

forestry & natural resources

MARKETING AND UTILIZATION

Predicting Black Walnut Log Prices

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Forest scientists have been gathering for over 30 years the information needed to manage black walnut plantations for timber and nut production. This information has led to great interest in black walnut plantation establishment and management for financial returns. Black walnut is one of the fastest growing and highest valued hardwood species, but the long time periods required for hardwood trees to mature limit potential financial returns.

Evaluation of long-term investments in black walnut plantations, depends on tree growth rates, log quality, and costs incurred, as well as the expected price for logs when the trees are big enough to sell. This publication reviews price changes over the last 40 years and discusses two basic ways to predict future prices using historical price trends. Particular attention is paid to the folly of predicting prices based on a portion of a cycle in prices and of using compound rates of increase to project prices with the effects of inflation removed.

Walnut price data collected for Indiana show that the dramatic price increases of the 1970's and early 80's have yielded to a period of decline followed by renewed increases at a much lower rate. The sawmills and veneer mills processing black walnut apparently realized that the dramatic higher prices paid in the 1970's and early 1980's couldn't be passed on to buyers of lumber and veneer. In addition, the supply of black walnut timber was so scarce that higher prices could do little to make more timber available for harvest.

Based on these observations, it's suggested that the most appropriate way to predict future walnut prices is to use a long-term average trend-

line price. The approach is recommended for estimating the financial returns from investments in plantations, not for timber marketing decisions. Marketing decisions should take into account current market conditions. Most owners of timber have the option of waiting out a decline in price levels.

Source of Price Data

The price data were collected by the Department of Forestry and Natural Resources, Purdue University. It is prices paid by mills in Indiana for delivered logs. The delivered prices include the price received by the timber owner—stumpage, plus the cost of logging and transportation of the logs to mills. Prices are reported for four grades of sawlogs and two grades of veneer logs of seven different sizes. Data for the current year is published in the "Indiana Forest Products Price Report and Trend Analysis" sold by the Ag Communications Service Media Distribution Center, 301 South 2nd Street, Lafayette, IN 47901-1232.

The market for walnut logs in Indiana is highly developed and based on over a century of fine hardwood processing. Logs are shipped to Indiana mills from many other states. Thus, the Indiana price data reflect regional market conditions. However, the amount actually paid to landowners for stumpage varies greatly across the region. Thus, you should seek information from consulting foresters and others familiar with your local market conditions to determine the relationship between the reported prices and prices in your area.

Analysis of Current Market Conditions

The changes in the actual price of sawlogs and veneer logs are shown in Figures 1 and 5 respectively. In addition to the year-to-year variation, prices tend to follow cycles covering four years or more. The cycles frequently differ among the grades and sizes of logs. As an example, compare prices between 1993 and 1994. The size of differences in prices in the spring of 1994 compared to 1993 were mixed. Prime and No. 1 sawlog prices were up by 15 percent and 2.4 percent respectively (Table 1). The price of No. 2 and No. 3's were down by 1.7 percent and 20.4 percent respectively.

These changes were apparently due to log supply conditions and not increased demand for lumber. Walnut lumber prices change very little (Table 2). The amount of change in a specific size and grade of log is also due in part to sampling error.

Veneer log prices generally declined from the spring of 1993 to 1994 (Table 3). The only exception was for larger lower grade (select) logs. Improvements in processing technology, especially veneer drying, have increased the value of these logs. The upper grade logs (prime) were down from 4 to 16 percent. The larger select logs were up 17 percent to over 50 percent. Smaller select logs were down 6 to 9 percent.

Figure 1. Actual price and trend lines for savings.

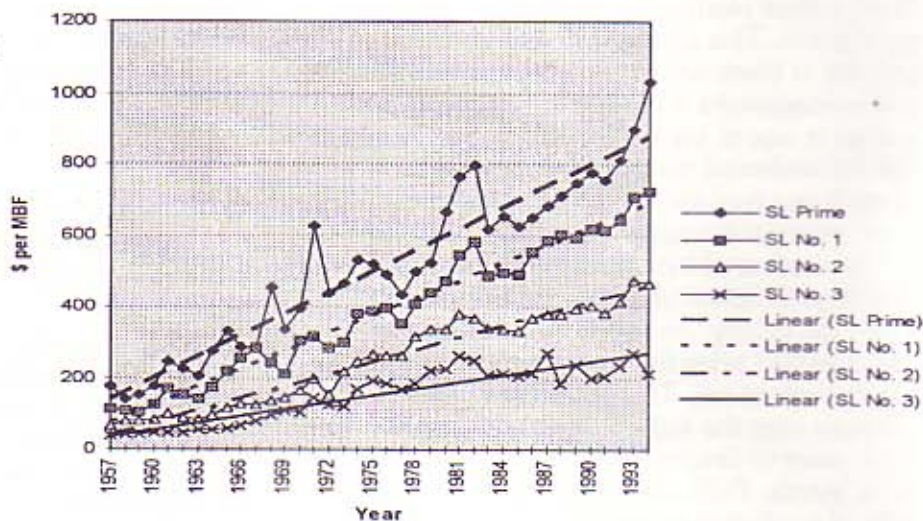


Figure 2. Annual compound rate of interest equivalent to trend line increase.

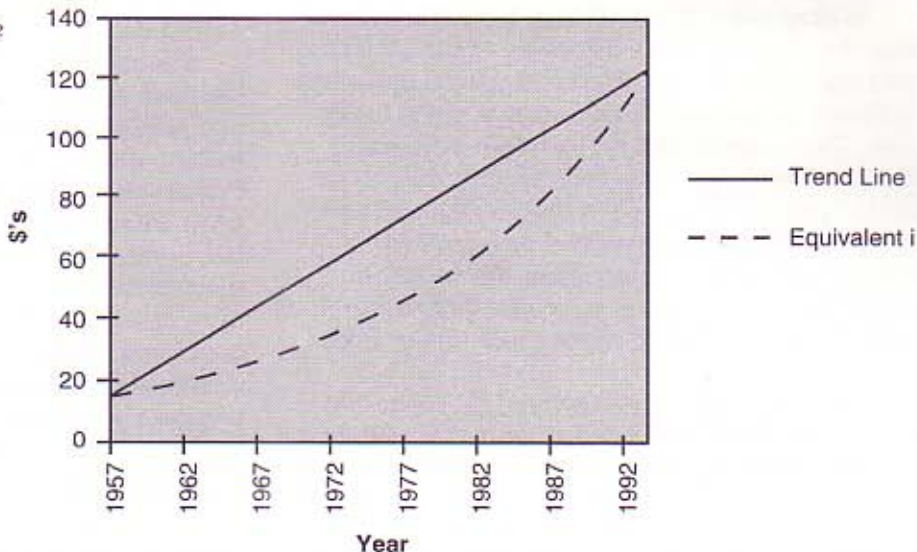


Table 1. Prices paid for delivered black walnut sawlogs by Indiana sawmills, May 1993 and May 1994, Doyle log scale.

Grade	Range	No. Respon.		Mean (s.e.) ¹		Median		Change (%)	
		1993	1994	1993	1994	1993	1994	Mean	Median
Prime	150-2500	30	20	900	1035	900	1000	15.0	11.1
					(40.4)	(103.4)			
No. 1	100-1000	33	24	708	725	700	725	2.4	3.6
					(28.9)	(37.7)			
No. 2	200-800	32	25	478	470	500	500	-1.7	0.0
					(24.7)	(33.0)			
No. 3	150-350	28	15	270	215	250	200	-20.4	-20.0
					(18.2)	(14.1)			

¹ Standard error of the mean is given in parentheses below the mean.

Table 2. Hardwood Lumber prices, 4/4 Appalachian unless otherwise indicated (Hardwood Market Report, Memphis, Tenn.), \$ per MBF, cont.

	Lumber Grade	July 1991	Jan. 1992	July 1992	Jan. 1993	July 1993	Jan. 1994	July 1994
Black Walnut								
	FAS	1605	1605	1605	1605	1605	1615	1615
	No. 1C	855	855	855	855	855	855	855
	No. 2A	290	290	290	290	290	290	290

Table 3. Prices paid for delivered black walnut veneer by Indiana mills, May 1993 and May 1994, Doyle log scale.

Species/Grade/ Log Dia.	1994 Range	No. Respon.		Mean (s.e.) ¹		Median		Change (%)	
		1993	1994	1993	1994	1993	1994	Mean	Median
Prime				(\$/MBF)		(\$/MBF)			
12-13	1000-2500	6	7	1850	1786	1750	2000	-3.5	14.3
				(269.3)	(184.4)				
14-15	2000-3000	7	8	2543	2438	2500	2250	-4.1	-10.0
				(385.4)	(175.2)				
16-17	2500-5000	6	8	3742	3500	3875	3000	-6.5	-22.9
				(552.3)	(313.4)				
18-20	3000-6000	6	6	4625	4500	4375	4250	-2.7	-2.9
				(768.5)	(447.2)				
21-23	4000-5500	4	3	5375	4833	5000	5000	-10.1	0.0
				(1028.2)	(441.0)				
24-28	4000-8000	2	3	7000	5833	7000	5500	-16.7	-21.4
				(1000.0)	(1166.7)				
>28	4000-10000	1	3	6000	6500	6000	5500	8.3	-8.3
					(1802.8)				
Select									
12-13	800-1500	4	5	1425	1300	1500	1500	-8.8	0.0
				(75.0)	(137.8)				
14-15	1000-2000	6	6	1767	1667	1750	1750	-5.7	0.0
				(197.8)	(166.7)				
16-17	1500-4000	5	6	2060	2417	1700	2000	17.3	17.7
				(294.3)	(374.5)				
18-20	3000-6000	5	4	2480	3750	2000	3000	51.2	50.0
				(453.2)	(750.0)				
21-23	4000	4	1	3050	4000	3100	4000	31.2	29.0
				(550.0)					
24-28	7000	1	1	4000	7000	4000	7000	75.0	75.0
>28	8000	0	1	---	8000	---	8000	---	---

¹ Standard error of the mean is given in parentheses below the mean

What's a Realistic Price Trend?

Analysis of investments with a pay-back period of 40 to 60 years or more are obviously risky. An investor needs to believe in the basic human values associated with the warmth and beauty of "real wood" to even consider this option. Social scientists generally agree that basic human values are much less subject to change than technology and how this technology is used to satisfy our wants and needs. To the extent that real wood meets some basic emotional need, it has an enduring place in our lives. What the last 15 years has taught us, however, is that no matter how primal the need, the reality of cost constraints affects how needs are met. In terms of value provided, the market place through the pricing mechanism constantly places goods and services in relative balance.

The price increases observed for walnut in the late 1970's and early 1980's with the affect of inflation removed, i.e. real prices, couldn't continue. To illustrate, consider the relative value of a board foot of walnut and a new car 40 years from now. Say the walnut is veneer quality timber now worth \$5.00 a foot and the car is worth \$20,000, both in terms of what a dollar will buy in 1994. The car is equivalent in value to 4,000 board feet (MBF) of walnut veneer logs.

Now assume that walnut prices increase 8 percent per year in terms of 1994 dollars for 40 years and the price of the car stays the same. The walnut price goes to \$109 per board foot. The car is then equivalent in value to 184 board feet of walnut. In general, however the relative values for the mix of goods and services consumers desire don't change that dramatically. By the way, car prices have increased primarily because of inflation and additional features, not because the real cost of basic labor and material inputs have increased.

Let's next consider walnut price trends and discuss whether or not they are sustainable at current levels.

Table 4. Average annual compound rate of increase equivalents for liner trend lines for veneer logs.

Log Size	Veneer Log Grade	
	Prime	Select
12-13	2.246	1.522
14-15	3.910	1.169
16-17	1.833	1.783
18-20	2.039	2.283
21-24	2.268	1.975
25-28	2.023	1.871
>28	2.246	2.379

Table 5. Parameters for trend line equations for real prices of sawlogs and veneer logs.

Sawlogs			Prime Veneer Logs			Select Sawlogs		
Grade	Slope	Intercept	Size (in.)	Slope	Intercept	Size (in.)	Slope	Intercept
SL Prime	-1.64872	800.3871	16-17	41.21946	1493.375	16-17	25.73094	969.1857
SL No. 1	1.37384	532.6862	18-20	56.16011	1745.933	18-20	38.42414	1008.315
SL No. 2	2.28446	312.1157	21-24	70.14297	1860.165	21-24	40.19652	1308.754
SL No. 3	0.977718	203.7385	24-28	74.64466	2344.795	24-28	44.79385	1575.474
			>28	86.23988	2319.89	>28	60.54943	1491.143
			12-13	23.36613	1177.36	12-13	15.21029	826.2637
			14-15	23.36424	1666.254	14-15	51.81863	881.0242

Sawlog Price Trends

Actual sawlog prices since 1957 have increased significantly (Figure 1 and Table 6). The trend lines (straight lines) shown in Figure 1 represent an average increase over the entire 38-year period. Because we are used to discussing price increases in terms of a compound rate of interest, I'll present the equivalent annual compound rate of increase. This is the interest rate which if compounded over the entire period (1957 to 1994) provides the same value in 1994 as the trend line, as illustrated in Figure 2. These compound rates should not be used to project prices into the future, as discussed above. Compounding gives price increases which aren't realistic. The equivalent compound rates for sawlogs were 5.1, 6.1, 6.9, and 5.6 percent for Prime, No. 1, No. 2, and No. 3 grade log respectively.

Investments should be judged in terms of the actual increase in purchasing power of the money invested. Therefore, we need to look at the price increase in terms of constant (real) dollars. The producer price index for finished goods is used as the indicator of inflation (Figure 3). Consumer prices follow the same pattern as producer prices over the long run. The trend line for inflation is equivalent to a 6.3 percent compound interest rate. To protect the purchasing power of the amount invested, the timber should increase in unit price at least at this rate. It's the total real rate of return, however, that should ultimately be used to decide on whether or not to make the investment.

The degree to which the increase in price has kept up with inflation is judged by "deflating" log prices. This is done by dividing the actual price by the producer price index. The resulting "real price" series can be used to evaluate the real price increase.

The real price of prime sawlogs increased dramatically, although in cycles, from 1957 to 1971 (Figure 4). After 1971 the real prices for prime sawlogs have not kept up with inflation. The trend line reflects a 0.2 percent decline. The real price of the lower grade logs has just barely kept up with inflation. The real increases for the 1957 to 1994 period were 0.2, 0.6, and 0.4 percent for No. 1, No. 2, and No. 3 sawlogs respectively.

Table 6. Actual average for black walnut sawlogs delivered to mills in Indiana, Doyle log scale, \$ per MBF, and the Producer Price Index for Finished Goods.

Year	Prime	No. 1	No. 2	No. 3	PPI
1957	176	114	67	41	32.5
1958	142	108	80	45	33.2
1959	155	106	82	45	33.1
1960	176	127	86	49	33.4
1961	245	170	99	50	33.4
1962	225	155	87	50	33.5
1963	205	142	85	58	33.4
1964	273	175	95	58	33.5
1965	333	218	116	60	34.1
1966	288	254	128	68	35.2
1967	284	283	126	80	35.6
1968	457	243	138	98	36.6
1969	335	212	145	109	38.0
1970	394	303	165	107	39.3
1971	627	314	199	147	40.5
1972	440	282	153	124	41.8
1973	467	300	217	121	45.6
1974	532	379	248	169	52.6
1975	521	387	265	195	58.2
1976	491	394	262	185	60.8
1977	436	352	263	171	64.7
1978	499	407	315	185	69.8
1979	525	442	335	222	77.6
1980	668	473	334	226	88.0
1981	764	544	381	264	96.1
1982	796	581	368	249	100.0
1983	620	490	339	210	101.6
1984	655	495	336	214	103.7
1985	627	493	333	206	104.7
1986	652	554	369	214	103.2
1987	681	586	381	271	105.4
1988	712	601	379	186	108.0
1989	749	594	397	239	113.6
1990	777	619	406	201	119.2
1991	754	613	383	207	121.7
1992	813	643	416	235	123.2
1993	900	708	478	270	124.7
1994	1035	725	470	215	125.5

Figure 3. *Producer price index for finished goods.*

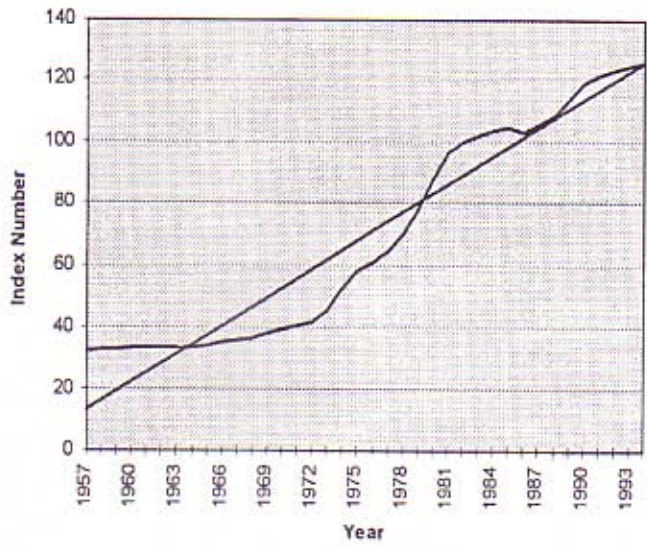


Figure 4. *Real prices and trend lines for sawings.*

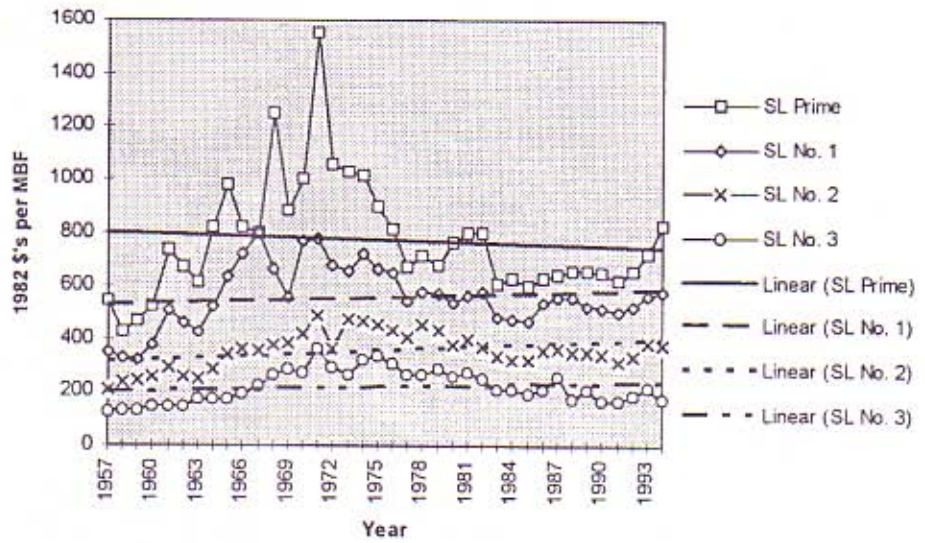


Figure 5. *Actual prices for prime veneer logs by diameter class.*

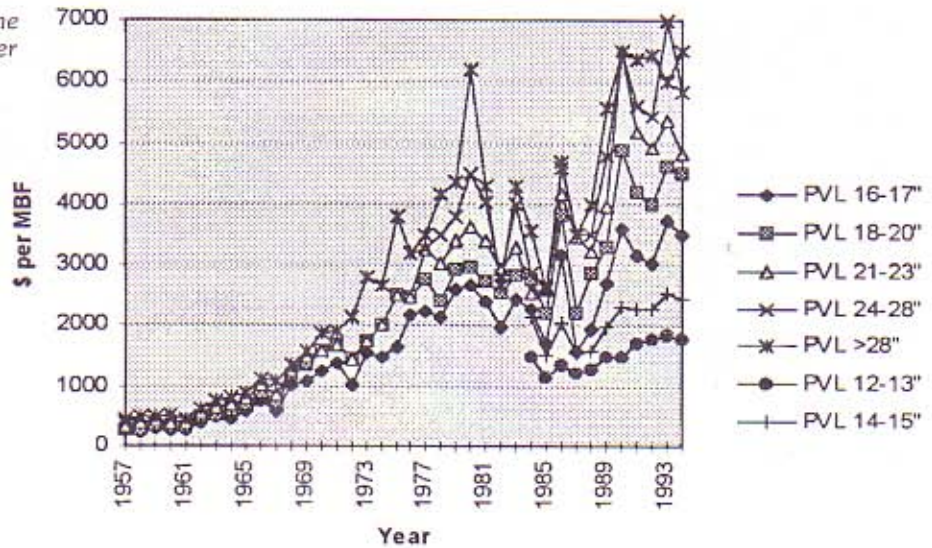


Table 7. Actual price of prime black walnut veneer logs delivered to mills in Indiana, Doyle scale, \$ per MBF.

Year	Prime Veneer Logs							Select Veneer Logs						
	12-13"	14-15"	16-17"	18-20"	21-23"	24-28"	>28"	12-13"	14-15"	16-17"	18-20"	21-23"	24-28"	>28"
1957			261	261	333	400	475			178	178	241	293	334
1958			215	280	398	480	480			165	190	275	360	360
1959			285	350	443	500	500			243	285	323	363	363
1960			280	328	412	540	540			215	260	320	405	405
1961			260	318	410	463	463			213	245	298	353	353
1962			408	500	545	635	635			273	318	373	428	428
1963			495	540	655	760	760			290	370	455	550	550
1964			460	580	700	840	840			298	345	450	575	575
1965			608	697	790	885	885			449	558	600	634	634
1966			755	894	1027	1115	1115			438	492	619	737	737
1967			604	733	858	1077	1077			460	508	560	740	740
1968			1009	1195	1244	1340	1340			734	808	834	910	910
1969			1083	1360	1500	1594	1594			575	758	812	883	883
1970			1250	1578	1578	1875	1875			781	936	936	1170	1170
1971			1381	1687	1687	1907	1907			550	550	818	944	944
1972			1035	1467	1467	2150	2150			929	929	1182	1633	1633
1973			1557	1750	1750	2800	2800			660	660	850	1021	1021
1974			1498	2005	2005	2659	2659			874	874	1850	2517	2517
1975			1659	2493	2493	3793	3793			1043	1043	1719	2505	2505
1976			2193	2483	2483	3188	3188			1286	1286	1556	1930	1930
1977			2242	2766	3280	3280	3500			1683	2000	2375	2150	2175
1978			2140	2400	3027	3500	4157			1190	1675	2105	2525	3675
1979			2608	2941	3412	3808	4350			1542	1785	2150	2428	2642
1980			2661	2966	3634	4500	6214			2024	2509	3061	3606	4800
1981			2404	2725	3394	4015	4298			1666	1843	2246	2317	2075
1982			1966	2540	2933	2825	2666			1450	2100	2250	2233	2750
1983			2440	2850	3300	4000	4300			1550	2100	1500	1600	2250
1984	1470	2133	2270	2775	2533	2866	3550	1120	925	1475	2087	1650	1800	1950
1985	1150	1533	1708	2228	2614	2666	2625	775	1000	1371	1625	1825	1433	1500
1986	1340	2060	3180	3820	4160	4575	4700	1000	1150	1420	1440	1480	1675	1875
1987	1220	1560	1600	2200	3466	3500	3500	800	1050	1125	1466	1966	1700	2850
1988	1300	1590	1940	2880	3250	3500	4000	800	1163	1325	1925	2267	1500	1800
1989	1482	1993	2695	3305	3965	4792	5594	1030	1496	2088	2764	3343	4383	5750
1990	1480	2300	3600	4875	6500	6500	6500	1025	1500	2100	2600	3000	3000	3000
1991	1728	2281	3177	4182	5188	5625	6375	1200	1757	2143	2750	3333	3800	4200
1992	1780	2293	3054	3996	4907	5443	6429	1075	1617	2050	2286	2600	2600	2625
1993	1850	2543	3742	4625	5375	7000	6000	1425	1767	2060	2480	3050	4000	4000
1994	1786	2438	3500	4500	4833	5833	6500	1300	1667	2417	3750	4000	7000	8000

Veneer Log Price Trends

The actual prices of prime and select veneer logs in seven size classes are shown in Figures 5 and 6, respectively, and Table 7. The pattern is similar to that of sawlogs. After advancing slowly from 1957 to the early 1970's, prices moved up sharply until the early 1980's. Prices during the 1980's were highly variable, but by the end of the decade were trending upward again. Note, also the differences in the patterns between the prime and select grades. In particular selects, the lower grade logs, have increased more than the prime grade in the last several years.

The deflated (real) prices and trend lines for the seven size classes of prime and select veneer logs are shown in Figures 7 to 10. The long-term trend lines show a pattern similar to sawlogs. The trend lines don't, however, reflect prices during the 1970's and overestimate price levels in the 1957 to late 1960's, and again from the

late 1980's to the early 1990's. High prices in the 1970's "pulled up" the trend line, placing it well below the exceptionally high prices of the 1970's. The unsustainably high prices of the 1970's caused projections based on the 1957 to the early 1980's data to yield grossly exaggerated estimates of increases.

Applying the concept of an average compound rate of increase for the trend lines for veneer logs, as discussed for sawlogs, gives higher rates of increase than for sawlogs. The trend line increases for veneer logs are given in Table 4. The largest increases are for small, high-quality veneer logs. This is inconsistent with pricing patterns over the last several years. Comparisons between the two smallest classes and the other size classes must be made with caution. Prices for 12 to 15 inch logs weren't collected until 1984. This was several years after markets for small veneer logs were well established.

Figure 6. Actual prices for select veneer logs by diameter class.

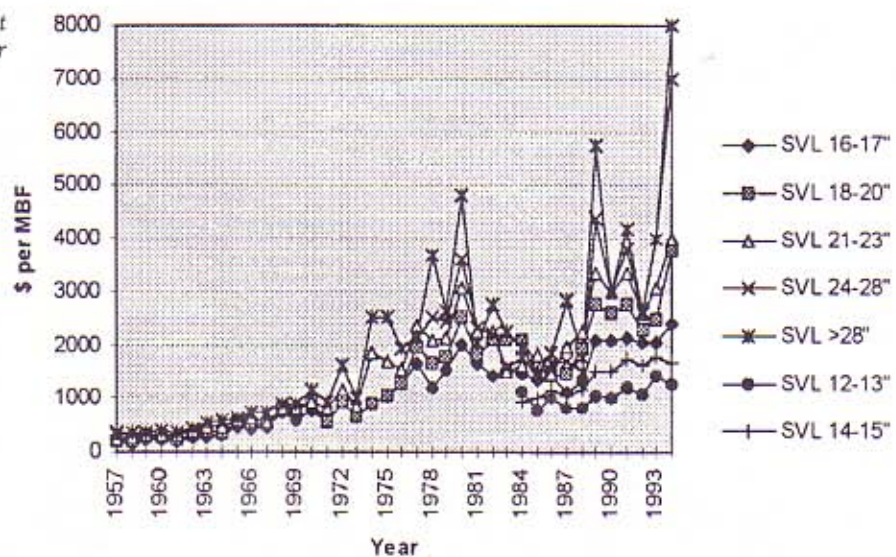


Figure 7. Real prices and trend lines for prime veneer logs by diameter class.

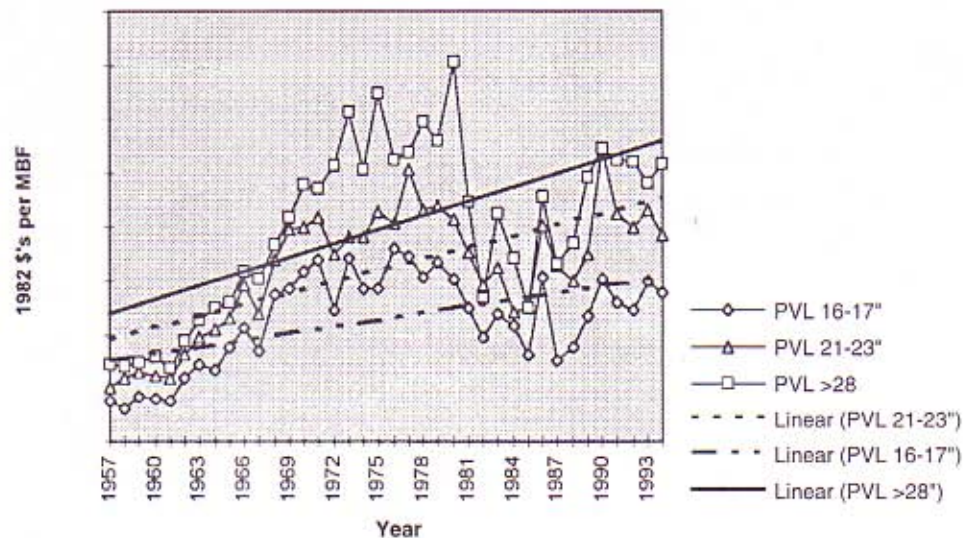


Figure 8. Real prices and trend lines for prime veneer logs by diameter class.

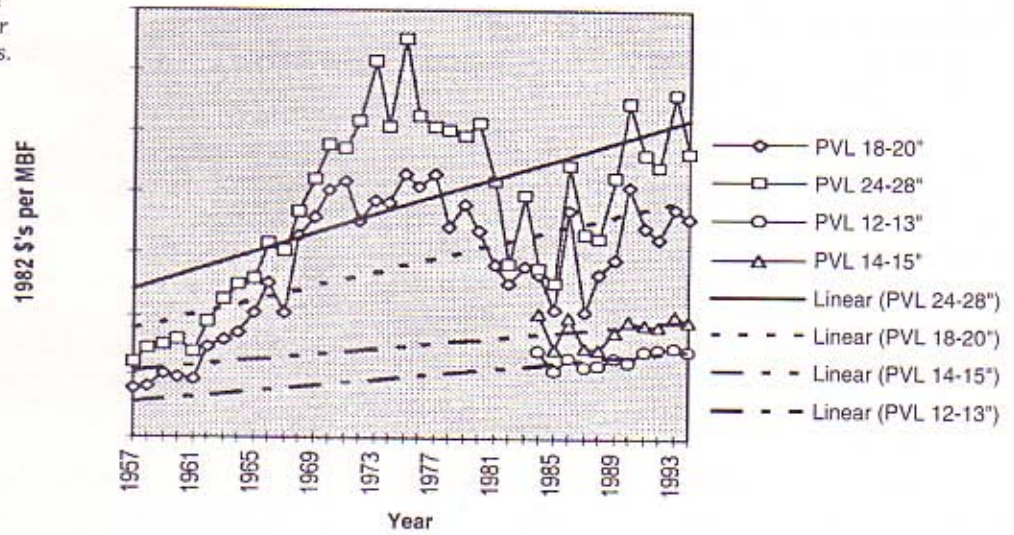


Figure 9. Real prices and trend lines for select veneer logs by diameter class.

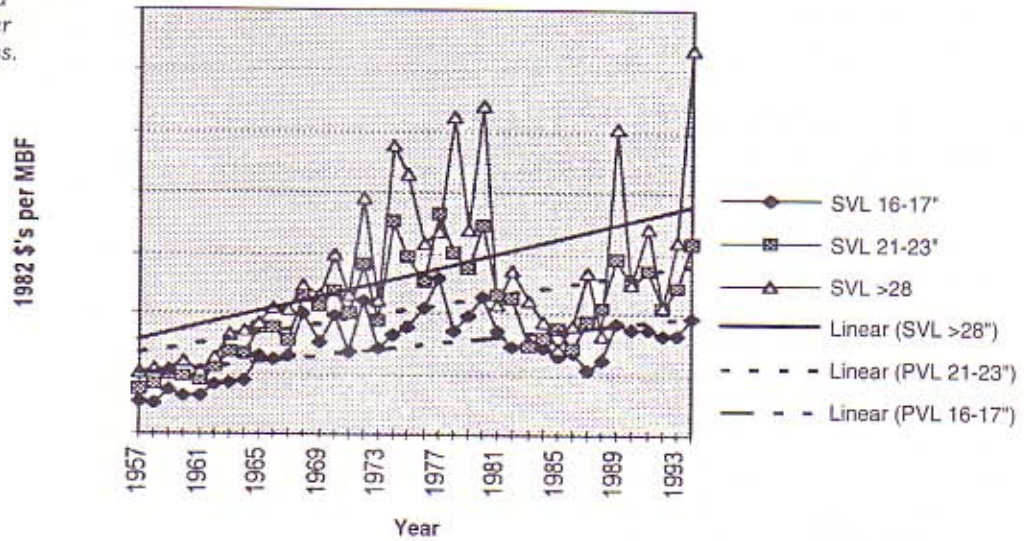
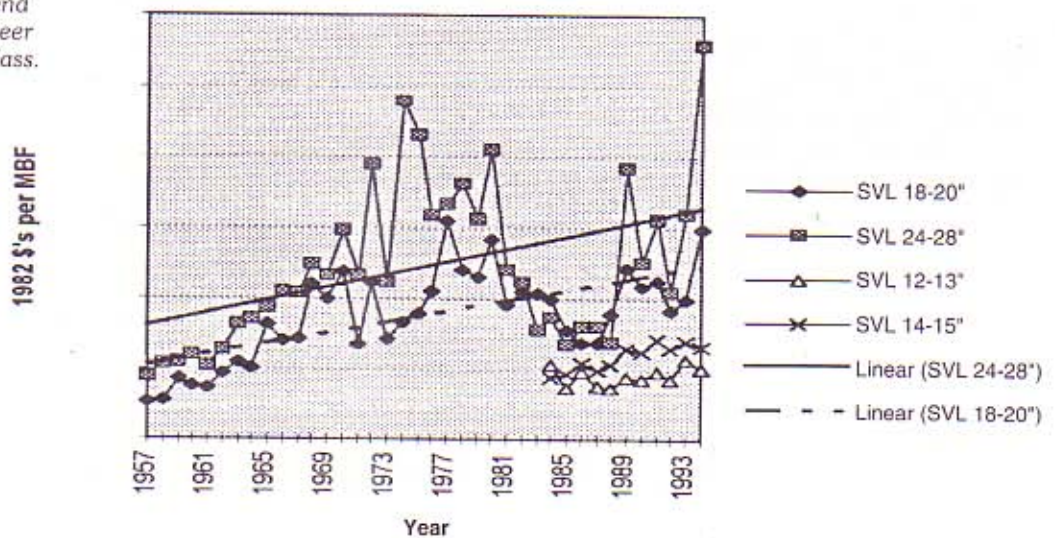


Figure 10. Real prices and trend lines for select veneer logs by diameter class.



Making Price Projections

A review of the figures showing the real prices of walnut logs, plus the discussion above, should convince you that prices don't increase exponentially, i.e. at a compound rate. In reference to Figure 2, projections should be made using the straight trend line. However, this is not the normal practice. Investment analyses are often simplified by compounding prices using the interest rates given in Table 4. This would mean projecting forward using the curved line in Figure 2. You can clearly see that the projected prices are going to be dramatically different with the two methods.

Investors also frequently use current prices to make investment analyses. Since walnut log prices are cyclical, this could give an unreasonably high or low level. An alternative is to use the current price from the trend line. If you believe that prices will continue to increase based on historical patterns, then use the equation for a straight line to project the price. The equation is,

$$P = a + b T,$$

where, "a" is the intercept and "b" is the slope. These values are given in Table 5. "T" ranges from 1 to 38 for years 1957 to 1994 for sawlogs and the five largest veneer logs sizes. "T" ranges from 1 to 11 for years 1984 to 1994 for the two smallest veneer log sizes. To project the price of a given type of log, substitute into the equation the value of T for the number of additional years of interest. For example, the 1982 base year trend line price for one thousand board feet (MBF) of 16-17 select veneer logs in the year 2039 (45 year projection), would be,

$$\text{Price} = 969.18 + 25.731 \times (83) = \$3,105 \text{ per MBF.}$$

Note that if the exponential method was used the projected price would be,

$$\text{Price} = 1947 \times (1.01783)^{45} = \$4,313 \text{ per MBF.}$$

In this equation \$1,947 is the trend line price in 1994 and 1.01783 is $(1 + i)$, where i is the interest rate from Table 4. The exponent, 45, is the number of years the price is compounded at 1.783 percent per year.

Summary

Planting trees provides many rewards. If, however, your primary focus is financial return and you have an area of fertile, deep, well-drained soil, you might consider establishing a black walnut plantation. Establishing and maintaining a plantation result in many expenses and a great amount of work by you or paid labor. The decision to make this investment should be based on realistic expectations, especially regarding the future value of walnut timber. Using the equations for straight trend lines statistically estimated for the entire time period for which data is available is recommended. The equations for these lines is updated annually and reported in the Indiana "Forest Products Price Report and Trend Analysis" for the current year.

NEW 3/95 (7M)

Cooperative Extension work in Agriculture and Home Economics, state of Indiana, Purdue University, and U.S. Department of Agriculture cooperating; H. A. Wadsworth, Director, West Lafayette, IN. Issued in furtherance of the acts of May 8 and June 30, 1914. The Purdue University Cooperative Extension Service is an equal opportunity/equal access institution.