Rural Land Use and the Balance of Payments[1]

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Balance of payment restrictions have long been recognized as important factors limiting Irish economic growth. It is germane then for agriculturalists and foresters to assess the impact on the balance of payments when change in land use is being contemplated. A study recently completed (Convery, 1972) compared forestry and agriculture as uses on the lowland drumlin soils of County Leitrim for a number of variables, including the likely effect of the two uses on the nation's balance of payments.[3] The discussion which follows treats this latter topic.[4]

PROCEDURE

Agriculture

Because 75 per cent of Leitrim's sheep population is found in the mountainous northern portion of the county (Duke, 1967, p. 39) it was assumed that the cattle population was confined to the lowland drumlin soils. The county was divided according to stocking density and soil type, as suggested by Lee and Diamond (1969). Their classification showed 250 thousand acres of lowland drumlin soils, with an average stocking density of 25-27 livestock

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3. It is not suggested that this particular criterion is of overriding importance, but to the extent that it differs with land use it has significance for policy makers, for the same reason that the IDA evaluates the exporting (or import saving) potential of prospective industrial investors.

4. Professor R. O'Connor (ESRI) in commenting on this paper has suggested that it would make more sense to examine this aspect of land-use at the national rather than the regional level. While this is undoubtedly true, the possibility is precluded since estimates of potential physical forest output on all Irish soil types are not yet available. However, the results are presented per unit of physical output, so that in the event of nation-wide physical estimates becoming available, the extention of the results to the national level would be a simple matter.

units[5] per 100 acres. One thousand acres was chosen as the study unit, hereafter referred to as a "land unit."

It was assumed that the present grassland cattle-grazing system of farming would be continued in the future. Two output levels were hypothesized. In the first case it was assumed that annual output would be maintained at present (1969) levels. In the second case it was assumed that over the next 30 years output would double in response to the much higher price levels anticipated on entry to the EEC (Sheehy, 1969, p. 12), achieving the physical grazing capacity of 50 livestock units per 100 acres cited by Lee and Diamond (1969).

Figures for annual agricultural output are not available in Ireland at the county level, so that the national figures had to be disaggregated. For livestock outputs, county livestock numbers were used as the principal allocator, and outputs were distributed among the various outlets in the same proportions as the national output. This could be justified because the structure of the cattle herds as to age and composition in Ireland and Leitrim were found to be very similar. Average per cow county milk yield[6] (300 gals.) multiplied by number of milk cows yielded an estimate of annual milk production, and this likewise was distributed among outlets in the same proportions as national output. Cattle and milk outputs per land unit are displayed in Table 2.

It was assumed that all of agricultural output was either import saving or export earning, and therefore that the value of gross output net of imported inputs could be regarded as contributing positively to the balance of payments. When livestock output was exported without further processing (live exports) it was valued at "farm gate" prices (CSO, 1970a, p. 96). When the output was processed (milk processing and slaughtering), the gross output of the processing sectors was assumed to be "induced" by the farm outputs. For milk processing and slaughtering, over 80 per cent of their raw materials comes from the farming sector; it was reasonable to assume that these industries would not exist without a flow of domestically produced raw material. Thus the gross out-

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5. A dairy cow of $10\frac{1}{2}$ cwt. is taken as a basic grazing livestock unit. All other grazing stock are given equivalents.

6. This per cow milk yield is very low compared to the national (1969) average of 527 gals per cow. However, Duke (1967, p. 36) found that in 1965 only 190 gals/cow on the average were delivered to creameries, so that an average of 300 gals/cow does not seem unreasonable. Milk output for Leitrim was valued using this method at 868,000 pounds in 1965. Using more detailed data and more sophisticated methods, Ross (1970, p. 42) arrived at an estimate of 754,000 pounds, so that perhaps some over-estimation is involved in this present study.

put of these two sectors was "attributed" to the milk and cattle farm outputs. These outputs were derived for 1969 using the Census of Industrial Production (CSO, 1971a, p. 203; CSO, 1971b, p. 266). In the case of slaughtering, the value of gross output attributable to beef was estimated by multiplying the total gross output by the proportion by value which cattle comprised of total livestock inputs (86 per cent in 1969). Dividing this figure by total number of cattle inputs yielded an estimate of average gross revenue generated per cow input (Table 1). For milk processing, the output value of eggs was deducted from gross revenue, the remainder being attributable to milk. This residual was then divided by the whole milk input to yield a gross output per unit milk input figure (Table 1).

TABLE 1

GROSS OUTPUT PER UNIT INPUT, BY TYPE, IRELAND 1969

Activity	Gross[7] Output £	Input nos.	Output/Input £
Slaughtering	53,982,516	560,276[8]	96·34
Milk Processing[9]	86,807,946	000s gals 658,652	133·5

Sources: CSO (1971a, p. 203), CSO (1971b, p. 266).

Applying the output per unit input figures of Table 1 to farm output per land unit yielded the value of total gross output induced for the two production levels.

Using an input-output table, O'Connor and Breslin (1968, p. 12) estimated the import requirements (direct and indirect) per dollar of final demand for various agricultural sectors in 1964. These requirements were deducted from gross output to yield an

7. Attributable to cattle and milk, as explained in the text.
8. Derived by dividing expenditure on cattle inputs by average per unit cattle price.
9. Includes milk "processed" for liquid consumption.

TABLE 2

VALUE OF ANNUAL GROSS OUTPUT "INDUCED" BY FARM OUTPUTS, PER LAND UNIT 1970-2000+. CONSTANT (1970 PRICES

Level 1

Activity	1970		1980	
Cattle	Nos.	Value (£)	Nos	Value[10] (£)
Live (exports)	38	2,736[11]	38	4,788
Dead Meat[12]	57	5,491	57	9,610
Milk				
	gals.		gals.	
Processed	32,271	4,308	32,271	6,462
Fed to livestock[13]	5,571	368		552
Total		12,903		21,412

Level 2[14]

Activity	1970		1980		1990		2000	
Cattle	Nos.	Value (£)	Nos.	Value (£)	Nos.	Value (£)	Nos.	Value (£)
Live (exports)	38	2,736	51	6,426	63	7,938	76	9,576
Dead Meat	57	5,491	76	12,814	95	16,017	114	19,220
Milk								
	gals.		gals.		gals.		gals.	
Processed	32,271	4,308	44,707	8,951	57,182	11,451	70,035	14,025
Fed to livestock	5,571	368	5,571	552	5,571	552	5,571	552
Total		12,903		28,743		35,958		43,373

Sources: CSO (1970, pp. 92 and 96); Table 1.

10. Incorporates a price rise of 50 percent in milk and 75 percent in beef, as anticipated by Sheehy (1969, p. 12). It was assumed that value of gross output would increase in like proportion.

11. Gross value was computed using an average per cow value of 72·0 pounds, derived from Table 7, CSO (1970, p. 96).

12. Includes exports and domestic slaughtering, the latter being valued as dea meat exports.

13. Gross value was computed by using the average price of milk used in farmers' butter (66·1 pounds per 1,000 gals.) derived from Tables 1 and 8, CSO (1970, pp. 93, 96). It was assumed that all of the increase in milk production anticipated in level 2 would be processed.

14. Because of the social, institutional and technological difficulties involved, the doubling of output was assumed to take place over 30 years, with one-third of the increase occurring every decade.

estimate of net contribution to the balance of payments for each sector (Table 3).

FORESTRY

From studies by O'Flanagan and Bulfin (1970) and Dillon (1970) it was estimated that the lowland drumlin soils would

TABLE 3

NET CONTRIBUTION OF AGRICULTURE TO THE BALANCE OF PAYMENTS, PER LAND UNIT, 1970-2000+. CONSTANT (1970) PRICES

Level 1

Sector	Import Requirements per pound of Final Demand	1970		1980	
		Gross	Net	Gross	Net
Cattle		£	£	£	£
Live (exports)	0·144	2,736	2,342	4,788	4,099
Dead Meat	0·148	5,491	4,678	9,610	8,189
Milk					
Processed	0·117	4,308	3,545	6,462	5,318
Fed to livestock	0·104	368	330	552	495
Total		12,904	10,895	21,413	18,101

Level 2

	1970		1980		1990		2000+	
Cattle	Gross £	Net £	Gross £	Net £	Gross £	Net £	Gross £	Net £
Live (exports)	2,736	2,342	6,426	5,501	7,938	6,795	9,576	8,197
Deat Meat	5,491	4,678	12,314	10,492	16,017	16,346	19,220	16,375
Milk								
Processed	4,308	3,545	8,951	7,367	11,451	9,424	14,024	11,542
Fed to livestock	368	330	552	495	552	495	552	459
Total	12,904	10,895	28,743	23,855	35,958	30,360	43,373	36,609

Sources: Table 2; O'Connor and Breslin (1968, p. 12)

support a Sitka Spruce crop with a mean yield class of 24.[15] It was assumed that a monocultural silviculture would be practised, with thinning beginning after 15 years and continuing periodically every 5 years thereafter to final clear-felling at 45 years. Thus the planning horizon under consideration extended from 1970 to 2015. It was also assumed that all output up to 7 inches top diameter would go to the sawmilling industry, with the remainder being absorbed by pulp and board manufacturers. Applying Forest Management Tables (Bradley *et al*, 1966, p. 91) yielded the wood outputs per land unit displayed in Table 4.

It was assumed that the pulp board and sawmilling plants would not exist without a flow of domestically produced raw material, and that therefore the gross outputs of these sectors could be "attributed" to the forestry sector. As in the case of agriculture, the simplifying assumption was made that all of the induced output was either import saving or export earning. Support for this assumption was derived from the fact that the pulpwood-using industries supply most of the domestic demand for particle board and hardboard, and export 60 per cent of their output. Most of any increase in output is likely to be exported. The Irish sawmilling industry presently supplies less than 10 per cent of total domestic consumption of sawn timber, so that additional production is likely to replace imports.

Classifying all of timber output as export earning (or import saving) is less defensible for wood products than it is for food. There are domestically produced substitutes for structural (lumber, chipboard, hardboard) and packaging (paper) wood products, such as cement, steel and plastics. Presumably part of any potential "decrease" in wood output could be met by an expansion in the output of these materials, rather than by imports. However, lumber and chemical pulp imports have increased by 33 and 43 per cent respectively from 1965 to 1969 (CSO, 1970b, p. 15, CSO, 1967, p. 157), which implies that substitutes, for whatever reason, cannot competitively fill the void. The assumption of a 100 per cent contribution to the balance of payments is probably not then a great distortion from reality.

The Census of Industrial Production's "Manufacturers of Wood" (CSO, 1971b) does not distinguish sufficiently among types of wood inputs, and in addition domestic and imported wood inputs are not differentiated, so that questionnaires had to be sent to the firms involved.

With 3 of the largest sawmills and 3 of the 4 pulpwood using plants in the country responding, the value of gross output per

15. Yield class for a particular species and site measures the maximum average annual volume increment per hectare in cubic metres. (Yield class 24 (metric) is equivalent to yield class 260 (Hoppus).)

TABLE 4

OUTPUT AND NET ANNUAL BALANCE OF PAYMENTS EFFECT FROM A LAND UNIT OF SITKA SPRUCE (YIELD CLASS 24 (260)[16]) BY OUTLET

Age	Output				Total Net Balance of Payments Effect (Annual)
	Pulpwood		Sawlogs		
	Output[16] (Periodic)	Net Balance of Payments Effect (Annual)	Output[16] (Periodic)	Net Balance of Payments Effect (Annual)	
	000s	£	000s	£	£
15	15 (408)	43,788			43,788
20	28 (780)	83,304			83,304
25	24 (673)	72,090	4 (107)	9,240	81,330
30	18 (503)	53,934	10 (277)	24,200	78,134
35	10 (284)	30,438	18 (496)	43,560	73,998
40	5 (146)	15,486	23 (634)	55,880	71,366
45	9 (250)	26,700	182 (5,050)	444,400	471,100

Source: R. T. Bradley *et al.* (1966, p. 91).

16. All output data have been converted to cubic metres from Yield Class 260 (Hoppus). Hoppus equivalents are given in brackets.

1,000 cubic metres of wood input was estimated as an average of £18,528 for pulpwood and £15,255 for sawlogs. Unfortunately estimates of total (direct and indirect) import requirements per dollar of final demand have not been computed for the forestery sectors. From the questionnaire responses it was estimated that inputs in the form of chemicals, emulsions, glue, etc., amounting to approximately 10 per cent of gross output were imported by the pulpwood-using firms, with a somewhat lower figure applying to the sawmilling sector. Considering that virtually all capital equipment must also be imported, and that there is an unaccounted for "indirect" importing effect, it was suggested that 20 per cent of gross output be "attributed" to imports. Making this deduction yielded a net effect on the balance of payments per 1,000 cubic metres of wood output of £14,811 for the pulpwood-using industry and £12,204 for the sawmilling sector. The net impact of forestry on the balance of payments was then calculated (Table 4). The effect of transferring a land unit from agriculture to forestry could then be estimated by difference (Table 5 and Figure 1).

TABLE 5

ANNUAL IMPACT ON THE BALANCE OF PAYMENTS OF TRANSFERRING A LAND UNIT FROM AGRICULTURE TO FORESTRY, 1970-2015

	Level 1	Level 2
	£	£
1970	—10,895	—10,895
1980	—18,101	—23,855
1985	25,687	19,933
1990	65,203	52,944
1995	63,229	50,972
2000	60,033	41,525
2005	55,897	37,389
2010	53,265	34,757
2015	452,999	434,491

Sources: Table 3 and 4.

COMPARISON AND CONCLUSIONS

In order to help clarify the issues that arise as a result of the different time paths displayed above, the concept of rate of time preference was introduced. A society's rate of time preference measures the rate at which it discounts future values in its decisions about current versus future "consumption." If present

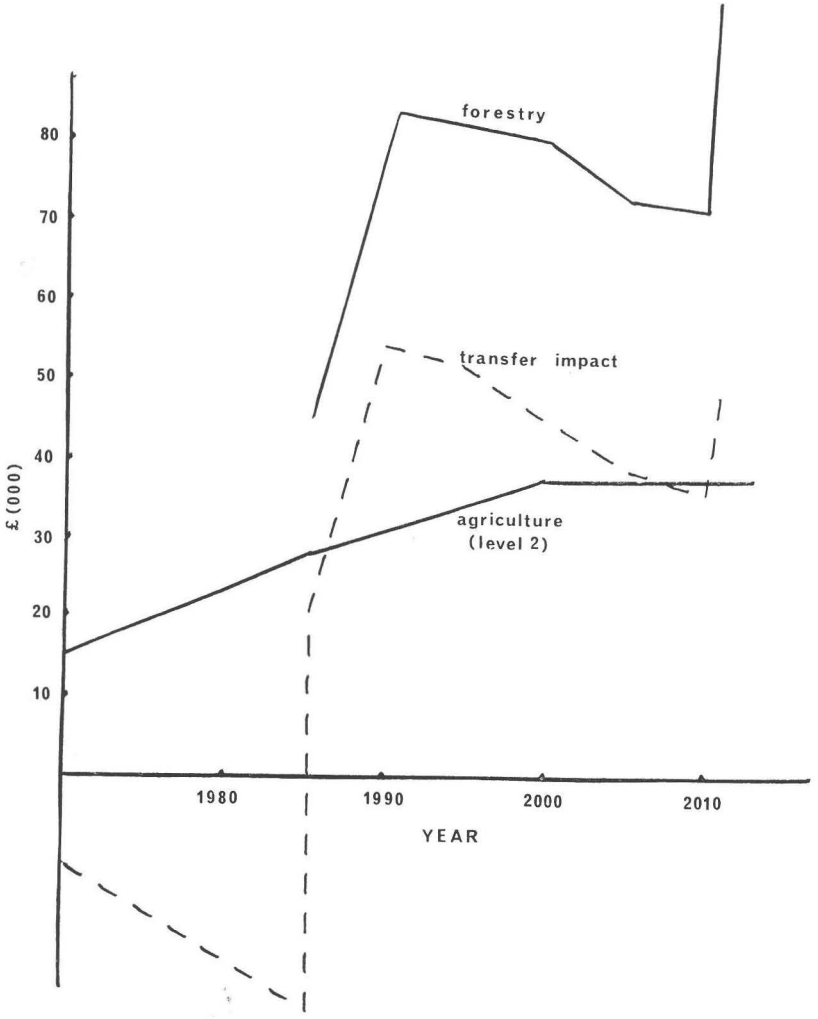

FIGURE 1. Annual impact of forestry and agriculture (level 2) on the Balance of Payments, and the impact of transferring from agriculture to forestry, per land unit, 1970-2015.

values are very heavily weighted relative to future flows, then the discount rate will be correspondingly high and *vice-versa*. Discounting rates of 14.0 and 12.5 per cent equated the discounted values of forestry and agricultural production levels 1 and 2 re-

spectively. Rates higher than these equating values will result in higher discounted values for agriculture; lower rates will "favour" forestry. It is clear then that even when future values are heavily discounted, forestry has the advantage as a generator of foreign earnings per land unit on lowland drumlin soils. This results because the land is very productive for wood production, but relatively much less so for forage production, and because the value added in processing for wood is high relative to grassland products; for example very little value is added to milk enroute from farm to liquid consumption (final demand) while 20-25 per cent of farm output flows unprocessed from farm to final demand in the form of live exports.

These processing conditions are unlikely to remain in the fixed proportions assumed in this discussion. Indeed a *caveat* should perhaps be entered at this stage concerning the labyrinth of assumptions both explicit and implicit that have been made throughout. By and large they have been necessitated by the fact that reliable predictions extending 45 years into the future were not available. Consequently the results are only valid to the extent that they measure relative performance if presently identifiable or hypothesized trends are fulfilled. Within this framework we can observe that a cubic metre of pulpwood makes a larger contribution to the balance of payments than a cubic metre of sawlog material. Encouragement here perhaps for Western forestry; certainly the finding has some implication for forest policy.

Since investment funds rather than land are often the scarcest resource, it may at times be more useful to estimate balance of payments contribution per pound invested rather than per land unit. Capital requirements for forestery and agriculture (level 2) were about the same (£71.0 and £68.1 per acre respectively) while constant production agriculture was much less capital intensive at £24.3 per acre.[17] When balance of payment contribution was discounted at interest rates from 5 to 9 per cent, and then expressed per pound of capital invested, the following picture resulted (Table 6).

Using this criterion, constant production agriculture would be the preferred use at discount rates above 6 per cent. This results from the fact that this use generates a relatively high output without "locking up" much capital. Having by now quite confused the reader, without even introducing the more traditional (and complicated) concerns of internal rate of return, income and employment generated, etc., it is perhaps time to bring this discussion to a close, falling back on the economists' oft spoken last line of defence; some information, however tentatively it must be accepted, is better than no information at all.

17. See Convery (1972, p. 96 and Appendix B) for the derivation of these figures.

TABLE 6

DISCOUNTED BALANCE OF PAYMENTS CONTRIBUTION PER POUND OF CAPITAL INVESTED. CONSTANT (1970) PRICES

	Agriculture				Forestry	
	Level 1		Level 2			
Discount Rate	Total	Per £ Invested/Ac	Total	Per £ Invested/Ac	Total	Per £ Invested/Ac
0·05	266·1	10·9	397·8	5·8	852·1	12·0
0·06	226·7	9·3	330·7	4·8	637·4	8·9
0·07	195·7	8·1	278·2	4·1	483·4	6·8
0·09	150·7	6·2	203·6	3·0	288·9	4·1

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