induced consumption (due to income, interaction of income with institutions) were assessed for forest products. In addition, how marginal propensity to consume varies between pre institutional (1971-1990) and post institutional period (1991-2009) was also assessed. The consumption of forest products using institutional consumption framework has been projected upto 2020. The result of the study indicated that the Marginal propensity to consume (MPC) increases over time with real national income irrespective of the influence of institution and falls in the post institutional period signifying the presence of good governance. The magnitude of autonomous consumption overweighed the magnitude of consumption induced by income and institution for five forest products out of sixteen (31%) and for the rest of the forest products (69%) the magnitude of consumption induced by income and institutions surpassed the magnitude of autonomous consumption in inducing consumption. This precisely reflected the role of forest and economic institutions in facilitating increased consumption. The percent deviation in projection was lower using the institutional framework compared with the log linear model deployed in the other studies reflecting the forecasting ability of the model.

Key Words: Economic liberalization, Economic institution, Forest products

The role of institutions, technologies, markets and governance in shaping the demand for forest products in India is crucial. In the Keynesian framework, the consumption of forest products considered as the effective demand is a function of real national income. In the institutional framework, consumption of forest product is hypothesized to be influenced by institutions. In India, two crucial forest institutions : Forest Conservation Act, 1980 (FCA) and National Forest Policy, 1988 (NFP) play a critical role in addressing supply side of forest products by imposing ban on clear and green felling as also by halting supply of raw materials to forest based industries at concessional rates. This triggered the development of technologies and substitutes in forestry sector. Although, NFP liberalized imports of forest resources and products, due to forces of demand, forest resources continued to be plundered in different parts of India. The economic liberalization (EL) of 1991 gave a fillip to imports of raw materials addressing the demand side.

This study is a sequel to the study by Kiran *et al.* (2013) where forest institutions, economic institution and real national income have been proved to have perceptible influence on consumption of forest products. While the FCA came into force from 1980, the NFP from 1988, and the EL from 1991, considering the gestation period, it is hypothesized that these institutions came to force in letter and spirit from 1991. This study focuses on projection of consumption of forest products incorporating the influence of forest and economic institutions. Prior to deploying institutional framework for projection, relative contribution of autonomous consumption, consumption induced by national income devoid of institutional interventions and induced consumption due to stringent forest institutions and liberalized imports (good governance) was assessed. In addition to this, the year of institutional break from which the effect of MPC surpasses that of autonomous consumption for various products were also assessed to ascertain the impact of good governance.Accordingly, three hypotheses were formulated (1) the marginal propensity to consume forest product (MPC) increases with real income over time; (2) MPC falls in the post institutional period (i.e. after 1991), due to good governance and economic liberalization and (3) the demand projections for forest products is shaped by real national income, institutions and their interaction.

MATERIAL AND METHODS

In order to test the first two hypotheses, the study uses the model

$C = á + âY + ä_1 D + ä_2 DY$ ----(1),

Here C = apparent consumption of forest product,

Y = real national income,

D = dummy variable (taking value of 0 for the period 1971 to 1990 representing the pre-institutional period and taking the value of 1 from 1991 onwards representing the post-institutional period,

á = autonomous consumption of forest product,

â = Marginal propensity to consume a forest product in the pre-institutional period,

$ä_1$= the shift in the autonomous consumption of the forest product due to Forest Conservation Act, National forest policy and economic liberalization,

$ä_2$= rate at which consumption is increasing (or decreasing) in the post institutional period due to rise in the real national income

Good governance: In order to halt rapid deforestation and inevitability to bring 1/3rd of India's geographical area under forest cover two crucial forest institutions such as Forest Conservation Act, 1980 (FCA) and National Forest Policy, 1988 (NFP) were enacted. These institutions were enacted to ensure ban on green felling, clear felling, and for empowering the State Forests to halt supply of forest raw materials at concessional prices to forest based industries. NFP was also entrusted to liberalize imports of raw materials to reduce pressure from demand side. Good governance is reflected in decreasing marginal propensity to consume for forest products in post institutional period. In the institutional framework the sign and magnitude of $ä_2$ coefficient reflects the presence of good governance. Negative sign and higher magnitude reflects the presence of good governance.

Accordingly model (1) gives rise to two marginal propensities to consume, one for the pre-institutional period for 1971 to 1990 and the other for the post-institutional period of 1991onwards.

The MPC of a forest product in the pre-institutional period = â, gives the rate at which consumption is increasing (or decreasing) per rupee of real income irrespective of the period, depending upon the relationship of consumption of forest product with real national income.

The MPC of a forest product in the post-institutional period = â + $ä_2$, implying that in the post institutional period, the MPC of forest product is increasing (or decreasing) per rupee of real income irrespective of the period plus the rate at which consumption is increasing (or decreasing) in the post institutional period, depending upon the governance. Thus, depending upon the rate at which the consumption is increasing (or decreasing) in the post institutional period, the MPC will rise or fall. If the post institutional period had an apparent impact on consumption, due to good governance of institutions and the effect of economic liberalization, the MPC will fall from the rate at which consumption is increasing per rupee of real income irrespective of the period, otherwise, would rise.

Component decomposition: The consumption of forest products according to the model used in the study as influenced by real national income and institutions are decomposed into two components. The first component is one which is strongly influenced by autonomous consumption and the second component is influenced by the marginal propensity to consume which varies over time period due to the absence/presence of institutions. The first component reflecting the effect of autonomous consumption is obtained by adding intercept coefficient and coefficient of intercept dummy = (á+$ä_1$). This autonomous consumption is hypothesized to be shaped by technological innovations, efficient utilization of raw materials and finished products, effective recycling of wastes, evolution of substitutes for forest products and their effective diffusion of technologies. The second component reflecting the effect of MPC is the consumption induced by MPC + consumption induced by institutions = ($âY_t + ä_2Y_t$).

Method for demand projection: In this study, for the sake of projection of demand, institutional framework of consumption described in equation (1) was used. The results of demand projection for 2005 have been compared with the projections made by Sharma and Kumar (1999) and Malik and Danda (2003). This exercise was undertaken to test how pragmatic the model in equation (1) is when compared with the Log Linear consumption functional framework used in above referred studies. The model used for projection of demand for forest product in those studies was Ln Z_{it} = Ln $á_o$+ $á_1$Ln Y_t+ $á_1$ T+ Ln u_{it}, where $Z_{it}$is the apparent consumption, Y_t is the real national income at 1980-81 constant prices and T is the time trend.

RESULTS AND DISCUSSION

The autonomous consumption of all forest products has shifted to the right, except for plywood, paper + paper board (NES) and wood-based panels. With the exception of paper + paper board (NES) and household + sanitary paper, for all other forest products (Table 1), the consumption is increasing per rupee of real income irrespective of the period (as indicated by positive sign for â) and the consumption is falling in the post-institutional period (as $ä_2$ the coefficient of slope dummy variable < 0). The results prove the hypotheses of the study for all except for two of the forest products -paper and paper board (NES) and household and sanitary paper, highlighting the role of good governance of forest and economic institutions in shaping the consumption of forest products in India. For the forest products such as industrial round wood, dissolving wood pulp, sawlogs + veneer logs,

round wood and sawnwood + sciages, the autonomous consumption was impressive. Autonomous consumption underscores the role of domestic science & technology research and development, relative prices of forest products and their substitutes. The autonomous consumption (Table 2) of industrial roundwood was 24936000m^3, dissolving wood pulp (242000 tonnes), sawlogs + veneer logs (16804000 m^3), round wood (277240000 m^3) and sawnwood + sciages (16291000 m^3).

For the forest products such as paper and paper board (NES) onto wood pulp, the contribution of MPC is more than that of autonomous consumption (Table 3). Thus, their consumption and their projection is influenced more by real income and its interaction with economic and forest institutions. Further for these products the year of structural/ institutional break was found. The year of structural/ institutional break refers to the year where the MPC times the real national income exceeds the autonomous consumption showing the relative importance of force of real income and its interaction with forest and economic institution over technology, efficient use of raw materials, recycling of wastes, and substitutes.

Consumption triggered by economic liberalization: The share of imports of forest products in the total consumption for four successive decades highlighted the perceptible influence of economic liberalization in facilitating increased consumption of various forest products. This apparently reiterates that EL has played a greater role in the demand/ consumption of forest products in India than the forest institutions of FCA and NFP (Table 4).

Table 2. Forest products relatively influenced by autonomous consumption

Forest products	Rationale
Industrial round wood ('000M^3)	For these forest products, autonomous consumption over time is relatively constant. Thus, consumption is consistently projected to increase due to rise in real income and its interaction with economic and forest institutions
Dissolving wood pulp ('000 tonnes)	
Sawlogs + veener logs ('000M^3)	
Round wood ('000M^3)	
Sawnwood + Sciages ('000M^3)	

The forest institutions such as NFP and FCA have constrained domestic supplies and led to reduction in domestic consumption of forest products. The result was in corroboration with the outcome of Forest Sector Report, ICFRE, India, 2010 indicating that the timber production from Government forests have declined gradually with increasing restrictions imposed by the central Government on felling (ban on green and clear felling above 1000 m in hills) of trees during 1980's for biodiversity conservation and bringing more area under protected area network. The NFP, 1988 have also emphasized on conservation of forests and biodiversity and discouraged production of timbers for industries. The annual production of timber from forests had declined to about 4 million M^3 by 1990. From 1998, the total annual production of

Table 1. Estimated linear consumption function of forest products

Forest Products	á = autonomous	â = MPC	ä1 intercept	ä2 slope	$?^2$	F
Industrial Round wood ('000M^3)	5034	0.02146	19898	-0.0211	0.9	121.03
Chemical wood pulp ('000 tonnes)	-290	0.00094	794	-0.0006	0.96	326.64
Dissolving wood pulp ('000 tonnes)	34 NS	0.0002	208	-0.0002	0.85	72.94
Wood pulp ('000 tonnes)	-466	0.00161	1229	-0.0011	0.98	541.49
Sawlogs + veener logs ('000M^3)	3081	0.01651	13723	-0.015	0.91	124.14
Round wood ('000M^3)	110806	0.16356	166434	-0.1477	0.96	327.54
Other Paper + paper board ('000 tonnes)	-241 NS	0.00115	768	-0.0005 NS	0.88	96.98
Printing + writing paper ('000 tonnes)	65 NS	0.00084	547	-0.0004 NS	0.88	98.16
Newsprint ('000 tonnes)	-127 NS	0.00063	346	-0.0003	0.95	221.85
Paper + paper board ('000 tonnes)	-7 NS	0.00206	1180	-0.0006 NS	0.92	152.82
Wrapping + packing paper + board ('000 tonnes)	-596	0.00142	1165	-0.0009	0.87	88.61
Plywood ('000M^3)	-158 NS	0.00055 NS	-591	0.0002 NS	0.86	80.7
Paper + paper board (NES) ('000M^3)	285	-0.00023	-352	0.0004	0.83	152.82
Wood-based panels ('000M^3)	-208 NS	0.00073	-644	0.0002 NS	0.89	106.36
Sawnwood + Sciages ('000M^3)	-6059	0.02522	22349	-0.0259	0.63	22.59
Household + sanitary paper ('000 tonnes)	68	-0.00005	-43	0.0001	0.18	3.85

All the regression coefficients are statistically significant at 5 % level, except for those marked as NS (non-significant)Dummy variable was used to capture the influence of forest and economic institutions. Dummy variable was assigned zero value for the pre-institutional period (1971-1990) and value of one for post institutional period. Slope dummy was used to capture the effect of rate of change in real income on consumption of forest products.

timber from Government forests declined to about 2 million M^3**.** The National Forest Commission also admits the alarming picture of imbalanced demand-supply situation in the country. The domestic demand for timber estimated at 64 million M^3 in 1996 rose to 82 million M^3in 2006. However, supplies from natural forest reduced following the directive of NFP, 1988 which discouraged harvesting of natural stand for commercial use and require prior approval of the working plans for harvesting the forests. The commission also indicated that only 12 million $M^3$of total demand of 64 million M^3 of timber can be sourced from forest, while 31 million M^3 has to be sourced from farm forestry and other sources including imports. The remaining 21 million $M^3$is estimated to be sourced from unrecorded removal from plantations and natural forests.

Open general license: The major policy initiative of Government of India permitted wood import by classifying wood under Open General License (OGL) in 1996 with a view to ease out the wood shortage, as also to reduce pressure on natural forests. However, the tariff structureis biased in favour of imports of logs and a conscious attempt has been made to keep out the import of processed wood and products to protect the domestic wood processing industry. Due to economic crisis during the course of major economic liberalization, imports have declined from 1.3 million M^3 in 1990 to 0.28 million M^3 in 1994. Later, economic liberalization facilitated the trade by increasing the volume of imports from 0.28 million M^3 in 1994 to 4.04 million M^3 in 2006. The share of imports to domestic production has increased from two per cent in 1994 to 17 per cent in 2006. Currently, India is the net importer of forest products by a big margin. In terms of value, in 2001, imports were ten times more than exports. In 1995, imports were US $ 0.5 billion and doubled to US$ 1 billion in 2001. Here, Industrial roundwood accounted for 42 per cent, paper and paper board 33 per cent, wood pulp 10 per cent, recovered paper 12 per cent and wood based panels 3 per cent. Imports of wood have continuously increased in the last two decades except for a slight dip in 2002 to 2003. There

Table 3. Forest products relatively influenced by autonomous consumption, MPC and institutions

Forest products	Year of structural/ institutional break	Autonomous consumption = (á + $ä_1$)	Consumption induced by MPC + consumption induced by institutions =($âY_t$ + $ä_2Y_t$)
Paper + paper board (NES) ('000M^3)	1971	285.19 - 351.93 = - 66.74	- 109.27 + 190.04 = 80
Household + sanitary paper ('000 tonnes)	1975	67.72-42.6 = 25.12	-27342 + 54.82 = 27.4
Newsprint ('000 tonnes)	1981	-126.97+346.15 =219.18	426.50 - 203.09 = 223.41
Paper + paper board ('000 tonnes)	1985	-7.45+1179.65 =1172.20	1667.6 - 485.72=1181.88
Other Paper + paper board ('000 tonnes)	1986	-241.19+767.91 =526.72	970.66 - 422.02 = 548.64
Wood-based panels ('000M^3)	1988	-208.45-644.43 = -852.88	699.25 + 191.57 =890.82
Plywood ('000M^3)	1989	-157.74-591.48 = -749.22	559.07 + 203.30 =762.37
Wrapping + packing paper + board ('000 tonnes)	1992	-595.66+1164.77 =569.11	1516.12-960.93=555.19
Printing + writing paper ('000 tonnes)	1996	64.7+547.37 =612.07	1253.62-596.96=656.66
Chemical wood pulp ('000 tonnes)	1996	-289.93+794.42 =504.49	1402.80-895.44=507.35
Wood pulp ('000 tonnes)	1997	-465.59+1229.03 =763.44	2511.98-1716.26 =795.72

Note: Dependent variable is consumption of forest products

Table 4. Share of imports of forest products in consumption (%)

Year	Industrial round wood	Wood based panel	Wood pulp	Chemical wood pulp	Dissolving wood pulp	Paper and paper board	Newsprint	Printing and writing paper	Paper + paper board (NES)
1981	0.08	0.00	18.27	6.15	33.80	17.74	83.15	1.93	9.88
1991	3.03	2.00	22.36	19.28	35.74	10.80	44.44	0.60	47.44
2001	10.41	14.80	13.82	11.82	16.39	12.24	36.31	5.26	21.21
2009	7.29	8.12	22.26	24.56	39.72	14.40	49.11	16.45	13.79

was a sudden increase in the imports by 60 per cent in 1997-1998 after liberalization policy. The current level of imports of wood is about 6 million M^3 of which round logs alone constitute more than 93 per cent. Value of imported wood and wood products has gradually increased from Rs. 3222 crores in 2003-04 to Rs. 7688 crores in 2009-10 (Forestry sector report, ICFRE, 2010).

Paper and paper based forest products: The imports of paper and paperboard have been growing at more than 8 per cent during 1981 to 2010. The rate of growth in imports of paper and paper products during liberalization period (1991-2000) was 16.77 per cent. In the last decade the rate of growth in its imports declined to 12.26 per cent. To have a better insight about the magnitude of imports, import intensity was calculated using appropriate procedure (Import Intensity = Import quantity/domestic consumption * 100). The Import intensity of paper has witnessed fluctuations during the past three decades. It has seen the worst slippage from 17.28 per cent in 1981 to 4.28 per cent in 1990 because of the rise in domestic production using non-conventional raw materials. Later the import intensity increased to 12.25 per cent in 2000 and again declined in 2010 to 9.55 per cent on account of substantial increase in the domestic production after liberalization.

From demand side, the import of industrial and cultural grades paper, such as, other paper plus paperboard, wrapping plus packaging paper plus board have been swelling. The import growth of newsprint and printing plus writing paper in contrast fell substantially. The major chunk of India's import of paper and paperboard originated from Australia, Belgium, China, France, Italy, Malaysia, Korea, Sweden, Thailand and UK from 1997 to 2008. On the other hand, the import of newsprint rose from Belgium, China, Japan, Poland, UK and United States of America. Although, India is a net importer of paper and paper products, its exports have also been swelling since liberalization (Sandeep,2009).

Andrew *et al*. (2003) indicated that India's forests have increased after decades of forest decline. Considering the trends in forest area and forest cover between 1880 and 1999, forest cover declined from 20 percent of total land in India in 1880 to about 16 percent in 1950. The proportion of land designated as forest land increased from 12.3 percent in 1951 to 23 percent in 1999. The tree coverage based on satellite imagery for a national sample of Indian villages since 1971indicated increase in proportion of land covered by forests, from around 10 percent in 1971 to over 24 percent in 1999. The findings established that economic growth is consistent with afforestation and deforestation can be reversed even at low levels of national income. The article opines that increases in aggregate demand due to income and population growth are leading to afforestation in forest products such as fuelwood, furniture and paper.

Plywood: India produces three categories of plywood according to the “Federation of Indian Plywood and Panel Industry” (FIPPI): commercial plywood, decorative plywood and block board & flush doors. Commercial plywood constitutes 90 per cent of the total plywood production. According to FIPPI, India's annual plywood production capacity is 124 million square meters, but the industry generally produces at half of its capacity. India predominantly relies on domestic production to meet domestic demand. Only 4 per cent to 7 per cent of annual consumption of plywood is met from imports. India is a net exporter of plywood. The value of plywood imports ranged from US$ 3.7 million to US$ 5.4 million between 1999 and 2004. Imports of plywood dropped gradually between 1999 and 2002 before increasing in 2003 and 2004. In 2004, the value of plywood imports from the US was less than US$ 2,000. The annual imports from US to India have declined sharply over the last six years from US$ 75,820 in 1999 to US$ 1,979 in 2004. India's plywood imports from China have increased significantly over the last six years from US$ 0.3 million in 1999 to US$ 1.9 million in 2004(Indroneil and Ivan, 2007).

Woodbased panel: The Indian wood panel industry is domestic production oriented. However, in recent years market increasingly relies on imports in the case of veneer sheets and fibreboard. Increasing demand, coupled with a projected drop in domestic production due to shortage of raw material will likely to result in increased Imports. The imports of wood based panels steadily increased from 1999 to 2004, with a temporary slump in 2002 resulting from the global economic recession. The rates of increase in India's imports of wood based panels have been impressive since 2003. It may be noted that fibreboard and particleboard imports have become increasingly important. Plywood and the veneer imports have remained relatively constant over the past six years.

A miniscule percentage of India's veneer consumption is met by imports**.** The percentage domestic consumption of veneer met by imports was less than 1%. The total value of imports of veneer sheets and sheets for plywood in 2004 totaled US$ 4.9 million. In 2000, the value of veneer products imported by India dropped by almost 40 per cent, although, the quantity of imports dropped by 26 per cent. Italy was the major source of imports in 1999 and in 2000 veneer imports became inexpensive (by almost 50 per cent) compared to the previous year. Since 2002, Myanmar and Thailand have increased their exports to India.

Myanmar's veneer exports to India increased from 127 metric tons in 1999 to almost 3,180 metric tons in 2004. The price of veneer imports from all the countries has declined over the past six years. India produces most of its domestic particle board requirements. The particle board industry is not export oriented and India is a net importer of particle board. In 2004, India imported a total of US$ 15.3 million worth of particle board and oriented strand board (OSB) while total exports in the same year were US$ 5.4 million. Indian imports of fibreboard are dominated by High Density Fibreboard (HDF), popularly known as 'hardboard'. The total value of HDF imported from Malaysia and Thailand by India was US$ 7.9 million in 2004, and is almost 50 per cent of the total value of fibreboard imported during the year. Medium density fibreboard imports increased from US$ 1.4 million in 1999 to US$ 3.9 million in 2004. India's imports of (low density) insulation board was relatively constant between 1999 and 2003 and increased substantially in 2004 (Indroneil and Ivan, 2007).

Saw logs and veneer logs: Log imports account more than 92 per cent in India's wood product imports. In 2004 the total import of logs was almost US$ 802 million. From 1999 to 2004, the total value of log imports by India almost doubled from US$ 418 million in 1999 to US$ 802 million in 2004. Malaysia and Myanmar are the largest exporters of logs to India in terms of both value and volume. In 2004, the total volume of logs imported from Malaysia was 1.6 million m^3 with a value of US$ 323 million. The total volume of logs imported from Myanmar in the same year was 0.53 million M^3, with a value US$ 208 million. Indonesia, Nigeria, Ivory Coast and New Zealand are also the large exporters of logs to India. Most of India's log imports comprised of tropical hardwood species. However, since the beginning of 2000, Indian imports of temperate softwood species have been increasing (Indroneil and Ivan, 2007).

Industrial round wood and round wood: Imports of industrial roundwood to India have grown at 20 per cent annually over the recent five-year period, reaching a volume of over 2 million M^3. However, this is still a small share (under 5%) of the national consumption of coniferous and non-coniferous logs. The tropical industrial roundwood has dominated over other industrial roundwood in Indian imports, i.e., of non-coniferous industrial roundwood. The import of tropical industrial roundwood has achieved a double-digit growth rate (10% per annum) over the last 10 years with a negative growth rate in the case of other industrial roundwood.

Industrial roundwood form bulk of India's wood imports: The bulk of timber and timber product imports mainly of tropical hardwoods, comprising about 90% of total import of wood and wood products, excluding paper and pulp. Changes in the supplies of industrial wood to India are even more dramatic. In 1997, 95 percent of India's roundwood supplies were obtained from many countries (due to small quantity sourced from each, these countries were aggregated as others'). However, by 2007, New Zealand and Australia collectively supplied 85 percent of India's roundwood and chip imports, while the share of 'others' declined to about 1 percent. Russia has also became an important supplier of industrial roundwood to India, accounting for 14 percent of imports in 2007. A significant trend is that major wood-importing countries are increasingly focusing on assured and stable supplies, reducing their reliance on diminishing tropical sources (Maharaj, 2004).

Demand projection: The deviation of the actual consumption from the projections made using equation (1) is the lowest compared with those of the other two studies (Table 5). For instance for 2005, considering wrapping +packing paper + board, the projection made with equation (1) is only 30 per cent away from the actual consumption, while in the other two studies, the deviation exceeds 140 per cent. Similarly, in the case of Industrial round wood, the extent of deviation in projection from actual, using equation (1) was a modest of -3 percent, while the deviation exceeds 38 per cent in the other two studies. Thus, considering empirical results as well as the strength of the econometric model equation (1) is a better forecasting model, compared with those of the other two studies. The demand for various forest products are projected upto 2020 considering institutional framework (Table 6).

CONCLUSIONS

The result indicated that for forest products such as industrial round wood, dissolving wood pulp, sawlogs + veneer logs, round wood and sawnwood + sciages, the autonomous consumption was impressive and underscored the role of domestic science technology research and development, substitutes and the relative prices of forest products and their substitutes. For rest of the 11 forest products from paper and paper board (NES) onto wood pulp, the contribution of MPC was more than that of autonomous consumption reflecting the profound influence of real income and its interaction with economic and forest institutions. This precisely indicated the role of forest and economic institutions in facilitating increased consumption. The projection of demand of forest product is being shaped by the interplay of real income, forest and economic institutions by comparing the percent deviation of projected consumption from the actual consumption for the year 2005 with the other two studies. The percent deviation in projection was lower

using the institutional framework compared with the Log linear model deployed in the other two studies. This also reflected the forecasting ability of the Institutional consumption model.

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Table 5. Actual and projected demand for forest products for India for 2005, the common year of data for the three studies

Forest Product (unit of measurement)	Actual consumption in 2005	Projected consumption according to					
		This study (2013)	Deviation from actual	Sharma and Kumar (1999)	Deviation from actual	Malik and Danda (2003)	Deviation from actual
Wrapping + packing paper + board	1696	2208	30%	4110	142%	4110	142%
Wood based panels (000M^3)	2685	2103	-22%	1110	-59%	380	-86%
Plywood ('000M^3)	2082	1615	-22%	870	-58%	70	-97.39%
Industrial round wood (000 M^3)	26870	26063	-3%	37610	40%	37080	38%
Newsprint ('000 tonnes)	1324	1343	1.43%	1610	21.60%	1820	37.46%
Wood pulp ('000 tonnes)	2762	2468	-10.64%	3210	16%	3360	21.65%
Round wood ('000M^3)	332415	328337	-1.22%	372130	12%	342060	2.90%
Paper + paper board ('000 tonnes)	5067	5915	17%	4730	-7%	6080	20%
Printing + writing paper ('000	1660	2014	21%	1660	0%	1750	5.42%

Table 6. Projection of demand for forest products

Year	Industrial Round wood ('000M^3)		Dissolving wood pulp ('000 tonnes)		Sawlogs + veener logs ('000M^3)		Round wood ('000M^3)		Sawnwood + Sciages ('000M^3)	
	Actual	Projected	Actual	Projected	Actual	Projected	Actual	Projected	Actual	Projected
1971	13287	15231	63	128	9572	10923	178788	188515	4778	5924
1975	16447	16800	129	143	11524	12130	197678	200475	6798	7768
1980	19765	18810	216	161	14536	13677	220366	215798	10991	10131
1985	23954	22407	181	195	18350	16443	249094	243211	17460	14358
1990	25698	27948	249	246	18350	20705	274972	285438	17444	20870
1995	25229	25415	387	291	18350	18911	285999	299081	17450	15293
2000	21087	25577	321	308	18350	19616	323286	306384	8399	14959
2005	26870	26063	363	358	22390	21734	332415	328337	14846	13956
2009	25007	26495	423	402	22390	23620	333564	347888	14835	13062
2010		26205		372		22353		334759		13662
2011		26280		380		22680		338148		13507
2012		26359		388		23026		341736		13343
2013		26443		397		23393		345535		13170
2014		26532		406		23781		349558		12986
2015		26626		415		24192		353818		12791
2016		26726		425		24627		358329		12585
2017		26832		436		25088		363106		12367
2018		26944		448		25576		368164		12136
2019		27062		460		26093		373520		11891
2020		27187		473		26640		379192		11632

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Year	Paper and paper board (NES)		Household + sanitary paper ('000 tonnes)		Newsprint ('000 tonnes)		Paper + paper board ('000 tonnes)		Wood-based panels ('000M^3)		Plywood ('000M^3)		Wrapping + packing paper + board ('000		Printing + writing paper ('000 tonnes)		Chemical wood pulp ('000 tonnes)		Wood pulp ('000 tonnes)	
	Actual	Projected	Actual	Projected	Actual	Predicted	Actual	Projected	Actual	Predicted	Actual	Projected	Actual	Projected	Actual	Projected	Actual	Predicted	Actual	Predicted
1971	161	174	20	44	247	170	1035	969	179	140	138	102	135	79	463	464	92	155	190	298
1975	109	157	46	41	153	216	1026	1120	153	194	112	142	200	183	507	526	240	224	397	416
1980	163	135	65	36	279	275	1349	1312	224	262	173	193	317	316	524	604	309	312	571	566
1985	27	96	14	28	388	380	1558	1657	426	385	354	285	638	554	725	745	507	469	844	836
1990	48	35	20	15	495	541	2176	2187	437	574	359	426	922	921	914	962	647	711	1144	1251
1995	107	96	30	32	568	699	3231	3199	318	411	222	262	1358	1269	1168	1211	820	945	1506	1492
2000	164	151	36	34	995	860	4528	3877	369	833	70	600	1711	1504	1622	1412	1220	1092	1807	1736
2005	345	315	41	40	1324	1343	5067	5915	2685	2103	2082	1615	1696	2208	1660	2014	1694	1534	2762	2468
2009	494	461	39	46	1500	1773	8546	7730	2774	3235	2168	2520	3581	2834	2932	2551	1862	1928	2965	3121
2010		363		42		1484		6511		2475		1913		2414		2190		1663		2683
2011		388		43		1559		6826		2671		2069		2522		2283		1732		2796
2012		415		44		1637		7159		2879		2236		2637		2382		1804		2915
2013		443		45		1721		7511		3098		2411		2759		2486		1880		3042
2014		473		46		1809		7885		3331		2598		2888		2597		1961		3176
2015		505		48		1903		8280		3578		2795		3025		2713		2047		3319
2016		539		49		2002		8699		3839		3003		3169		2837		2138		3469
2017		574		50		2107		9142		4115		3224		3322		2968		2234		3628
2018		612		52		2219		9612		4408		3459		3485		3107		2336		3797
2019		652		53		2336		10109		4718		3706		3656		3254		2444		3976
2020		694		55		2461		10635		5046		3969		3838		3410		2559		4165

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