AN ECONOMIC ANALYSIS OF THE CASE AGAINST AD VALOREM PROPERTY TAXATION IN FORESTRY*

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Throughout this century, foresters have been unanimous in their condemnation of the ad valorem property tax as applied to forestry. The tax problem in forestry was especially acute in the 1920's and 1930's when inability to pay annual tax bills led to widespread abandonment of cutover forest land in the Lake States and the South. The more prosperous times following the Great Depression and the leveling off of property tax rates largely eliminated the tax delinquency problem, and the tax issue subsided somewhat in the consciousness of the forestry profession.[1] Recent increases in the cost of local government, however, and the concomitant rise in property tax bills have once again brought taxation forward as a topical issue.

The chief aim of the forestry lobby at state and local levels has been relief from alleged burdensome property taxes. This lobbying effort has met with notable success in that almost every state has modified its tax laws to give special consideration to forestry (Williams). Until recently, the most widely adopted alternative has been the substitution of a yield tax at time of timber harvest for the annual property tax on timber. Numerous exemptions, rebates, modified assessments and rates, and deferred payments also exist in state laws. The most recent trend in providing tax relief, particularly for land located near urban areas, has come in the form of use value taxation. Under use value legislation taxes on forest (as well as farm) lands are reduced below that of other

classes of real estate by basing property tax assessments on the productivity of land in its current use.

The forestry profession's indictment of the property tax has hinged on notions that the tax is somehow unfair in its application to forestry vis-a-vis other land uses, notably agriculture. Most of the arguments advanced by foresters boil down to one of four basic issues.

First, forestry, being perhaps the lowest income producing use of rural land, suffers from the tendency toward average property assessment in which low value properties are over-taxed in relation to high value properties. This is referred to as "parcel bias." Since market land value, in theory, reflects a capitalized net income stream, parcel bias carries with it the fear that the entire income from timber will be taxed away, in which case ownership becomes a liability. This problem, referred to as "confiscation," was in fact wide-spread in the 1920's and 30's as noted above.

Second, the property tax discourages investment in forestry and the accumulation of timber capital while encouraging liquidation of forests, thus working against the socially optimal level of conservation of natural resources.

Third, most forests produce income periodically whereas the tax bill comes due annually, thereby creating hardship with respect to cash flow.

Fourth, a properly administered ad valorem tax with frequent reassessment is theoretically incorrect when applied to deferred yield investments such as forestry because double taxation results. This argument is referred to as "deferred yield bias." One way of stating

the case is that annual timber growth (income) must be accumulated on the stump until final harvest, and each year's increment of income is repeatedly taxed year after year until final harvest. In contrast, enterprises such as agricultural crops which yield an annual income escape altogether the property tax on income. Property taxes in agriculture are based on land values which reflect market valuation of a capitalized net income stream. In forestry, however, taxes are assessed not only on land values but also on the income which gives rise to land value -- thus the double taxation.

The first three of the above four points can readily be dismissed as containing little possibility for theoretical bias against forestry. The first argument is an indictment of faulty assessment and administration of the tax, not the tax itself. The second argument merely reflects the fact that property taxes discourage investment in all real property. The nature of the tax does not prevent market forces from allocating resources in the most socially desirable pattern given the existence of the tax. The third point can be answered by commenting that there is no presumption in tax theory that taxes could or even should be equally convenient for all tax payers.[2] The fourth point, however, cannot be so lightly dismissed. Through the years, "deferred yield bias" has been used as the most damming and convincing argument against ad valorem taxation in forestry, and its theoretical soundness has been widely accepted and reiterated time and time again by leading forest economists.

In a recent article, Trestrail questioned the concept of deferred yield bias in the case of property taxes levied on forests, but his

work does not appear to have had much impact. The limited reaction to Trestrail's paper is mixed. While Lindholm accepts Trestrail's arguments, Klemperer disagrees with some of Trestrail's conclusions and concludes that a lower property tax rate for forestry is, in principle, justified.[3] Hargreaves and Jones dismiss Trestrail's arguments as being "only marginally related to the economic facts of life" (p. 9).

The purpose of this paper is to take up the debate concerning deferred yield bias and to clarify certain points that were never made clear by Trestrail. The confusion surrounding the deferred yield bias concept is shown to hinge on the definition of income. Our conclusion supports that of Trestrail -- the property tax contains no theoretical discrimination against forestry relative to other classes of investment. But more than this, we conclude that the entire controversy over deferred yield bias is largely irrelevant.

Deferred Yield Bias

The argument against the use of the property tax in the case of deferred yield forests has been accepted with little question by the forestry profession at least since the Fairchild Report of the Forest Taxation Inquiry research project in 1935 (Fairchild). Jens P. Jensen, in his classic property tax study reports with apparent approval the following conclusion of an earlier Fairchild report. "The property tax is fundamentally defective when applied to the total value of land and trees in a growing forest, resulting, if strictly administered, in grossly excessive taxation of forests, as compared with other forms of property yielding annual incomes" (Jensen, p. 231).

Leading forest economists have agreed with Fairchild and Jensen. Zivnuska states that: "If the land is taxed annually on the basis of its productive value for growing timber over the full production cycle of the timber crop, then any separate taxation of the timber value involves double taxation and discriminates against timber as compared to productive activities with cycles of one year or less" (p. 28). Essentially the same statement is found in Duerr's textbook on forestry economics.[4]

Alleged Effect on Tax Ratio

In their review of forest property taxation, Manning and Thompson present a hypothetical example of the widely accepted idea of deferred yield bias (Table 1). Using a 5 percent compound interest rate to adjust cash flows over time, they show that 35 percent of a deferred yield forest's income is taken by a 1 percent (10 mills) ad valorem tax that is perfectly administered (Table 1). In contrast, they show that only 20 percent of an annual crop's income would be taken by the same 1 percent property tax. This proportion of net income taken by the property tax is referred to as the "tax ratio," and the fact that forestry's computed tax ratio is higher than that of an annual crop is the "proof" of the deferred yield bias.

The key to deferred yield bias is, of course, the argument that the owner of a timber stand must defer the realization of income until rotation end. As Chapman and Meyer put it: "...he cannot 'spend' or 'sell' the annual growth. His is an enforced saving, inherent in the venture. He is compelled to defer his income" (p. 274). They go on to say that since standing timber is real property in addition to income when harvested, it cannot escape the tax collector. Such statements, of course, apply

Table 1. Amount of Property Tax per $100 of Revenue for Annual and Deferred-Yield Properties[a]

ANNUAL YIELD PROPERTY

Year	Land Value[b]	Tax	Revenue	Tax per 100 dollars income
Annually	2,000	20	100	20

DEFERRED-YIELD PROPERTY

Year	Land Value	Timber Value	Total Value	Tax	Taxes compounded to year 20	Revenue	Cumulative tax payments[c]
	dollars per acre						
1	60.50	5.00	65.50	.65	1.64	0.00	1.64
2	60.50	10.00	70.50	.70	1.68	0.00	3.32
3	60.50	15.00	75.50	.75	1.72	0.00	5.04
4	60.50	20.00	80.50	.80	1.75	0.00	6.79
5	60.50	25.00	85.50	.85	1.77	0.00	8.56
6	60.50	30.00	90.50	.90	1.78	0.00	10.34
7	60.50	35.00	95.50	.95	1.79	0.00	12.13
8	60.50	40.00	100.50	1.00	1.80	0.00	13.93
9	60.50	45.00	105.50	1.05	1.80	0.00	15.73
10	60.50	50.00	110.50	1.10	1.79	0.00	17.52
11	60.50	55.00	115.50	1.15	1.78	0.00	19.30
12	60.50	60.00	120.50	1.20	1.77	0.00	21.07
13	60.50	65.00	125.50	1.25	1.76	0.00	22.83
14	60.50	70.00	130.50	1.30	1.74	0.00	24.57
15	60.50	75.00	135.50	1.35	1.72	0.00	26.29
16	60.50	80.00	140.50	1.40	1.70	0.00	27.99
17	60.50	85.00	145.50	1.45	1.68	0.00	29.67
18	60.50	90.00	150.50	1.50	1.65	0.00	31.32
19	60.50	95.00	155.50	1.55	1.63	0.00	32.95
20	60.50	100.00	160.50	1.60	1.60	100.00	34.55

[a]The annual tax rate is 1% (10 mills) of assessed property value. All figures on a per acre basis.

[b]Manning and Thompson have ignored the liklihood that property taxes would have to be paid on capital items used in production of the annual crop (i.e., buildings and machinery) as well as on the land.

[c]Cumulative tax payments are expressed in value at year 20 using 5% compound interest

SOURCE: Manning and Thompson, p. 557.

primarily to even-age silviculture. Under even-age management, it is quite true that attempts to physically remove annual value growth which leave a residual growing stock incapable of fully utilizing the site's potential will destroy the productivity of the stand. This derives from the fact that the tree is both "factory" and "product."

Trestrail criticizes the alleged deferred yield bias of the property tax as follows: "The growth of a timber stand occurring prior to the optimal rotation age cannot realistically be regarded as 'deferred income' which is therefore unreasonably burdened by an ad valorem property tax which increases as the value of the standing timber increases. Rather, it is logically viewed as current income which would earn a greater return if allowed to 'automatically reinvest' itself than if realized and re-invested elsewhere" (p. 356).

While Trestrail is correct in his conclusion, he fails to point out the theoretical basis for viewing annual timber growth as income. Foresters know that the value growth of each acre cannot be physically harvested each year and converted into income. Not only would one run into dis-economies when attempting to remove small quantities per acre, but as previously stated, attempts to generate annual cash flows equivalent to an even-age stand's annual value growth would destroy the "factory."

The rationale for viewing the annual increase in value of standing timber as reinvested income lies in the economic definition of income. Simons' (1938) definition of income is widely accepted: "Personal income may be defined as the algebraic sum of (1) the market value of rights exercised in consumption and (2) the change in the value of the store of property rights between the beginning and the end of the period in question.

In other words, it is merely the result obtained by adding consumption during the period to 'wealth' at the end of the period and then subtracting 'wealth' at the beginning" (p. 50). Hicks' definition of income for an individual is essentially the same, viz., "the maximum value which he can consume during a week, and still expect to be as well off at the end of the week as he was at the beginning" (p. 172). Gain is the sine qua non of income in the Simons-Hicks definition.

Gains vs. Realization as Income Criteria

A basic issue in defining income is whether gain must be realized to be considered as income. One can "realize" without gaining and gain without realizing (Simons, p. 84).[5] From a practical standpoint, it is difficult to contend that an individual may grow infinitely rich without ever increasing his income. Yet, one must so argue if the realization criterion is retained as a requisite to the existence of income. Logically, the gain and realization criteria as income requisites cannot be imposed together since (as indicated above) one may "realize" without gain and vice versa.

Tax laws generally emphasize realization of income to the exclusion of gain. However, income and costs for tax purposes often bear little relationship to the economic concepts which motivate producer and consumer behavior. There is no theoretical reason to differentiate between the growth in value of a cattle herd, the growth of a forest, or any other business venture which is not initiated and completed within a single fiscal period.

The case of timber growth is closely analogous to appreciation of agricultural land values. Investors in a rising land market count yearly increments to value as income (Gaffney, p. 415). Farm real estate prices,

on the average, increased at a compounded rate of about 5.5 percent per year during the period from 1947 to 1972 (U. S. Department of Agriculture, 1973). The annual appreciation in land value is an unrealized income increment which raises the same "double taxation" problem as the annual value increment in timber growth.

The annual increment in timber growth serves to increase the value of a forest and represents income. A timber stand can be transferred from one owner to another at any age. Investors count yearly increments in timber growth as income. Thus, there is no reason to expect a timber transaction to take place at a price which fails to reflect the value of timber growth at that time (Lindholm, p. 9).

The emphasis upon the necessity of "realization" of gain, however, has led forest economists to consider increases in timber value as deferred income. Even though wealth in the form of immature timber may not be highly liquid (as is the case for many assets), capital markets allow the owner to borrow against the increased value of his assets so that the owner may receive an increase in realized income even though the timber is not harvested nor transferred to another owner.

Deferred Yield vs. Annual Income

A realistic forestry example is now used to compare the deferred yield and annual income approaches and to show that the average tax ratio is the same for annual income enterprises and for forestry when income is appropriately defined. Our yield data are for an unthinned slash pine plantation established on old field site index 70 (25-year base)[6] at a cost of $40 per acre. Pulpwood, the final product, is valued at $12 per

cord on the stump. Annual management costs are $1 per acre per year. Using the widely accepted Faustmann formula and a discount rate of 5 percent, the capitalized net value of future rotations reaches a maximum of $241 per acre at an optimum rotation age of 19 years.[7] This, then, is the value of bare land for purposes of producing timber.

Table 2 illustrates the accepted forestry view of deferred yield bias. The annual property tax in column 4 is computed as 1 percent of the current values of land plus timber (column 3).[8] Since there is no positive cash flow to offset annual tax payments, taxes must be carried forward with interest (explicit or implicit) to rotation end at which time their accumulated value is $119.62. At final harvest, the gross stumpage income of $499 is offset by compounded establishment and management costs with the result that net returns before property taxes are $369.79 (Table 2). The resulting tax ratio is .32 (= 119.63/369.79).

In contrast to the calculations in Table 2, assume that the site is equally valuable if used by some enterprise yielding an annual income. An annual income of $12.05 [= (.05) (241)] is implied, using 5 percent interest. The one percent tax results in a tax of $2.41 and a tax ratio of .20 (= 2.41/12.05). If the product were taxed along with the land (as in forestry), the annual property tax would be slightly higher, viz., $2.53 [= (.01)(241 + 12.05]. The tax ratio for this annual income enterprise where the product is taxed along with the land is .21 (= 2.53/12.05) as compared with .32 for forestry. This is the conventional forestry proof of deferred yield bias.[9]

A contradiction of this alleged proof of deferred yield bias is worked out in Table 3. Here columns 1-4 are the same as before, and cash

Table 2. Computation of the Tax Ratio for a Slash Pine Plantation According to the Deferred Yield Concept

(1) Age	(2) Stand Conversion Value	(3) Land and Stand	(4) Property Tax	(5) Taxes Compounded to Year 19@5%	(6) Cash Flow (Excl. tax)
0	0	241.00	--	--	-40.
1	(42.00)[a]	283.00	2.83	6.81	-1.
2	(44.10)	285.10	2.85	6.53	-1.
3	(46.30)	287.30	2.87	6.26	-1.
4	(48.62)	289.62	2.90	6.03	-1.
5	(51.05)	292.05	2.92	5.78	-1.
6	(53.60)	294.60	2.95	5.56	-1.
7	(56.28)	297.28	2.97	5.33	-1.
8	(59.10)	300.10	3.00	5.13	-1.
9	70.00	311.00	3.11	5.06	-1.
10	113.00	354.00	3.54	5.49	-1.
11	159.00	400.00	4.00	5.91	-1.
12	198.00	439.00	4.39	6.18	-1.
13	247.00	488.00	4.88	6.54	-1.
14	293.00	534.00	5.34	6.81	-1.
15	336.00	577.00	5.77	7.01	-1.
16	377.00	618.00	6.18	7.15	-1.
17	421.00	662.00	6.62	7.29	-1.
18	460.00	701.00	7.01	7.36	-1.
19	499.00	740.00	7.40	7.40	+498.
				119.63	

Net Income = $499 - $1[(1.05)^{18} - 1)]/.05 - $40(1.05)^{19} = $569.79

Tax Ratio = 119.63/369.79 = .32

[a] Until merchantable timber develops at year 9, the stand is conservatively assumed to equal initial capital invested in establishment compounded forward at 5%.

Table 3. Computation of the Tax Ratio for a Slash Pine Plantation According to the Annual Income Concept

(1) Age	(2) Stand Conversion Value	(3) Land and Stand	(4) Property Tax	(5) Costs	(6) Net Increase in Wealth Before Taxes	(7) Annual Tax Ratio[a]
0	0	241.00	--	-40.	--	--
1	42.00	283.00	2.83	-1.	1.00	2.83
2	44.10	285.10	2.85	-1.	1.10	2.59
3	46.30	287.30	2.87	-1.	1.20	2.39
4	48.62	289.62	2.90	-1.	1.32	2.20
5	51.05	292.05	2.92	-1.	1.43	2.04
6	53.60	294.60	2.95	-1.	1.55	1.90
7	56.28	297.28	2.97	-1.	1.68	1.77
8	59.10	300.10	3.00	-1.	1.82	1.65
9	70.00	311.00	3.11	-1.	9.90	.31
10	113.00	354.00	3.54	-1.	42.00	.08
11	159.00	400.00	4.00	-1.	45.00	.09
12	198.00	439.00	4.39	-1.	38.00	.11
13	247.00	488.00	4.88	-1.	48.00	.10
14	293.00	534.00	5.34	-1.	45.00	.12
15	336.00	577.00	5.77	-1.	42.00	.14
16	377.00	618.00	6.18	-1.	40.00	.15
17	421.00	662.00	6.62	-1.	43.00	.15
18	460.00	701.00	7.01	-1.	38.00	.18
19	499.00	740.00	7.40	-1.	38.00	.19
					Average Tax Ratio[b] =	.21

[a] Column 4 divided by column 6

[b] The average tax ratio was found by compounding all taxes and income to a single year.

flows are now shown in column 5. Column 6, however, shows net increases in stand value year by year (timber growth less management costs). It is this annual increase in wealth that is consistent with the economic definition of income.[10]

Viewing column 6 as annual income, the annual tax in column 4 is divided by column 6 to compute annual tax ratios (column 7). The variable tax ratio is a function of the biological growth function. If the growth rate were constant, the tax ratio would be .21 each year. An average tax ratio over the entire rotation is computed by compounding all taxes and incomes to a single year. When all taxes and incomes are compounded to year 19, for example, accumulated taxes total $119.63 and accumulated income totals $567.82.[11] This represents an average tax ratio of .21, the same as for the annual income enterprise where the product is taxed along with the land. Thus, the average annual tax ratio is the same for forestry as for an annual income enterprise (where the product is taxed along with the land).

It was shown in table 2 that the cumulative value of annual tax payments totalled 32 percent of final crop value. Thus, although the average tax ratio for one year is .21, the tax ratio from the standpoint of the entire investment cycle is .32. The reason this tax ratio of .32 appears higher than for annual income property is that earnings from annual property are assumed not to be re-invested in a form subject to the property tax. If earnings from annual income property are re-invested, the tax ratio for a given investment period will be the same as for forestry. However, the fact that income is received annually instead of being unrealized and automatically reinvested (as in the case of forestry) has no effect on the tax ratio when income is properly defined.

The conclusion is that the tax bill will be larger in terms of total earnings the longer capital is invested in taxable forms with concomitant larger additions to a given capital stock. That is, the tax ratio will be higher the longer the period during which earnings are reinvested (Trestrail, p. 350). This is the case for annual income property as well as for "deferred income" property. Thus, the property tax discourages investment in forestry in the same way that it discouraged investment in any other real asset where earnings are reinvested.[12]

Conclusions and Implications

Using the tax ratio as proof of theoretical property tax bias, there is no evidence to suggest that forestry is discriminated against by the property tax. A more basic consideration, however, has apparently been totally ignored in the forestry literature. The "proof" of deferred yield bias, however stated, always involves a demonstration that the property tax takes away a higher proportion of income in forestry than is the case for investments with annual income. This is what the tax ratio is all about. Yet a property tax is a tax on property or wealth, not on income. The property tax is intended to remove a proportional share of wealth.

(continued on page 14)

There is no presumption that the property tax should place an equal burden on the income that arises from ownership of property. Thus, the debate concerning deferred yield bias in forestry is largely pointless from a theoretical standpoint. The standard by which judgment has been rendered -- the tax ratio -- is an irrelevant yardstick.

Foresters have apparently overlooked this point because they have concentrated on the fact that the forest crop is taxed whereas most agricultural crops, which constitute the major competing use for rural land, escape taxation. Casual empiricism reveals that the property tax is anything but neutral with respect to taxes paid as a proportion of income. For example, property taxes paid by banks and hotels are a relatively large proportion of net product. The proportions are relatively low for trade and most services (Netzer, p. 27). The variability of the property tax ratio among industries is affected by differences in capital-output ratios, by the profitability of investment reached by the property tax, by geographic location, and by property tax coverage and administration.

There are two other issues closely related to the appropriateness of ad valorem taxation in forestry. The first concerns the incidence of ad valorem property taxes levied on forest lands. Most of the attention devoted to the property tax as applied to forest lands has been concerned with the allocative effects of the tax, viz., that the tax results in excessive taxation of forests when compared with other forms of property yielding annual income. This concern implicitly assumes that the tax is completely borne by the owners of forest land. Yet, there has been little work to determine the extent to which such taxes are, in fact, capitalized into lower values of forest lands. The extent of capitalization is significant from the standpoint of income distribution.

A second related issue concerns "spillovers" associated with forestry land use. There has been a great deal of pressure to lower the assessments on forest lands from the standpoint of resource allocation. If there are beneficial side effects associated with the use of forest lands such as fresh air, noise abatement, rural scenic beauty, etc., the market value of forest land is not an accurate measure of its social value. The magnitude of these side effects and the actual effects of preferential assessment must be known before one can determine whether preferential assessment laws for forest lands acutally improve resource allocation. That is, information on externalities associated with forest land must be determined in the final analysis before one can fully assess the case for lowering ad valorem property taxes in forestry. Both the capitalization and externality issues, though related to the appropriateness of the ad valorem tax in forestry, are beyond the purview of this study.

FOOTNOTES

1. A more detailed historical perspective is given in Duerr (Chapter 26).

2. It is correct, of course, that the owner of property such as timberland which produces income periodically is likely to have a more difficult time meeting annual tax bills than is the owner of property which generates income annually. But such liquidity problems are not unique in forestry. For example, the farmer on an urban fringe may find it difficult to pay escalating property taxes which result from increases in the market value of his land. Although his wealth is increasing, liquidity problems may force him to sell and thereby prevent him from reaping the full benefit of increasing property values. In such cases, some economists have proposed an arrangement to defer payment of taxes (including interest). This, presumably, is the aim of forestry yield tax laws which have been enacted.

3. Klemperer holds that a lower property tax rate for forestry is justified because forestry tends to bear a heavier burden (i.e., a larger tax induced percentage reduction in value) than many other land uses due to the combination of a long pay-off period and low land value which characterize most types of forestry. His conclusion hinges on the fact that the property tax affects investment opportunities and land use patterns. Yet he assumes that an increase in property taxes is fully capitalized into lower property values. A fully capitalized tax implies that the supply of forestry land is perfectly inelastic in supply and that a tax change will have no effect on the quantity

of land in forestry. Thus, Klemperer's assumption that property taxes levied on forestry land are fully capitalized into lower land values appears inconsistent with the contention that an unmodified property tax might stimulate second-best uses.

4. Duerr graphically describes the situation as follows: "The corn stalk, it is said, walks up to the collector's office just once, whereas the tree is obliged to march there countless times, borrowing all the while on its credit" (p. 445).

5. For example, a share of stock purchased for $100 on January 1 which is worth $150 on December 31, represents a gain whether or not the share is sold ("realized"). Conversely, a share of stock bought for $150 and sold for $100 is a "realization" but represents no gain.

6. Yields are from an unpublished stand simulation model developed by Frank Bennett, Benee Swindel, Ed Whitehorn, and Tom Lloyd at the USDA Forest Service's Southeastern Forest Experiment Station, Asheville, N. C.

7. At age 19, the stand's conversion value is $499. The Faustmann formula computes the net present value of a perpetual series of 19-year rotations as: land value = $\frac{\$499 - \$40(1.05)^{19}}{(1.05)^{19}-1} - \frac{\$1}{.05} = \$241$.

8. The tax is assumed to be fully "shifted" so that the value of land in forestry is not affected by the tax.

9. We have ignored any additional property taxes that enterprises must pay on property other than land (and timber in the case of forestry).

10. Trestrail points out that the traditional viewpoint implicitly assumes that timber markets are imperfect and place no value on immature timber. It is more reasonable, however, to assume that the growth of immature stands would be recognized in any competitive market transaction. Therefore, the increase in annual value can be viewed as an increase in wealth or income.

11. The annual net increases in wealth shown in column 6 of table 3 total $499, the terminal value of the stand. The accumulated value of taxes compounded to year 19 total $119.62. The annual net increases in wealth compounded to year 19 do not represent the value of the stand at that time since the earnings in each period assume that all previous earnings are reinvested. Income and taxes in table 3 are compounded only as a weighting procedure to obtain the average annual tax ratio where the annual tax ratio varies from year-to-year.

12. An increase in the property tax rate affects the optimal rotation of a timber stand in the same way as an increase in the interest rate, viz., it will shorten the rotation.

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