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Working Paper

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An Assessment of the Competitive Impact of Japanese Domestic Wood Programs on the Future Demand for US Wood Products in Japan

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Executive Summary

Since 1970, Japan has increasing relied on imports to meet its domestic demand for wood products. This reliance on imported wood has always caused a certain tension in Japan where forests cover two-thirds of the country. This tension is caused by the fact that along with the plentiful supply of wood, there is an extensive sawmill industry in Japan. Despite the closure of more than 13,000 sawmills over the past twenty five years (from 20,256 in 1983 to 5,927 in 2012), the Japanese sawmill industry remains uncompetitive and plagued by small, inefficient sawmills located in rural areas far from the main demand markets. High production and transportation costs have made both domestic logs and lumber uncompetitive within the domestic market and, as a result, lower cost imported wood products have become the primary source of supply within Japan.

Over the years, the Japanese government and the forest products industry have proposed a number of subsidies and policies designed to improve the competitive position of domestic wood products as well as the forestry and sawmill sectors. A recent regulatory initiative, the Forest and Forestry Revitalization Plan, proposes to develop an extensive system of subsidies and regulations designed to increase the volume of timber harvested from domestic forests while promoting the expanded use of domestic wood over imported wood in the construction of both public buildings and residential homes. Clearly any program designed to raise the market share of domestic wood in Japan will adversely impact the competitiveness of imported wood and would have serious implications for forest products manufacturers in the Pacific Northwest, many of whom are located in rural, timber-dependent communities which were particularly hard hit by the recent economic crisis. With the US economy still feeling the effects of the housing crisis, and housing starts remaining at historically low levels, export markets have been the one bright spot in an otherwise dismal economic landscape for the forest products industry. Total US forest products exports have increased by 46% since 2009, rising from $5.2 billion in 2009 to $7.5 billion in 2012. Japan is the third largest destination for US wood exports, with exports of wood products increasing from $517 million in 2010 to approximately $730 million in 2012. With the introduction of the new Forest and Forestry Revitalization Plan in Japan it is critical that the US undertake research to better understand the potential implications of the subsidy programs on the competitiveness of US wood products in Japan.

This research project was designed to gain a better understanding of how the newly implemented Forest and Forestry Revitalization Plan would impact the overall demand for wood products in Japan in general and the competitiveness of US wood products specifically. The objectives of the proposed research include the following: 1) describe the forest resource in Japan and assess the factors that influence the supply and demand of domestic wood products in Japan; 2) provide an overview of the major wood industries in Japan (lumber, plywood and glue laminated lumber); 3) provide an overview of the housing sector; 4) assess the changing demographics in Japan; 5) assess the broad range of forestry and wood subsidies and support programs in Japan and 6) assess the potential impact of the domestic wood policies and programs on wood use in Japan and the demand for imported wood products from the US.

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1. Introduction

Forestry Sector Overview

Japan's forest sector faces numerous physical and structural challenges, most of which adversely impact the competitiveness of the forestry sector in general and the small private forest owner in particular. One of the most basic obstacles is Japan's geography. Many forests are located in steep mountainous terrain, which makes forest management challenging and increases the costs of building roads, harvesting timber, and transporting logs from the forest. These high costs are further exacerbated by the fact that the majority of private forests are very small, which makes it difficult for the owners to raise capital and harvest their forests. The small size of private forest holding also makes it difficult to coordinate management and harvest activities to ensure a reliable supply of raw materials to local wood processing facilities, making it difficult for companies to invest in expanding the wood manufacturing capacity in rural areas. At the same time, emigration from rural to urban areas reduces the number of available workers, while the workers who remain are aging and few younger workers are drawn to the hard and dangerous labor involved with forestry, despite the fact that wages for forestry work are increasing.

Meanwhile, on the demand side, stumpage prices for the major domestic species (*sugi*, *hinoki*, and pine) have been declining precipitously since 1980. Caught between rising costs of production and declining stumpage prices, many forestry households are finding it more and more difficult to continue in business. This point is illustrated by a set of financial statistics published by the Forestry Agency in Japan. Based on a time series of production cost and stumpage price data, the Forestry Agency calculated the internal rate of return derived from an investment in a *sugi* plantation. Using their own methodology, the Forestry Agency estimated that the internal rate of return from a *sugi* plantation has declined from 6.3% in 1965 to 4.1% in 1975 to 2.1% in 1985 to 0.6% in 1993 to -1.7% in 2000 (the most current year for which this data is available). The Forestry Agency stopped collecting this data in 2001 although anecdotal information suggests that the situation has gotten worse in the ensuing years. Their results clearly show that it is becoming virtually impossible to manage a forest plantation as a viable economic enterprise.

Sawmill Sector Overview

There are a variety of factors that adversely affect the competitiveness of Japan's sawmill industry. These factors include the structure of the industry itself, with its rising production costs and small, regional structure, lack of coordination within the supply chain, lack of investment in efficient processing and kiln-drying technology, regulatory reform within the residential construction industry that has affected the demand for lumber produced from domestic species like *sugi*, the transition of the post and beam home building industry to the pre-cut construction technology (i.e., pre-cut structural components), the continued strength of the yen, and imports of low cost, high quality logs and lumber.

Foreign suppliers continue to export large volumes of wood products to Japan. Generally these imported wood products are lower priced with less price volatility and higher quality than domestically produced wood products and local Japanese sawmills find themselves at a competitive disadvantage in many of the larger urban markets. There is no doubt that competition within the Japanese lumber market will continue to increase and this competitive business environment will force more consolidation and closures within Japan's sawmill industry, particularly within the huge ‘mom-and-pop’ segment of the industry.

Thus, in order to remain viable, domestic lumber manufacturers must develop a strategy that will allow them to compete within the new business environment. However, rather than undertake the reforms and consolidation necessary, as well as make the capital investment in more efficient processing technologies, required to become internationally competitive, many companies and industry associations within the Japanese sawmill and forestry sectors continue to seek regulatory relief from competition through a variety of non-tariff regulatory constraints and subsidies.

Impact of the Revitalization Plan on US Wood Exports to Japan

The Forestry and Forest Revitalization Plan was specifically designed to increase both the supply and demand for domestic wood in Japan, with a goal of increasing the market share of domestic wood to 50% by 2020. It would have been almost impossible to meet the goals of the Revitalization Plan simply by substituting domestic wood for imported wood within the residential housing sector. Thus, MAFF in consultation with other government Ministries, developed a comprehensive strategy designed to expand the use of wood within other sectors of the economy, including non-wood housing, public buildings, commercial buildings, public works, biomass energy and log exports. Many of these programs were supported by an extensive system of subsidies at both the national and local levels.

Based on our analysis, total cumulative export losses for the US between 2012 and 2020 due to the subsidies provided by the Revitalization plan could potentially reach $1.1 billion in lost log exports with an additional $379 million in lost lumber exports. Total cumulative export losses for the US to Japan for just logs and lumber over the period 2012-2020 reach $1.46 billion, while the estimated total cumulative export losses for all wood product exports could reach $1.8 billion by 2020. This is a conservative estimate and our analysis did not take into account the impacts of the other subsidy programs that have been adopted (the Public Building Law or prefectural subsidies for the 200 Year House program) or will be adopted in the near future (Wood Use Points Program).

Objectives

This research project was designed to gain a better understanding of how the newly implemented Forest and Forestry Revitalization Plan would impact the overall demand for wood products in Japan in general and the competitiveness of US wood products specifically. The objectives of the proposed research include the following: 1) describe the forest resource in Japan and assess the factors that influence the supply and demand of domestic wood products in Japan; 2) provide an overview of the major wood industries in Japan (lumber, plywood and glue laminated lumber); 3) provide an overview of the housing sector; 4) assess the changing demographics in Japan; 5) assess the broad range of forestry and wood subsidies and support programs in Japan and 6) assess the potential impact of the domestic wood policies and programs on wood use in Japan and the demand for imported wood products.

2. Economy and Demographics

The Japanese Economy

Japan's economy has been in a state of flux since the end of the bubble economy in the early 1990s and the 1997 Asian economic crisis. Widespread concern about the economy caused extensive industrial restructuring, increasing numbers of bankruptcies and record post-war unemployment levels. On the way out are the days of the lifetime employment guarantee between a company and its employees and many of the large iconic Japanese manufacturers (e.g., Sony, Honda and Toyota) are increasing their use of contract labor. In its place is a Japan that is less sure of its role in the global economy. Of course, as with everything in Japan, a closer look reveals that the economic landscape (as well as the political landscape) is divided into traditional, rural-based small agricultural producers and highly competitive urban industrial manufacturers. Examples of both of these types of producers can be easily found within the forest products industry where small labor intensive "mom and pop" sawmills can operate within a stone's throw of huge highly automated sawmills and precutting manufacturers. In this sense, Japan truly is a study in contrast and contradictions.

In an effort to jump-start the economy, Japanese politicians have dramatically increased government spending (Japan's gross debt that was almost 250% of GDP in 2012, compared to 58% in 1991), while interest rates have been maintained near zero since 1995. The fact that these measures have not been effective in jump starting the economy is perhaps the most compelling evidence that Japan's economic woes are systemic and not purely economic.

The 1990s, perhaps aptly described as the post-bubble decade, was a decade of economic stagnation. During this period, GDP growth averaged a mere one percent per year. Since the late 1990's, Japan has experienced four recessions and the most recent GDP data, if correct, will show that Japan has just entered their fifth recession since 1997 (Figure 1), although the recent economic policy implemented by the new LDP government of Prime Minister Abe is likely to result in strong gains for the economy.

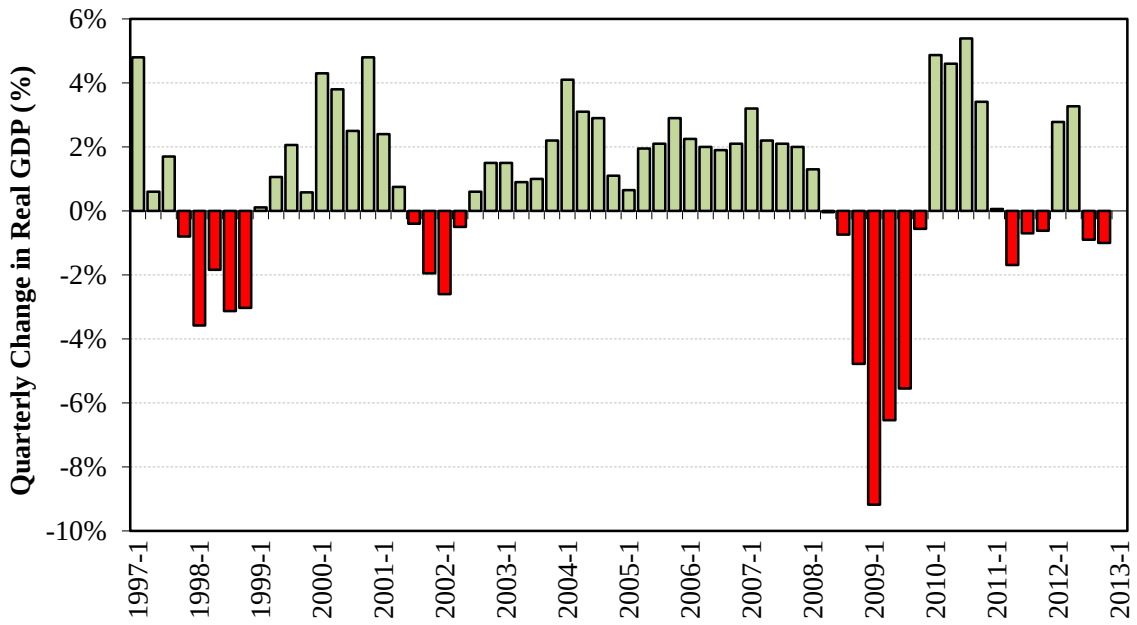

Figure 1 Quarterly changes in real GDP in Japan between 1997 and 2012.

The unemployment rate, which was historically below 2%, exceeded 5% five times since 2001 although it dropped to 4.4% in 2012 (Figure 2). Uncertainty over the future has caused Japanese consumers to reduce spending and continuing concern over the state of the economy resulted in a record ***23 quarters*** of deflation in Japan that began in the first quarter of 1999 and did not end until the third quarter of 2004 with deflation continuing to plague the economy on and off until the middle of 2007 (Figure 3).

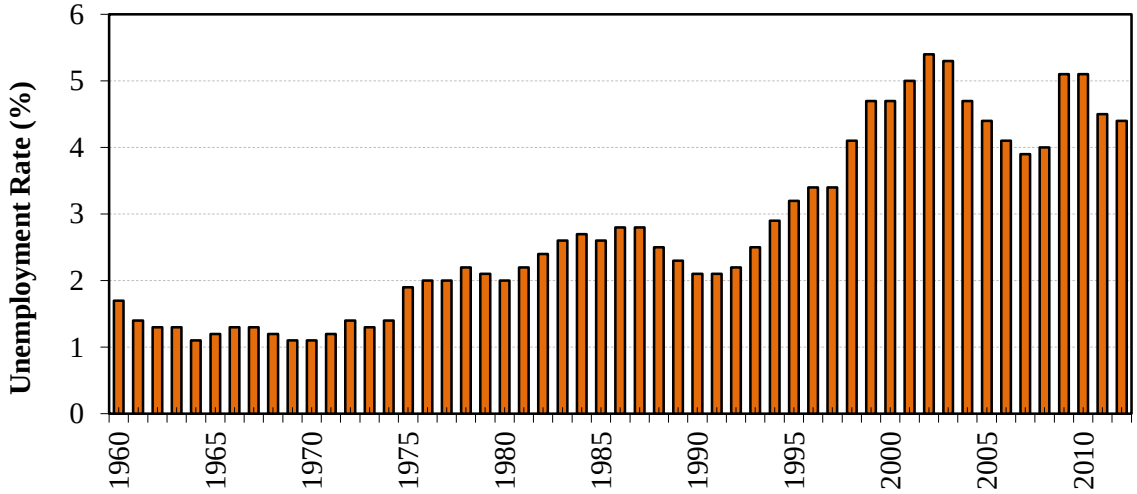

Figure 2 Annual change in the unemployment rate in Japan between 1960 and 2012.

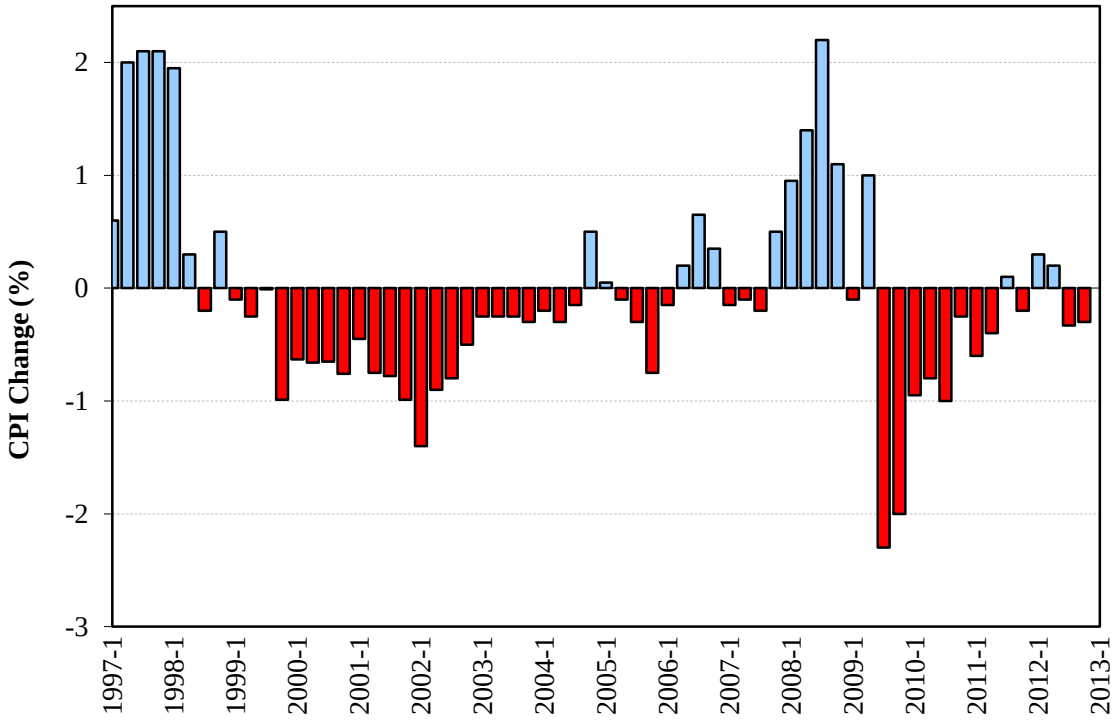

Figure 3 Changes in consumer price index in Japan between 1997 and 2012.

Following a short period of 1.3% inflation, the economy has again been plagued by deflation since the beginning of 2009. The pullback in consumer spending was reinforced by several periods of substantial declines in monthly earnings: 1998-1999, and the last half of 2001 through 2002. However, the biggest declines in monthly earnings occurred in 2009 and 2010 when earnings dropped by as much as 2.2% during the third and fourth quarters of 2009, (Figure 4).

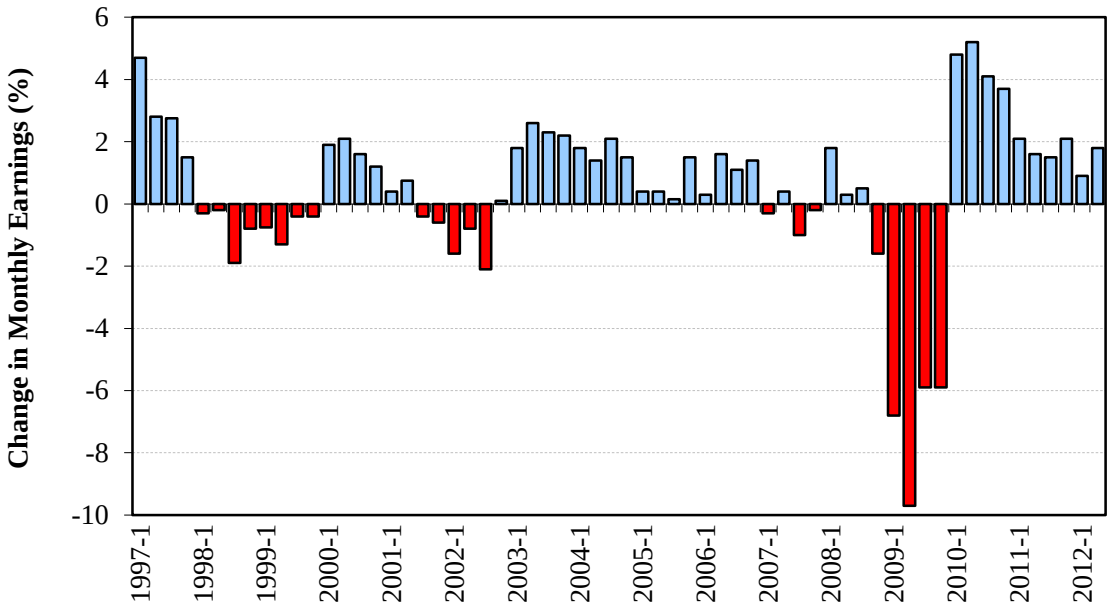

Figure 4 Changes in monthly earnings in Japan, reported on a quarterly basis.

By the end of 2002, the Japanese economy began to respond to the fiscal stimulus and relaxed monetary policies introduced by Prime Minister Koizumi. Between 2003 and the middle of 2008, real quarterly GDP growth averaged almost 2% and unemployment dropped from a post-war high of 5.5% to 3.8%, although deflationary pressure continued to haunt the economy.

The global financial crisis hit the Japanese economy hard with GDP declining substantially in 2009, unemployment jumping back over 5%, deflation reaching record levels and monthly earnings falling by about 7% throughout 2009. Perhaps a bigger concern for the Japanese has been the relative strength of the yen, which went from ¥109 per US dollar at the end of 2008 to ¥77 per US dollar by the middle of 2011. The strong yen, combined with the declining domestic demand for automobiles and electronics, has significantly affected the international competitiveness of Japanese exports.

The recent election in December 2012 saw the change of government from the Democratic Party of Japan back to the Liberal Democratic Party of Japan. In a massive rejection of the DPJ, Japanese voters not only returned the LDP to power but gave them control of 325 of the 480 seats in the lower house of the Diet. This landslide win for the LDP provides them with a supermajority in the lower house, ensuring that they will have more than two-thirds of the seats required to override a veto on legislation handed down by the upper house of the Diet. Shinzo Abe, the leader of the LDP, (who previously served as the Prime Minister of Japan for less than a year in 2007) ran a campaign that was focused on exhorting the central bank to further loosen the monetary policy in Japan and adopt a 2% inflation target for consumer prices. He has called for the central bank to buy government bonds in unlimited quantities until the inflation target is reached. His apparent goal is to end deflation (consumer prices are below where they were two decades ago), encourage consumer spending and pull Japan out of its fifth recession in less than 15 years.

The LDP has proposed a massive spending package of 10 trillion yen (largely financed by more state borrowing) which, in conjunction with rising energy costs, is widely expected to add to the country's debt which already exceeds 240% of the GDP, the largest ratio among all of the rich countries, (Figure 5). The sheer magnitude of the proposed spending increases will easily offset the increased revenue derived from the increase in the consumption tax, which will rise from its current 5% to 10% by 2015.

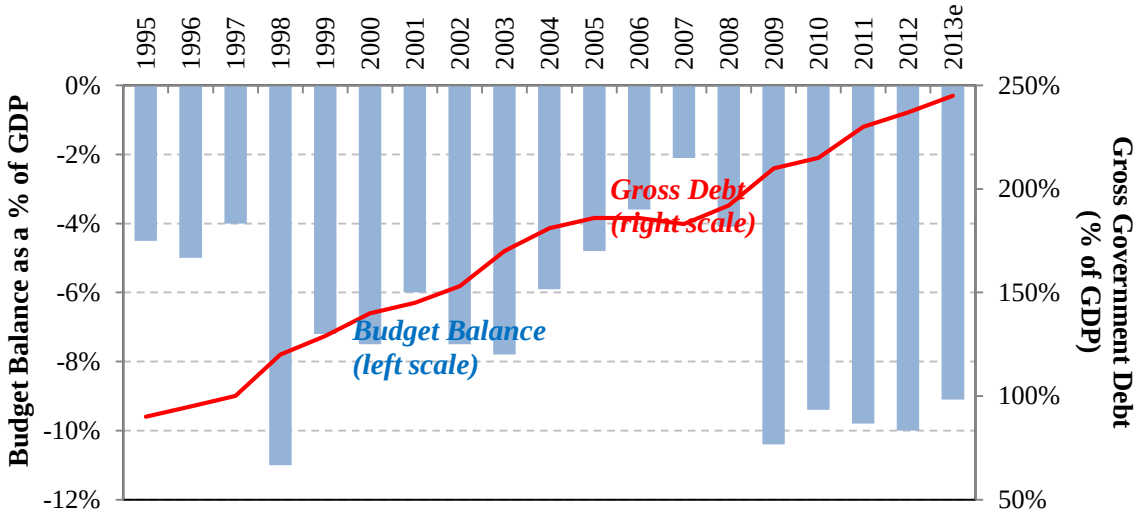

Figure 5 Gross government debt as a percentage of GDP.

Demographics

Looking into the future, demographic data clearly indicates that Japan's trend of an aging and shrinking population will have serious implications in the future. Perhaps two statistics best summarize the demographic problem confronting Japan. First, the population of Japan peaked at 127,787,000 in 2004 and is expected to decline below 100 million by 2051. At the same time, the dependency ratio in Japan (defined as the ratio of people aged 65 and above to the number of people aged 15 to 64) jumped from 8.9% in 1960 to 25.3% in 2000 and is expected to increase to 49.4% by 2015. Further, the formation of new households is expected to peak in 2015 while the ratio of elderly households continues to rise (Figure 6).

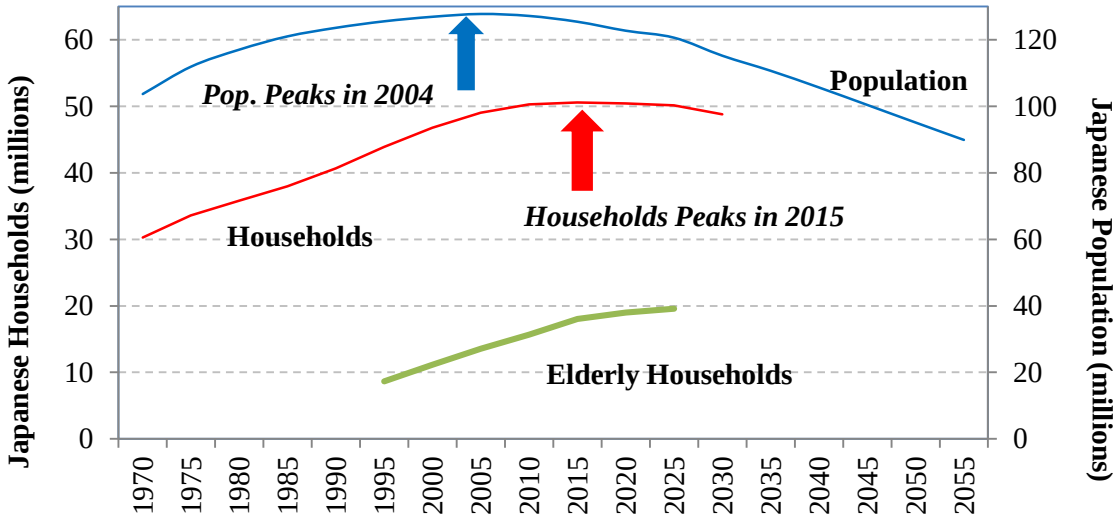

Figure 6 Population demographics in Japan from 1970 thru 2055.

Clearly the government must address two major challenges in the years ahead. In the short-term it must aggressively resolve the lingering structural problems in the financial sector that have undermined economic performance in the wake of the global economic crisis. In the longer-term, the government must realistically confront the social and financial challenges presented by a shrinking and aging population (for example bringing more women into the workforce). Addressing this demographic trend will be particularly problematic in Japan where immigration has not been traditionally viewed as an acceptable option.

Housing is an important industry in Japan and, in order to understand Japan's housing industry, it is essential to understand demographic trends. Japan had 127.4 million people in 2012 (MIAC 2013), ranking it as the 10th largest population in the world. The Japanese population is aging and birth rates are low, so the population began shrinking in 2005. This demographic shift is leading to an aging society that will soon place heavy burdens on Japan's welfare and pension systems.

As a result of the post-World War II baby boom, a large percentage of Japan's population is now between the ages of 55 and 70 (Figure 7). As is often the case after a large war, many Japanese soldiers and civilians returned home and had many children. Children born between 1947 and the mid-1950s are called the Japanese baby boomers or the *Dankai* generation. This group started retiring in 2007, bringing both positive and negative impacts to the Japanese economy.

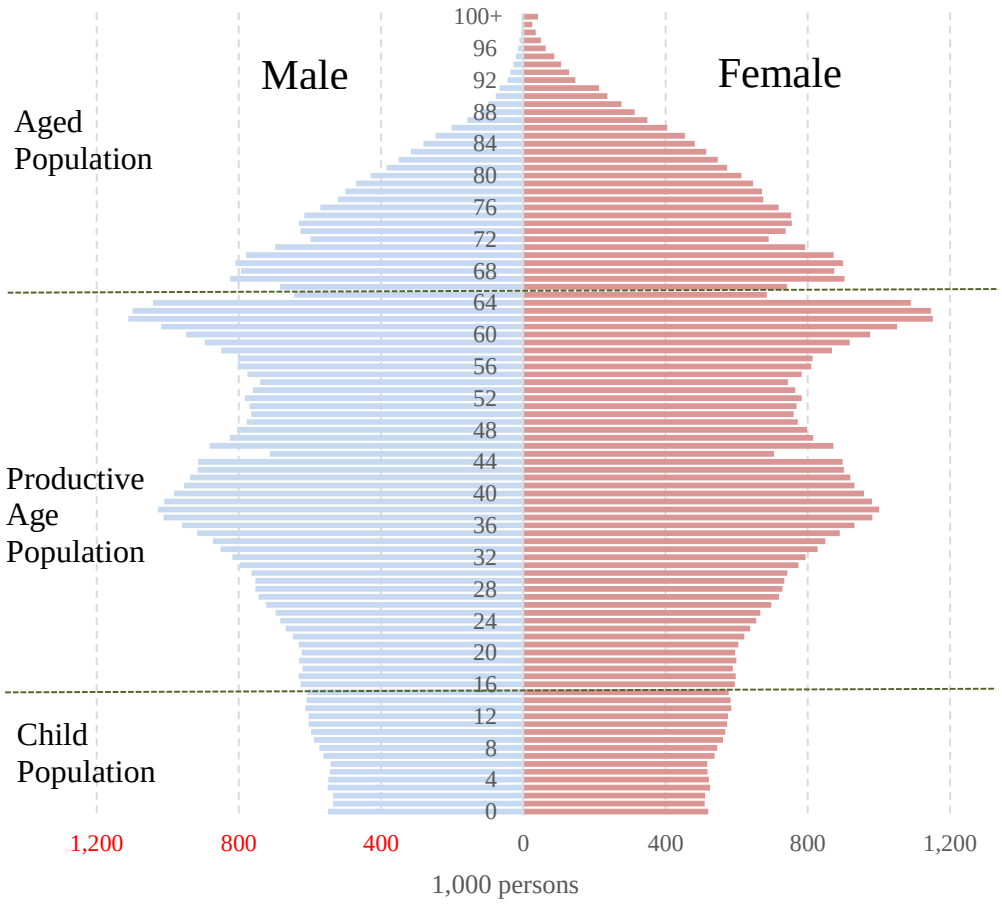

Figure 7 Japanese population pyramid in 2011.
(Source: Japan Statistics Bureau http://www.stat.go.jp/english/data/jinsui/2011np/index.htm)

Recently, Japanese "echo baby boomers" have begun to turn 30, establish families, and start buying houses, which has helped spur the housing industry. These are the *Dankai Jr.*, the children of the Japanese baby boomers. The echo baby boomers were born in the early 1970s, and many of them are now in their 30s. The 29- to 38-year-old cohort in 2005 (born from 1966 to 1975) accounted for around 15% of the total Japanese population in 2005. This market segment is very large, and targeting them is very important to the housing industry since buying a house is generally regarded as a once-in-a-lifetime event in Japan. Because the liquidity of the housing market is very low, and a large segment of the echo baby boomers are potential first-time home buyers, it is very important for home builders to understand them (Sasatani, Eastin and Roos 2009).

3. Forest Resource and Industry

Contrary to popular belief, Japan is a richly forested country with forests covering more than two-thirds of its land area (Table 1). However, this has not always been true. During the Second World War the forests of Japan were devastated to provide fuel-wood for both the industrial sector involved in the war effort as well as to provide heating and fuel for individuals. Following the conclusion of the war, a massive replanting effort was undertaken to restore the forests of Japan. This effort was hugely successful, although the passage of time has shown that some strategic mistakes were made. For example, the vast majority of the trees planted were Japanese cedar (*sugi*) of poor genetic quality and as a result, the quality of the *sugi* resource is poor. In addition, the strain of *sugi* chosen gives off large volumes of pollen which has contributed to the large number of asthma cases that occur every spring.

The ratio of forest cover is generally consistent across Japan, with the exception of the Kanto region (with the heavily industrial prefectures of Tokyo, Chiba, and Kanagawa) in eastern Japan. Forest cover ranges from 74.5% of the land area in rural Chubu and Shikoku regions to just 44.5% in the heavily industrialized Kanto region. The majority of the forest resource in Japan lies in the northern and western regions of the country, with 22.4% of the forest area located on the island of Hokkaido, 18.6% in the Tohoku region, and 18.3% in the Chubu region.

Forest Ownership

A breakdown of forest owners by size of forest holding shows that approximately 58% of private forests are less than one hectare in size and an additional 31% are less than five hectares (Table 2). More importantly, barely one percent of forest owners in Japan have forest holdings that exceed 30 hectares. From 1970-1990, the forestry statistics show that there has been a trend towards smaller forest holdings. Forests that are 1 to 10 hectares have generally been converted to smaller forests of less than one hectare. This ownership pattern has clear implications for the ability of private forest owners to economically manage their forests for timber production. It also restricts the ability of forest owners to access the capital required to actively manage their forests and improve the quality of their timber.

Almost 60% of the forests in Japan are privately owned, 31% are owned by the national government, and other public groups own 11% (Table 3). Other public bodies that own forest areas are primarily prefectural governments (38.3%) and municipal governments (39.2%). Private forests are distributed across a large number of small plots with over 2.5 million owners. The average size of forest holding is just under 10 hectares per forest owner, although this statistic seriously overstates the size of the typical forest holding.

By area, the largest forest areas are located in the Hokkaido, Tohoku, and Chubu regions (Table 1). The largest private forest areas are located in the Chubu, Tohoku, Kyushu-Okinawa, Kansai, and Chugoku regions. As a percentage of forest ownership, public forest ownership is highest on the island of Hokkaido (71.1%) and lowest in the Shikoku (23.4%), Chugoku (22.6%) and Kansai (17.4%) regions.

Table 1 Forest area and forest households in 2010, by region.

Region	Total Land Area (hectares)	Percent Forested	Total Forest Area (hectares)				Forest Households (number)	Average Forest Size (ha)
			Total Forest	Total (%)	Private Forest	Private (%)		
Total	**36,684,500**	**68.2%**	**25,026,282**	**100%**	**14,004,553**	**100%**	**2,508,605**	**9.98**
Hokkaido	8,345,200	67.1%	5,597,221	22.4%	1,613,290	11.5%	72,957	76.72
Tohoku	6,398,300	72.8%	4,655,386	18.6%	2,129,330	15.2%	369,169	12.61
Kanto	3,214,600	44.5%	1,430,042	5.7%	900,506	6.4%	335,381	4.26
Chubu	6,156,800	74.5%	4,587,445	18.3%	2,794,974	20.0%	473,821	9.68
Kansai	3,293,000	67.2%	2,211,694	8.8%	1,822,845	13.0%	299,657	7.38
Chugoku	3,180,900	73.7%	2,343,988	9.4%	1,814,243	13.0%	352,545	6.65
Shikoku	1,878,800	74.5%	1,399,175	5.6%	1,071,172	7.6%	158,896	8.81
Kyushu-Okinawa	4,216,600	66.4%	2,801,331	11.2%	1,858,193	13.3%	446,179	6.28

Source: 84th Statistical Yearbook of MAFF, 2011.

Table 2 Number of forestry households by area of forest owned.

	Total	<1	3-5	5-10	10-20	20-30	30-50	50-100	100-500	500-1,000	> 1,000ha
Nationwide	**906,805**	**520,123**	**160,563**	**119,292**	**64,163**	**19,504**	**13,005**	**6,797**	**3,089**	**193**	**76**
Hokkaido	38,685	11,109	7,363	9,446	6,244	1,958	1,373	783	373	25	11
Tohoku	174,648	98,456	32,248	23,639	12,574	3,626	2,409	1,186	473	29	8
Hokuriku	61,382	39,238	10,391	6,683	3,142	894	588	299	137	9	1
Kanto / Tozan	120,479	75,137	20,380	14,061	6,739	1,885	1,256	653	347	16	5
Tokai	83,342	46,005	13,851	11,120	6,820	2,404	1,703	967	425	29	18
Kansai	77,166	45,816	13,481	9,418	4,802	1,477	1,038	659	427	32	16
Chugoku	151,634	82,433	29,604	22,319	11,274	3,010	1,792	821	340	28	13
Shikoku	70,688	36,459	13,246	10,524	6,297	2,039	1,234	623	252	12	2
Kyushu	128,055	84,960	19,882	12,015	6,252	2,205	1,608	804	314	13	2
Okinawa	726	510	117	67	19	6	4	2	1	0	0
Kyushu-Okinawa	128,781	85,470	19,999	12,082	6,271	2,211	1,612	806	315	13	2

Source: http://www.e-stat.go.jp/SG1/estat/ListE.do?bid=000001037762&cycode=0

Table 3 Growing stock in Japanese forests (Area: 1,000 hectare).

(Growing stock: million cubic meters)

	Total Growing stock				Planted forest Growing stock				Natural forest Growing Stock			
	Area	**Total**	**SW**	**HW**	**Area**	**Subtotal**	**SW**	**HW**	**Area**	**Subtotal**	**SW**	**HW**
1986	25,255	2,862,330	1,785,839	1,076,491	10,219	1,360,691	1,341,430	19,261	13,666	1,500,023	444,072	1,055,951
1990	25,212	3,137,581	2,023,867	1,113,714	10,327	1,597,844	1,578,863	18,981	13,523	1,538,141	444,656	1,093,485
1995	25,146	3,483,234	2,310,521	1,172,713	10,398	1,891,993	1,864,030	27,963	13,382	1,590,016	446,125	1,143,891
2002	25,121	4,040,124	2,756,061	1,284,063	10,361	2,338,039	2,301,943	36,096	13,349	1,700,862	453,725	1,247,137
2007	25,097	4,431,737	3,078,921	1,352,816	10,347	2,651,307	2,607,527	43,780	13,383	1,779,393	471,245	1,308,148
National forest	7,686	1,078,272	606,887	471,385	2,364	423,611	396,160	27,451	4,691	653,805	210,609	443,196
Public Forest	2,830	484,326	337,057	147,269	1,247	294,618	291,197	3,421	1,449	189,627	45,849	143,778
1. Prefectural forest	1,188	190,346	124,242	66,104	464	100,662	99,562	1,100	667	89,676	24,680	64,996
2. Municipal bodies	1,642	293,980	212,815	81,165	783	193,956	191,635	2,321	782	99,951	21,169	78,782
Private forest	14,535	2,863,512	2,131,341	732,171	6,724	1,930,599	1,917,705	12,894	7,217	932,813	213,616	719,197

Source: 84th Statistical Yearbook of MAFF, 2011.

Table 4 Estimated annual growth in Japanese forests (m^3).

Time Period	**1966-1971**	**1971-1976**	**1976-1981**	**1981-1986**	**1986-1990**	**1990-1995**	**1995-2002**	**2002-2007**
Annual Growth	108,626,000	74,147,000	103,279,000	116,167,000	107,816,000	103,827,000	105,236,000	104,691,000

Forest type and stocking volumes

Over half of the forests in Japan (53.2%) are classified as natural forest while the remainder is artificial (plantation) forest (Table 3). The majority of the National Forests are natural forests (61%) while private and other public forests are more evenly distributed between natural and plantation forests. The volume of growing stock in Japan's forests totaled 4.4 billion cubic meters in 2007 and it has more than doubled since 1966 (Figure 8). At the same time, forest management activities (e.g., thinning) and harvest levels have remained low, leading to the very high stocking volumes. As might be expected, the majority of the growing stock (64.6%) is located in private forests, although private forests represent 58% of the forest area. In contrast, national forests contain only 24.3% of the growing stock, while they represent 30.6% of the total forest area.

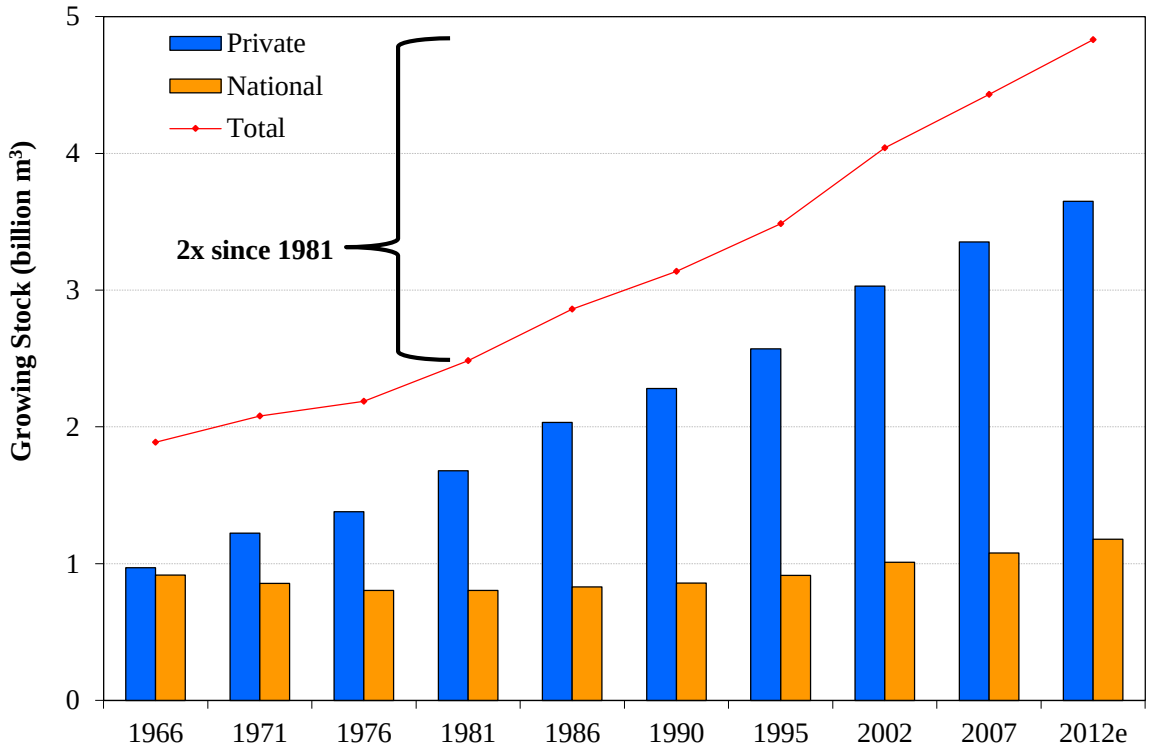

Figure 8 Inventory of growing stock in Japanese forests.

Japan's growing stock is approximately two-thirds softwood species and one-third hardwood species. While the National Forests display a more balanced level of stocking between hardwood and softwood species, private forests are heavily skewed towards softwood species. This is due to a combination of factors, including the fact that 76.5% of the area of plantation forest ownership is private or "other public", the stocking volume in natural forests (119 m^3 per hectare) is substantially lower than in plantation forests (181 m^3 per hectare), and the species distribution in plantation forests is almost entirely softwoods (99.4%).

Approximately 8.8 million hectares of primarily publicly owned forests have been designated as protection forests. The dominant type of protection forests are headwater conservation forests (72%) followed by soil loss prevention forests (23.7%). The total area of protection forest represents approximately 35.2% of all forest area in Japan.

Interestingly, MAFF does not appear to collect annual growth data for forests in Japan, although they do report annual growth data for five year time periods (Table 3). *(**Note**: it appears that annual growth data is collected at the prefectural level and MAFF apparently does collect this information although they do not publish it)*. This situation seems unusual given the fact that a number of MAFF policies, particularly the Forest and Forestry Revitalization Plan, specify annual harvest volume targets. Following a number of discussions with MAFF officials, it is unclear how the five year growing stock estimates are developed. For the purposes of this paper annual growth volumes were estimated. The annual growth estimates provided in Table 4 were developed by estimating the annual growth averages based on the growing stock data provided in Table 3.

Forest age and species distribution

The age class distribution for private and National Forests is presented in Figure 9 (note that the age class information for other publicly owned forests is included in the privately owned forest data). The data clearly shows a bimodal distribution for both the private and national forest resource, with peaks at 41 to 50 year age class and at 81+ year age class. Over half of the total forest area is less than 50 years of age (53.5%; mostly located in private forests) while an additional 16.4% is over 80 years of age (mostly located in the national forests). Clearly, the age class distribution for private forests is substantially different than that of the National Forests. Almost two-thirds of the private forest resource is between 31 and 60 years of age while over half of the National Forest resource is in excess of 81 years in age.

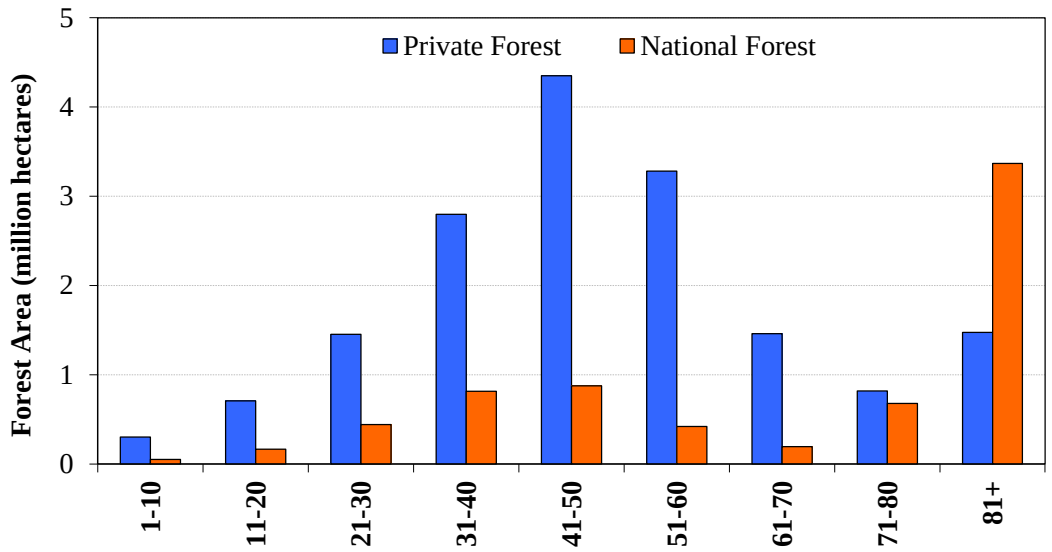

Figure 9 Age class distribution of forests in Japan, by ownership.

Since the majority of the National Forest area has been set aside for protection, we would expect to see a distribution skewed towards the older age classes. The bulk of the private forest resource, which is more actively managed for timber production, is clustered in the 31 to 60 year age classes. Given a forty to sixty year rotation for the major softwood species in Japan, it is obvious that there is already a large volume of timber becoming available for harvest in the private forests. The fact that harvest volumes are lower than we would expect reflects the fact that harvesting costs are high in Japan, wood quality is average at best, labor is expensive and hard to find and the logging road infrastructure is severely undeveloped.

Another way of analyzing the age class distribution of forests in Japan is plantation versus natural forest (Figure 10). This type of classification shows that almost 60% of plantation forests are between 31 years and 50 years of age. It also shows that the age class distribution in natural forests is bimodal, with about 35% of natural forests between 41 and 60 years of age and another almost 40 % over 81 years of age.

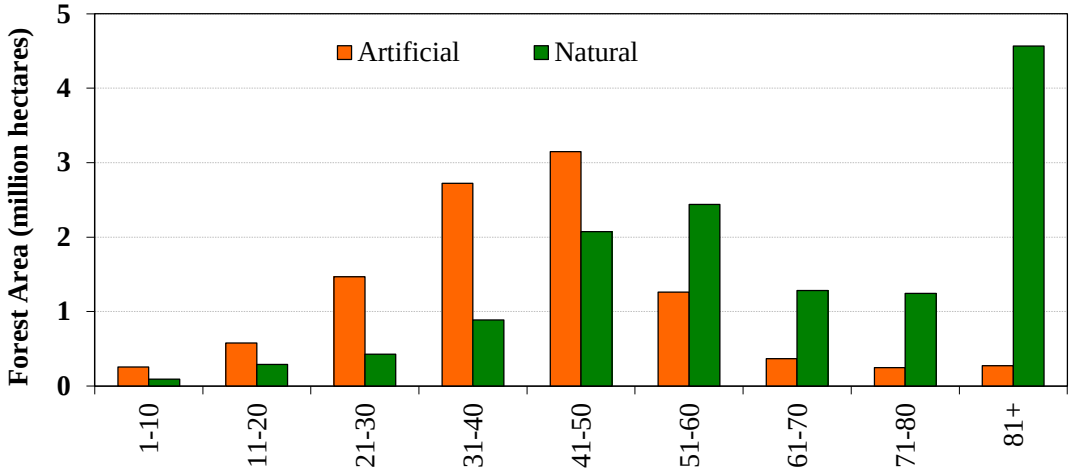

Figure 10 Age class distribution for natural and plantation forests in Japan.

The data presented in Table 3 shows that softwood species are the predominant species in plantation forests. The two primary commercial softwood species grown in Japan are *sugi* (Japanese cedar) and *hinoki* (Japanese cypress). The age class distribution of Japanese forests, by the major species, is presented in Figure 11. The age class data clearly shows that *sugi* is the dominant species in Japan, planted on over 4.5 million hectares compared to approximately 2.5 million hectares of *hinoki* and 3.31 million hectares of other species (notably pine and larch). However, it is interesting to note that while *sugi* is the dominant species in the 35 to 70 year age classes, the area planted in *sugi* and *hinoki* over the past twenty years has been roughly equivalent (although at much lower volumes). This would suggest that there has been a fundamental shift in the timber market and forest management philosophies over the past twenty years that has changed the relationship between these species. Certainly the higher market value and quality of *hinoki* is one factor as is the serious problem of pollen release associated with *sugi*, particularly in areas adjacent to major metropolitan cities.

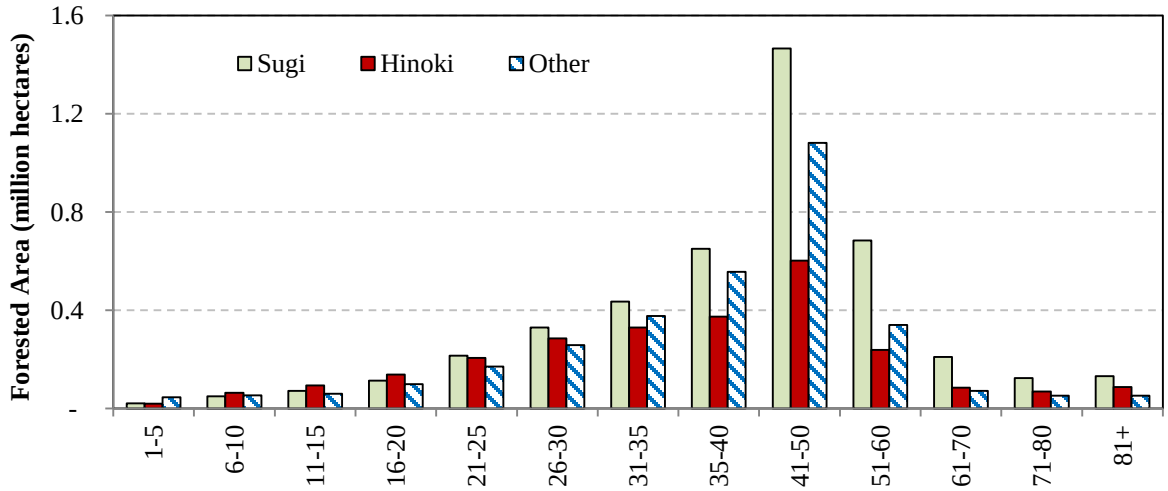

Figure 11 Age class distribution of Japanese plantation forests, by major species.

Reforestation

Since the end of the Second World War the Japanese have replanted over 12 million hectares of forest (Figures 12 and 13). The majority of the reforested area is located on private and other public lands, although a substantial amount of reforestation occurred within the National Forests between 1955 and 1985 (Figure 12). From 1950-1970, the total area of land reforested was quite high, fluctuating between 300,000 and 430,000 hectares annually. However, since 1970 the area of land reforested has been steadily declining and has been less than 30,000 hectares since 2000.

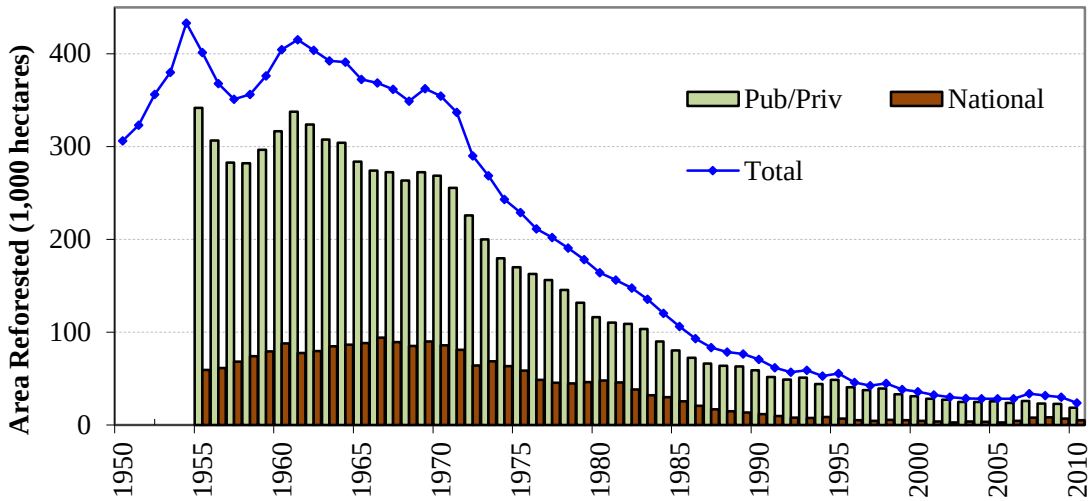

Figure 12 Annual area reforested in Japan, 1950-2010.

The reforestation data clearly shows that *hinoki* and *sugi* have been the predominant species planted in Japan, although between 1950 and 1970, pine and larch represented a substantial percentage of the area reforested in Japan (Figure 13). In fact, throughout this period the area planted in *hinoki*, pine and larch was approximately equivalent. However, by the early 1980s, the majority of the area reforested in Japan was in either *sugi* or *hinoki*, and, as a result, the Japanese forest inventory is heavy to *sugi* and *hinoki*. It is only in the past few years that the ratio of *sugi* and *hinoki* has dropped in favor of other species such as pine and larch, although the volume of area being reforested in these years is quite low and thus will have little impact on the overall species mix in Japanese forests.

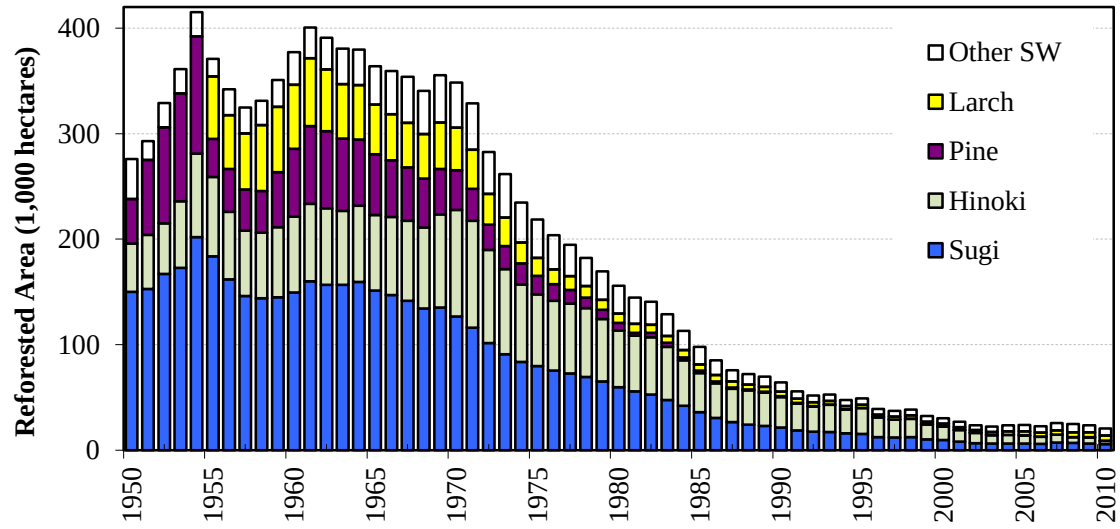

Figure 13 Annual area reforested in Japan, by species, 1950-2010.

Timber Harvest

Domestic production of logs declined throughout the period 1968 to 2003 and it is only since 2005 that the combination of forest improvement programs and domestic wood programs (often heavily subsidized by MAFF and the Forestry Agency) has allowed domestic log production to increase. One outcome of this strong budgetary support has been that the total wood harvest in Japan has jumped from 20.8 million m^3 in 2004 to 47.7 million m^3 in 2011, Figure 14. Based on informal discussion with MAFF, it seems that the huge jump in "Other Harvest" can be attributed to a large increase in forest improvement operations, including forest thinning, in 2005. It should be noted that a substantial volume of "Other Harvest" is left in the woods unused for a variety of reasons including lack of access for collection and removal as well as a lack of markets for the resource, which is often small sized and poor quality.

Harvest, by ownership

Timber harvests in Japan have generally been declining over the period 1950-2003 (Figure 14 and 15). The majority of timber harvest has been from private forests, although the National Forests play an important role in the timber supply (particularly since 2005 when MAFF started to accelerate thinning of plantation forests in order to meet Japan's commitment under the Kyoto Protocol)[1]. In contrast, prefectural and municipal forests (other public forests represent about 11% of the growing stock) have traditionally supplied approximately 5% or less of the timber harvest. The trend in timber harvest volume can be broken down into two periods: 1965-2003 and 2003-today. In the first period, the timber harvest from both private and National Forest harvests declined sharply, although private timber harvest volumes increased slightly in the 1980s. In contrast, the post-2003 period has seen a substantial increase in timber harvest volumes, particularly from the National Forests. This reversal in timber harvest volumes can, to a large extent, be traced to the acceleration of thinning of plantation forests in 2005. While private forest owners have been slow to increase their harvests in response to the Plan given the diversity and large number of forest owners, timber harvest volumes within public forests have risen dramatically, jumping by 41.3% since 2005.

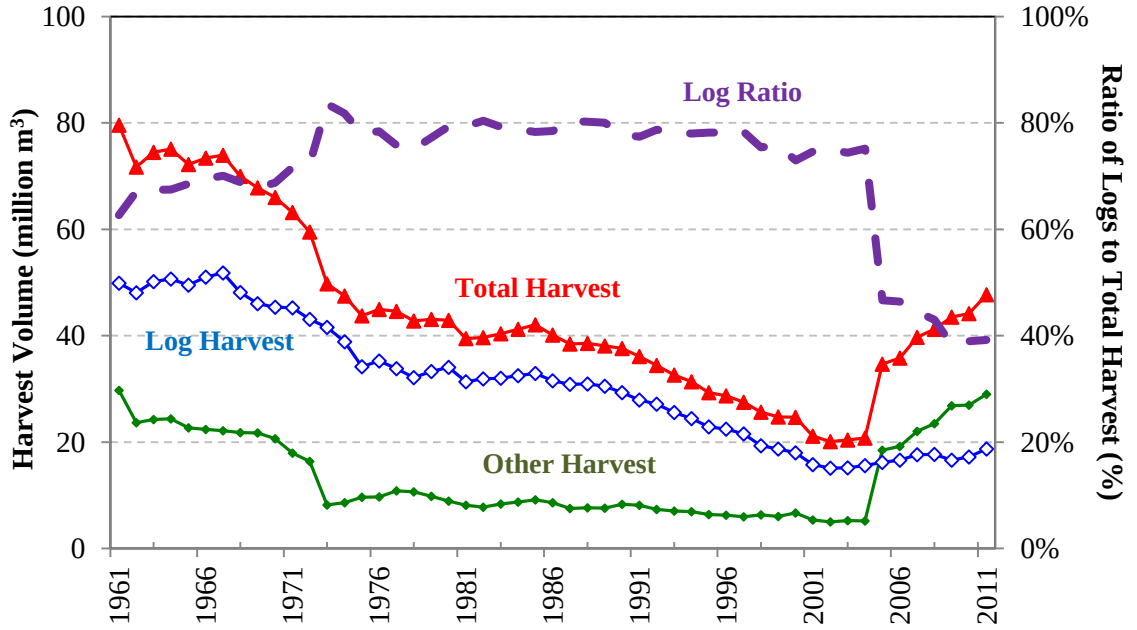

Figure 14 Timber harvest in Japan with ratio of logs to total timber harvest.

[1] *The Japanese government developed the Kyoto Protocol Target Achievement Plan in 2005. In response to this Achievement Plan, a large amount of budget was allocated to the Forestry Agency for the promotion of domestic forest management (esp. thinning) since 2005. This is the main reason why timber harvest increased dramatically in 2005.*

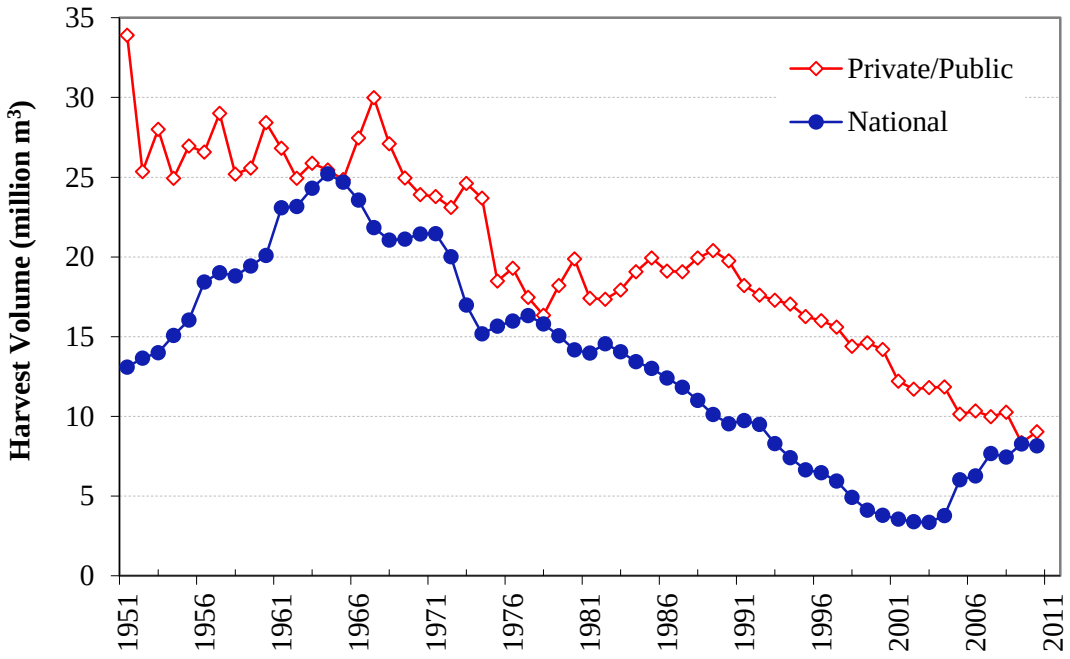

Figure 15 Total volume of timber harvested, by forest ownership.

Harvest, by species

At the species level, there have been two important changes in the mix of logs harvested. First, as described above, the volume of hardwood logs harvested has declined significantly since the mid-1970s (Figure 16). While, there is little species specific data collected for the hardwood harvest in Japan, anecdotal data collected through personal interviews in Japan suggest that the main hardwood species harvested is oak followed by beech and ash (one reason for this is that the bulk of the hardwood harvest is used to produce chips for the pulp and paper industry, hence the species is less important than the volume).

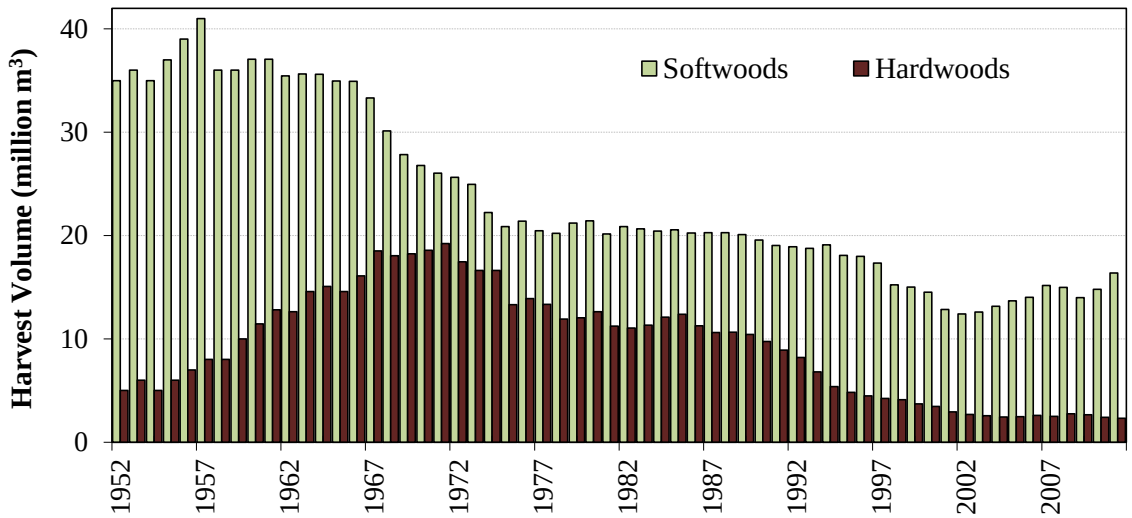

Figure 16 Total harvest volume, softwood vs. hardwoods.

Second, the volume of pine harvested in Japan declined significantly between 1952 and 1998. During this period, the volume of pine logs harvested declined from 11 million cubic meters (28.2% of the total log harvest) to 2 million cubic meters (10.5% of the total log harvest) (Figure 17).

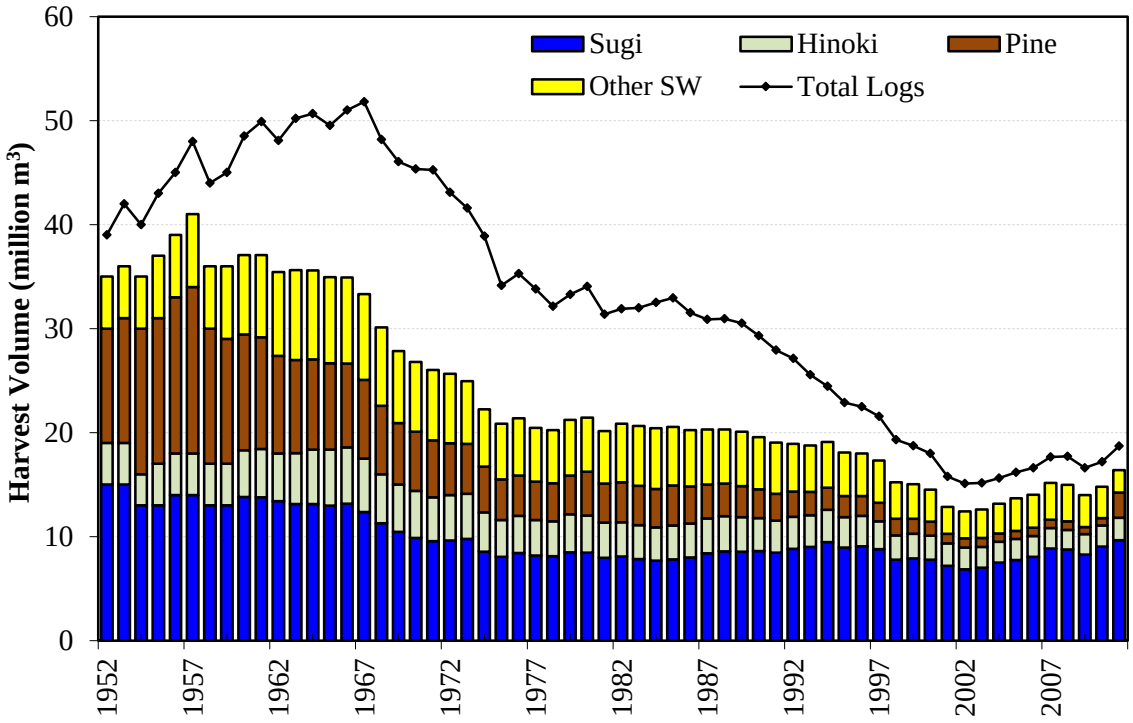

Figure 17 Total log harvest volume in Japan, by species.

From 1952-1974, the percentage of hardwoods in Japan's timber harvests increased from 12.8% to 43.6% of the total logs harvested. In contrast, the softwood log harvest during this period declined substantially. Between 1975 and 1990, the volume of softwood logs harvested stabilized at approximately 20 million cubic meters, while the volume of hardwood logs harvested was approximately 10 million cubic meters. Following the end of the Bubble Economy in 1989, timber harvest volumes dropped from 30 million cubic meters to 15 million cubic meters by 2003, with substantial declines in the harvest of both softwood logs and hardwood logs. It is only since Kyoto Protocol was signed, followed by the introduction of the Revitalization Plan in 2005, that there has been a resurgence in the timber harvest, with the timber harvest projected to reach 20 million cubic meters in 2012. However, virtually all of the increase can be attributed to increased harvests of *sugi*, and to a lesser extent, pine (Figure 16). The volume of hardwood logs harvested actually declined between 2005 and 2011.

Stumpage price trends

The stumpage price data displays not only the price trends for the three major softwood species, it also highlights the fact that each of these species is differentiated in the marketplace (Figure 18). This differentiation is clearly illustrated by the fact that *hinoki* consistently receives a price premium relative to *sugi* and pine, particularly after 1965. In contrast, the price premium for *sugi* relative to pine is substantially less than that for *hinoki*. The data shows that since 1965 *hinoki* has been perceived to be the most valuable softwood species as indicated by the huge price premium that buyers are willing to pay for *hinoki* logs. While the price premium for *sugi* logs over pine is substantially smaller, end-users clearly attach a higher value to *sugi* relative to pine. Partly this is due to the cultural role of *sugi* within the post

and beam construction system where it has been traditionally used in horizontal posts and in exposed applications within the traditional *tatami* room.

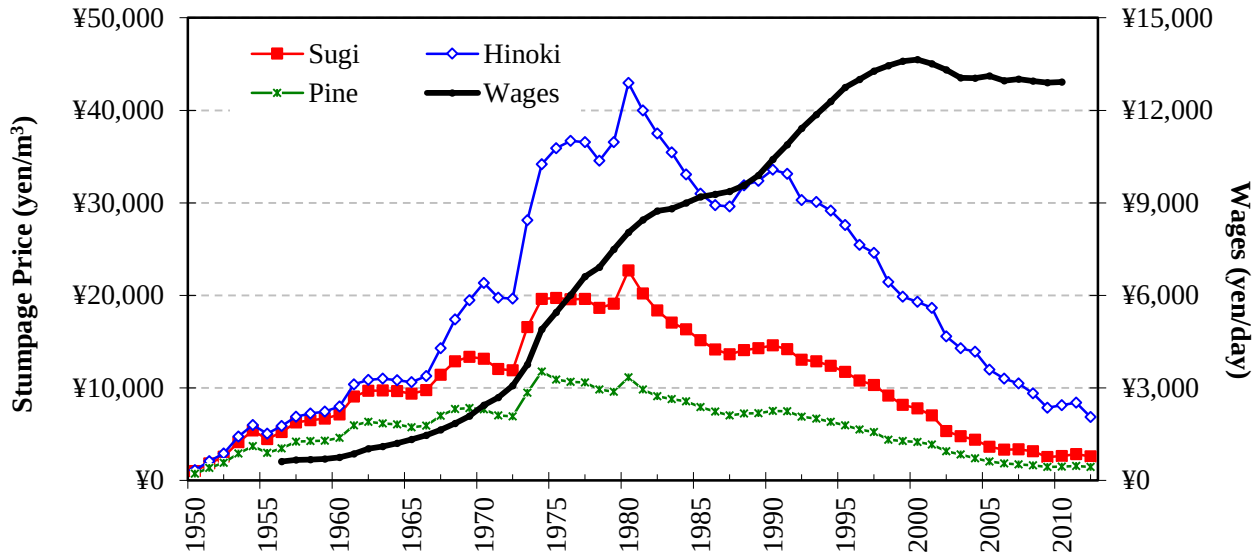

Figure 18 Forestry labor wages relative to stumpage price trends for the major SW species.

Between 1966 and 1980, stumpage prices for these species rose at an annual rate of 8.8% for *sugi*, 18.7% for *hinoki* and 5.9% for pine. It was during this period that the price differential between *hinoki* and the other major species widened significantly. From 1950-1966, the price premium for *hinoki* relative to *sugi* had averaged 12.6%, yet during the period 1966 to 1980, the price premium for *hinoki* (relative to *sugi*) rose to as high as 92% and averaged a hefty 68.8%.

Beginning in 1981, stumpage prices dropped significantly for all three of the major softwood species. The stumpage price declines ranged from an average annual price decline of 2.6% for *hinoki* to 2.9% for pine, and 3.1% for *sugi*. Despite these declines, the price differential for *hinoki* relative to the other major softwood species continued to rise, reaching 230% in 2006. From 1981-2012, the price premium for *hinoki* averaged 158.4%, relative to *sugi*. This is a major reason why more area has been reforested with *hinoki* than *sugi* since the early 1980s.

MAFF has calculated the internal rate of return for *sugi* and *hinoki* plantations during the period 1965 thru 2000, Figure 19. The IRR data shows several troubling trends. First, *hinoki* plantations have traditionally and consistently provide a substantially higher return than *sugi* plantations. Second, returns from both *sugi* and *hinoki* forest plantations have been declining throughout the entire period. Third, in the absence of subsidies, the IRR for *sugi* plantations is negative while for *hinoki* plantations it is close to zero. Finally, even with subsidies the IRR on plantations has been declining and is quite low, just 1.0% for *sugi* and 2.5% for *hinoki* in 2000.

It is against this setting of rapidly rising stumpage prices throughout the 1970's, coupled with a booming economy and a strengthening yen, that we see the increased importation of wood products into Japan. In the face of rapidly escalating domestic wood prices, Japanese wood manufacturers and home builders quickly determined that the strong yen made purchasing imported wood products a better value proposition than continuing to purchase domestic wood products. At the same time, by negotiating quarterly price contracts for imported wood products, Japanese importers and manufacturers were able to reduce the price volatility that had become problematic with domestic wood. As a result, the demand for

domestic wood declined as its competitiveness fell and imported wood began to be increasingly substituted for domestic wood in the housing market.

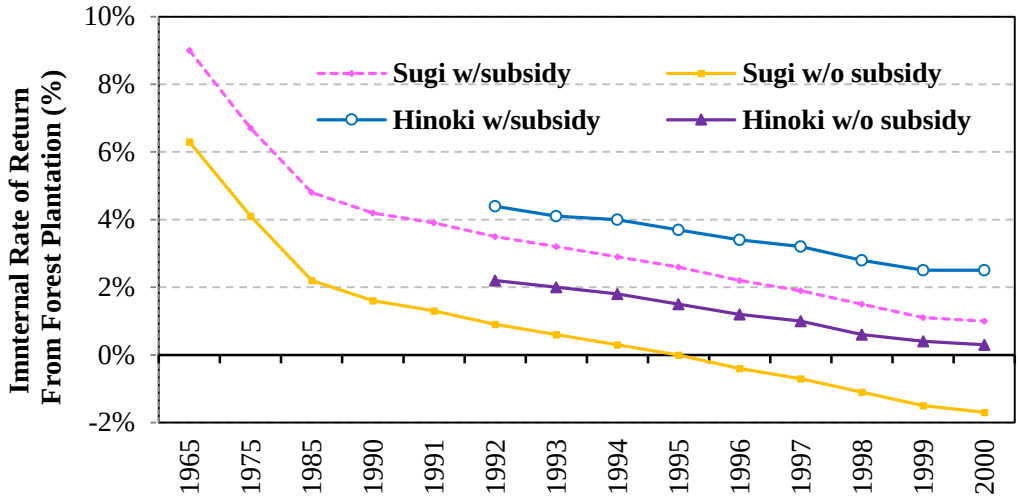

Figure 19 Internal rate of return for forestry plantations in Japan.

Labor wages and demographics

In contrast to stumpage prices, logging wages have increased steadily since 1960 (Figure 18) while the number of forestry workers have plunged from over 500,000 workers in 1955 to just 50,000 in 2007. At the same time, there has been a significant demographic shift in the forestry industry as the age structure of the workforce has changed dramatically (Figures 20 and 21). The most recent survey of forestry workers shows that 57% were over the age of 50 while less than 10% were under the age of 30.

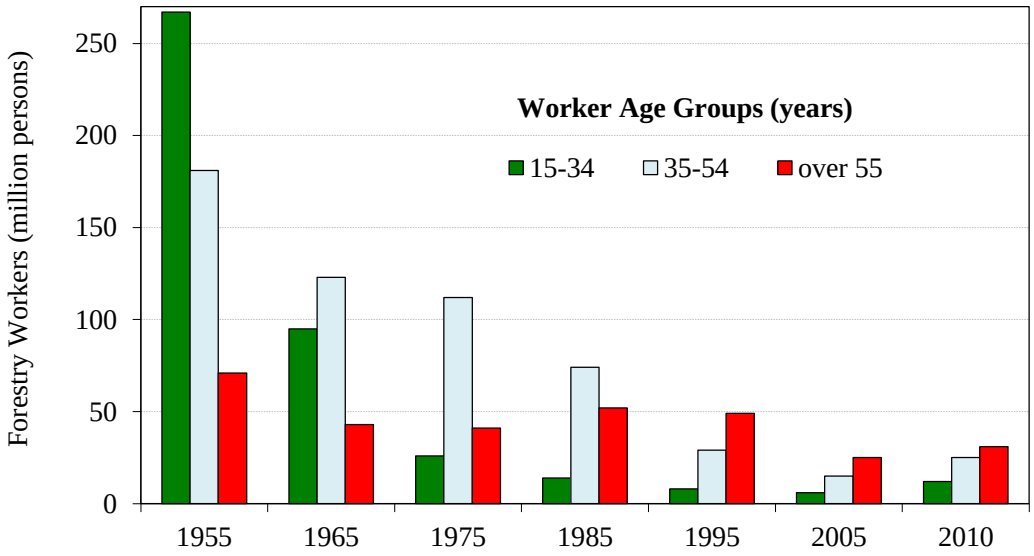

Figure 20 Demographic trends for forestry workers in Japan.

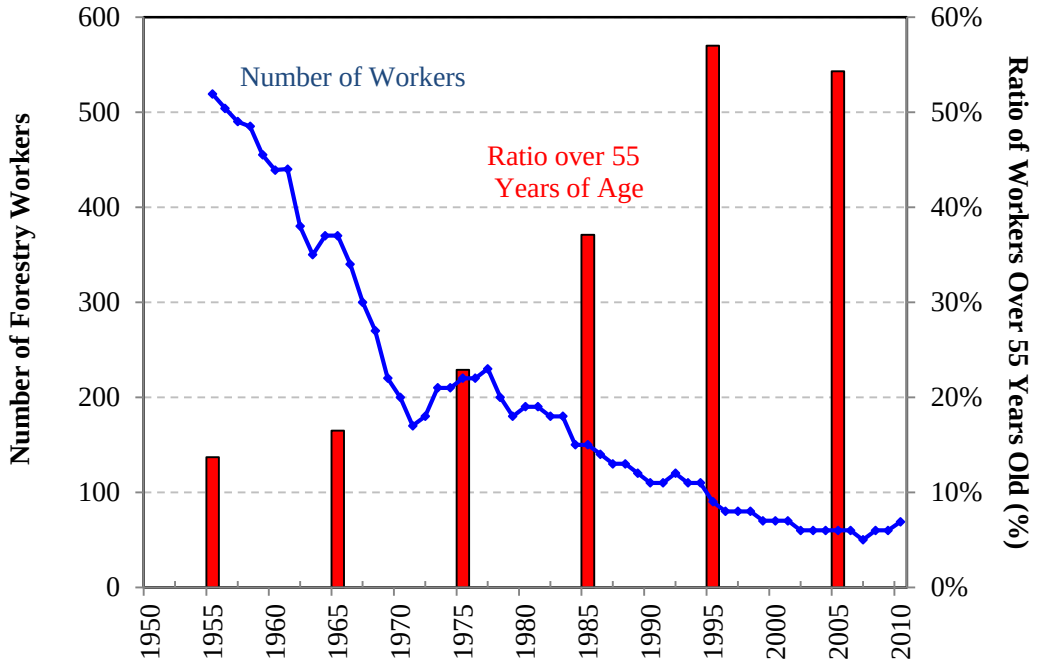

Figure 21. Number of forestry workers and ratio of workers over 55 years of age.

The combination of a declining and aging workforce and a rising wage structure has serious implications for the productivity and efficiency of the forestry industry. Recognizing this problem, one component of the Revitalization Plan developed by MAFF (the Green Employment Program) has focused on expanding the forestry workforce by emphasizing the outdoor and environmental aspect of the job[2]. This strategy has been successful to a limited extent, and the employment data shows that the forestry workforce has grown from 50,000 in 2007 to 69,000 in 2010. However, growing the workforce will be a difficult proposition as few young workers value the experience of working in rural areas where there are few young people and the work is characterized by the Japanese phrase: *"kitanai, kiken, kitsui"* (difficult, dangerous, demanding).

Summary of Forest Industry Trends

Japan's forest sector faces several physical and structural challenges, most of which adversely impact the competitiveness of the forestry sector in general and the small private forest owner in particular. One of the most basic obstacles is Japan's geography. Many forests are located in steep terrain, which makes forest management challenging and increases the costs of building roads, harvesting, and transporting logs from the forest. These high costs are further exacerbated by the fact that the majority of private forests are very small, which makes it difficult for the owners to raise capital and harvest their forests. The small size of private forest holding also makes it difficult to coordinate management and harvest activities to ensure a reliable supply of raw materials to local wood processing facilities, making it difficult for companies to invest in expanding the wood manufacturing capacity in local areas. At the same time, emigration from rural to urban areas reduces the number of available workers. The workers who remain are aging and few younger workers are drawn to the hard and dangerous labor involved with forestry, despite the fact that wages for forestry work are increasing.

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[2] *The idea of "human resource development" in the Revitalization Plan focuses on developing a highly-skilled workforce and knowledgeable managers, like foresters, not on increasing the overall number of the workforce. The major increases in less skilled workers will be achieved through the "Green Employment program" which the Forestry Agency started in 2003 in order to increase the number of young forestry workers.*

Meanwhile, on the demand side, stumpage prices for the major domestic species (*sugi*, *hinoki*, and pine) have been declining precipitously since 1980. Caught between rising costs of production and declining prices, many forestry households are finding it more and more difficult to continue in business. This point is aptly illustrated by a set of financial statistics published by the Forestry Agency in Japan. Based on a time series of production cost and stumpage price data, the Forestry Agency has calculated the internal rate of return derived from an investment in a *sugi* plantation. Using their own methodology, the Forestry Agency estimates that the internal rate of return from a *sugi* plantation has declined from 6.3% in 1965 to 4.1% in 1975 to 2.1% in 1985 to 0.6% in 1993 to -1.7% in 2000 (the most current year for which this data is available). Their results clearly show that it is becoming virtually impossible to manage a forest plantation as a viable economic enterprise.

This situation is summarized very succinctly in a passage from a book on the historical growth and performance of Asian economies[3]. Discussing the business ethics and factors influencing competitiveness in rural Japan, author Nicholas Kristoff and Sheryl WuDunn (2000) emphasized the relationship between business practices and culture that impacts the ability of small forest owners to maintain their profitability.

> *The paramount concern was not prices or cost but giri-ninjo, an ancient Japanese ethic that translates roughly as "duty and empathy". The result throughout Japan…was an economy whose outward façade was skyscrapers and business suits but whose human interactions were still rooted in traditional concepts of honor. And the collision of the international market economy with rural Japan's giri-ninjo economy was not a pretty sight. Americans may think of Japanese businessmen as ruthless, calculating tigers, but this is true only in sectors that compete abroad. Domestic companies are the opposite. (pp:84)*

In specifically relating this philosophy to the situation of small forest owners, Kristoff and WuDunn points out that most small forest owners employ an economic principle that does not necessarily aim to maximize profits, but rather takes into account community welfare considerations. This point is highlighted during a discussion he has with a local forest owner in the Mie prefecture.

> *The problem is the same as that faced by many sectors of the Japanese economy: A long-sheltered business was exposed to international competition and battered by it. Businesses that had thrived under protectionism faced [international] companies that had been forged in the furnace of free markets…Throughout the 1990s logs and finished wood began to pour into Japan at prices [rural forest owners] could never compete with, and 80 percent of Japan's lumber is now imported. "My break-even cost of selling a log in Tokyo is higher than the price of an American log in Tokyo," Zenzaburo complained.*
>
> *The underlying difficulty…was that business was not run according to market economy principles. [Rural forest owners] are not profit-maximizers. They pay their employees above market wages and hire more workers than they should. They produce high quality timber that they can feel proud of, they build roads and provide land for schools and buttress the economy, but while all this is admirable, it makes them economically inefficient as timber producers. (pp:83)*

The high cost of forestry in Japan relative to other supply regions of the world places Japanese small forest owners at a competitive disadvantage in the marketplace. This suggests that it may be time to reassess the future role of the forestry sector in Japan. Given the comparative disadvantage that Japan faces in the production of timber, it may be time to focus on the environmental role of the forests, rather than the role of the forest as a raw material supply. While this is certainly one small component of the Revitalization Plan, the bigger emphasis is providing subsidies to support the increased use of domestic

[3] *Kristoff, N.D. and S. WuDunn, 2000. Thunder from the East. Alfred A. Knopf Publishers, New York. 377 pages.*

timber and thereby offset its competitive disadvantage relative to imported timber. One could certainly argue that the huge amount of subsidies required to invest in the infrastructure to expand the supply of domestic wood and support the increased demand for domestic wood might be better spent on improving the environmental functions of forests rather than the wood supply.

4. Wood Manufacturing Industry

Japanese Softwood Lumber Industry

The lumber industry in Japan has traditionally been characterized by small-scale "mom and pop" sawmills operating within very localized, rural markets. These mills typically process domestic logs into lumber for use by local home builders. Most of their lumber is sold to local wholesalers who perform many of the marketing functions for the sawmill. As a result, most small sawmills have a poor understanding of the markets and demand for their products. The strong yen and increased competition from imported lumber has contributed to the problems confronting local sawmills, as has the closure of a large number of small rural sawmills over the past twenty years due to the combination of outdated sawmill technology and the high cost of domestic logs. These small rural sawmills are often family run and the continued movement of population from the rural areas to the big cities has caused many of these small sawmills to close when the owner retires.

Large sawmills located in the industrial zones of port cities have to a large extent replaced small rural sawmills, at least in terms of production volumes if not number of sawmills. These larger sawmills often process a combination of imported logs and domestic logs, although some of the largest sawmills process imported logs almost exclusively. These mills are larger, more efficient, with more modern equipment and better access to capital than the small local mills. However, these large mills are also confronted with the rising costs of production that have plagued the small rural mills and they are also finding themselves at a competitive disadvantage to foreign lumber producers. The recent adoption of the Revitalization Plan has resulted in government subsidies for sawmills that participate in the program to revitalize and expand the sawmill capacity for domestic wood.

Demographics of the Japanese Softwood Lumber Industry

Number of sawmills, by region

The number of sawmills in Japan has been declining steadily since 1963 while lumber production has been falling since 1973, although there has been a modest increase in lumber production since 2009 (Figure 22). The number of sawmills in Japan, which totaled 25,295 in 1963, had fallen to 5,927 by 2012. As a consequence, lumber production has declined from a high of 45.3 million m^3 in 1973 to 9.4 million m^3 in 2012. It is interesting to note that while the number of sawmills has declined by 75% since 1973, the decline in lumber production over the same time period has been a much higher 78.9%. This signifies that mill closures have not been limited to just the small, rural "mom and pop" sawmills.

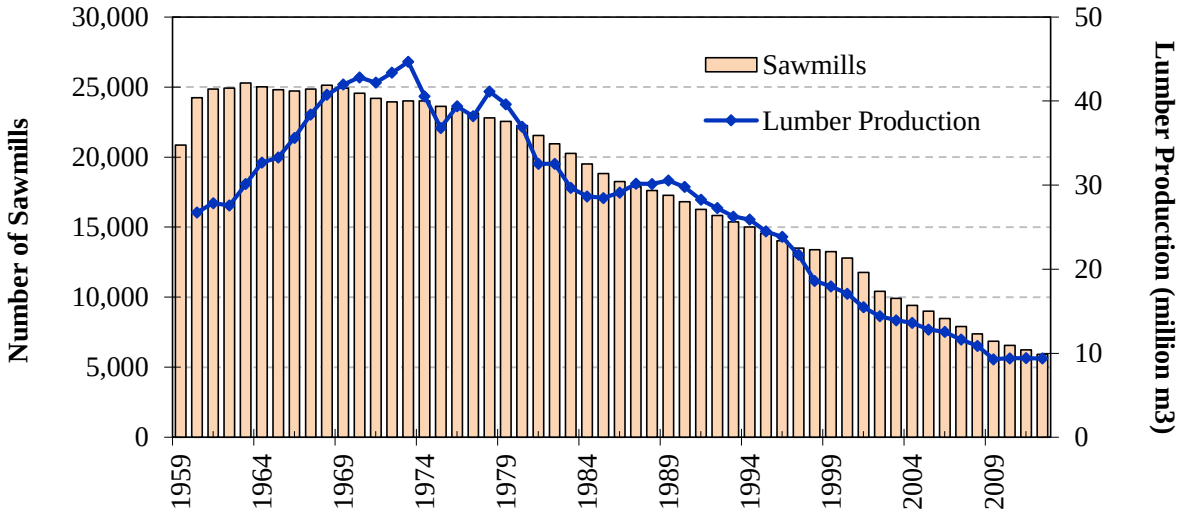

Figure 22 Number of sawmills and lumber production in Japan, 1959-2012.

The number of sawmills in 2012 is estimated to have been 5,927, a decline of 57.7% from 1996. Meanwhile, the number of employees in the sawmill industry fell to 33,479 in 2010 (the most recent year data is available), a decline of 66.3% since 1996, Table 5. Similarly, lumber production declined 60.6% between 1996 and 2012. The data presented in Table 5 shows that substantial numbers of mill closures occurred across every region of Japan. The decline in regional lumber production ranged from 21.8% in the Chugoku region to 52.8% in the Kansai region. This trend has been extremely worrisome to the Japan Forestry Federation (Zen Mokuren) and MAFF, and many efforts have been made to support the forestry and sawmill industries in rural regions, including the recently implemented Revitalization Plan.

Several measures of sawmill productivity are provided in Table 6, although the reader should keep in mind that these numbers are averages. Given the wide variation in sawmill size in Japan it is perhaps better to consider the lumber production per employee data. Based on this data, it would appear that the more productive sawmills are located on the island of Hokkaido and in the Chugoku and Shikoku regions. In contrast, sawmills with the lowest productivity tend to be located in the Kanto, Kansai and Chubu regions. The data also show that both the number of workers and the average lumber production of sawmills has declined in every region. However, a recent trend towards investing in new and larger sawmilling facilities means that sawmill productivity (measured in terms of lumber production per employee) has actually increased in almost every region with the exception of Chubu.

Sawmills processing imported logs tend to have a higher level of lumber production, as the log input data suggests (Tables 7 and 8). In 2010, the average annual lumber production for mills that process domestic logs was 1,023 m^3, while it was 1,582 m^3 for mills that process imported logs. This is hardly surprising, given the fact that imported sawlogs, in general, have a larger diameter and are higher quality than domestic sawlogs. As a result, we would expect that sawmills processing imported sawlogs would be more efficient with a higher level of productivity. It is interesting to note that in 2004, the volume of domestic logs being processed by sawmills exceeded the volume of imported logs being processed for the first time in more than a decade. The highest share of imported logs are found in the Chugoku, Kanto and Kansai regions and the share of US logs in the imported log mix exceeds 50% in every region except Kansai and Chubu (Table 9 and 10).

Table 5 Number of sawmills, employees, and lumber production (m^3) in Japan, by region.

Region	1996			2004			2010		
	Sawmills	Employees	Production	Sawmills	Employees	Production	Sawmills	Employees	Production
Total	13,990	99,464	24,206,000	9,407	55,118	13,603,000	6,519	33,479	9,415,000
Hokkaido	482	7,149	2,115,000	269	3,600	1,276,000	192	2,165	814,000
Tohoku	2,014	15,467	3,778,000	1,356	7,878	1,842,000	933	4,912	1,175,000
Kanto	1,694	8,929	1,552,000	1,121	4,714	802,000	767	3,321	1,092,000
Chubu	3,784	22,779	4,773,000	2,505	12,201	2,344,000	1,606	6,274	1,052,000
Kansai	2,234	14,167	3,075,000	1,531	8,023	1,363,000	1,133	4,655	997,000
Chugoku	1,044	8,831	2,894,000	707	5,493	2,282,000	471	3,266	1,388,000
Shikoku	827	7,139	2,481,000	587	4,197	1,326,000	404	2,554	863,000
Kyushu-Okinawa	1,911	15,003	3,538,000	1,331	9,012	2,368,000	1,013	6,332	2,034,000

Source: Japan Ministry of Agriculture, Forestry and Fisheries, various years.

Table 6 Productivity of Japanese sawmills between 1996 and 2010.

Region	Production per Sawmill (1,000m^3)			Production per Employee (m^3)		
	1996	2004	2010	1996	2004	2010
Total	1,730	1,446	1,444	243	247	281
Hokkaido	4,388	4,743	4,239	296	354	376
Tohoku	1,805	1,358	1,259	236	234	239
Kanto	866	715	1,423	159	170	329
Chubu	1,417	936	655	215	192	168
Kansai	1,415	890	879	207	170	214
Chugoku	2,480	3,228	2,946	281	415	425
Shikoku	2,766	2,259	2,136	324	316	338
Kyushu-Okinawa	1,601	1,779	2,007	200	263	321

Source: Japan Ministry of Agriculture, Forestry and Fisheries, various years.

Table 7 Summary of softwood sawmills in Japan, by region, 2010

Region	Domestic Sawmills	Imported Sawmills	Domestic Lumber Production	Imported Lumber Production	Production/Mill (Domestic Logs)	Production/Mill (Imported Logs)	Domestic to Imported ratio
Total	**6,048**	**2,042**	**6,185,000**	**3,230,000**	**1,023**	**1,582**	**64.7%**
Hokkaido	192	40	793,000	21,000	4,130	525	786.7%
Tohoku	912	285	1,041,000	134,000	1,141	470	242.8%
Kanto	699	189	494,000	592,000	707	3,132	22.6%
Chubu	1477	752	585,000	467,000	396	621	63.8%
Kansai	1006	366	461,000	536,000	458	1,464	31.3%
Chugoku	419	165	385,000	1,000,000	919	6,061	15.2%
Shikoku	359	111	484,000	379,000	1,348	3,414	39.5%
Kyushu-Okinawa	984	134	1,936,000	96,000	1,967	716	274.6%

Source: Japan Ministry of Agriculture, Forestry and Fisheries, various years.

Table 8 Log input volumes for sawmills in Japan, by region and log type.

Region	1996 Log Sources (1,000 m^3)			2004 Log Sources (1,000 m^3)			2010 Log Sources (1,000 m^3)		
	Total	Domestic	Imported	Total	Domestic	Imported	Total	Domestic	Imported
Total	**35,545**	**16,154**	**21,705**	**21,705**	**13,246**	**14,203**	**15,762**	**10,582**	**5,180**
Hokkaido	3,713	2,526	2,432	2,432	2,068	884	1,619	1,548	71
Tohoku	5,615	3,062	2,929	2,929	2,445	1,779	2,039	1,868	171
Kanto	2,166	1,223	1,185	1,185	978	613	1,814	819	995
Chubu	6,984	1,726	3,639	3,639	1,366	3,901	1,578	923	655
Kansai	4,420	1,647	2,040	2,040	1,331	1,766	1,535	743	792
Chugoku	4,337	1,102	3,892	3,892	897	2,780	2,410	658	1,752
Shikoku	3,369	1,308	2,047	2,047	1,050	1,500	1,401	801	547
Kyushu-Okinawa	4,941	3,560	3,541	3,541	3,111	980	3,366	3,216	147

Source: Japan Ministry of Agriculture, Forestry and Fisheries, various years.

Table 9 Ratio of specific log imports to total log imports.

Region	1996			2004			2010		
	Domestic Ratio	Imported Ratio	US Share of Imports	Domestic Ratio	Imported Ratio	US Share of Imports	Domestic Ratio	Imported Ratio	US Share of Imports
Total	**0.45**	**0.55**	**0.66**	**0.53**	**0.47**	**0.58**	**0.67**	**0.49**	**0.69**
Hokkaido	0.68	0.32	0.49	0.79	0.21	0.29	0.96	0.05	0.89
Tohoku	0.57	0.43	0.67	0.66	0.34	0.39	0.92	0.09	0.75
Kanto	0.49	0.51	0.80	0.71	0.29	0.72	0.45	1.21	0.96
Chubu	0.26	0.74	0.57	0.31	0.69	0.31	0.58	0.71	0.31
Kansai	0.32	0.68	0.71	0.47	0.53	0.58	0.48	1.07	0.33
Chugoku	0.40	0.60	0.75	0.19	0.81	0.85	0.27	2.66	0.83
Shikoku	0.32	0.68	0.66	0.45	0.55	0.62	0.57	0.68	0.63
Kyushu-Okinawa	0.61	0.39	0.64	0.86	0.14	0.61	0.96	0.05	0.63

Source: Japan Ministry of Agriculture, Forestry and Fisheries, various years.

Table 10 Trends in Japanese sawmills and log inputs by major source of logs.

	Domestic Logs			Majority Domestic Logs			Majority Foreign Logs			Foreign Logs		
	Mills	Log Input	Ave. Input	Mills	Log Input	Ave. Input	Mills	Log Input	Ave. Input	Mills	Log Input	Ave. Input
1996	5,892	11,338,000	1,924	2,486	4,727,000	1,901	3,480	6,309,000	1,813	2,120	13,172,000	6,213
1999	5,568	9,818,000	1,763	2,246	3,361,000	1,496	2,715	4,056,000	1,494	1,711	10,214,000	5,970
2001	5,271	9,039,000	1,715	2,017	2,673,000	1,325	2,234	3,132,000	1,402	1,434	9,035,000	6,301
2002	5,082	8,738,000	1,719	1,969	2,353,000	1,195	2,027	2,824,000	1,393	1,317	8,406,000	6,383
2003	4,995	8,813,000	1,764	1,843	2,391,000	1,297	1,804	2,576,000	1,428	1,208	8,077,000	6,686
2004	4,913	9,211,000	1,875	1,779	2,270,000	1,276	1,591	2,307,000	1,450	1,104	7,917,000	7,171
2005	4,978	9,704,000	1,949	1,560	1,879,000	1,204	1,457	1,960,000	1,345	960	6,997,000	7,289
2006	4,897	9,684,000	1,978	1,448	1,997,000	1,379	1,222	1,976,000	1,617	866	6,685,000	7,719
2007	4,723	10,275,000	2,176	1,295	1,698,000	1,311	1,093	1,653,000	1,512	727	5,822,000	8,008
2008	4,661	9,622,000	2,064	1,215	1,501,000	1,235	860	1,461,000	1,699	594	4,894,000	8,239
2009	4,543	9,025,000	1,987	1,048	1,261,000	1,203	669	1,929,000	2,883	541	3,064,000	5,664
2010	4,442	9,344,000	2,104	975	1,333,000	1,367	643	981,000	1,526	426	4,104,000	9,634
2011	4,372	10,326,000	2,362	841	1,154,000	1,372	565	1,950,000	3,451	397	2,996,000	7,547
2012	4,164	10,251,000	2,462	814	1,109,000	1,362	512	1,759,000	3,436	393	3,128,000	7,959
2013	4,147	10,975,000	2,646	753	1,100,000	1,460	410	2,090,000	5,098	349	3,106,000	8,900

Number of sawmills, by size

As discussed earlier, many of the sawmills in Japan are extremely small and inefficient "mom-and-pop" type operations. This is a carryover from the period extending roughly from 1950-1975 when most of the single family houses in Japan were built using the traditional post and beam method. The structural components for traditional post and beam houses built during this period were generally produced by skilled carpenters who cut the many structural members with their complicated joints and connectors by hand on the construction site. Most of these houses had very traditional architectural designs and utilized extensive amounts of interior wood paneling, moulding and millwork, particularly in the tatami room. It was this demand for high quality moulding and millwork lumber products that supported the development of the sawmill sector that exists in Japan today.

Unfortunately, the transition of the homebuilding industry away from fabricating structural components on the construction site to the production of structural components by highly precise CAD/CAM machine centers in precut facilities had an adverse impact on these smaller traditional sawmills because they could not produce kiln dried lumber to the exacting specifications of the post and beam precut manufacturers. Similarly, the declining demand for traditional tatami rooms among younger Japanese home buyers, who prefer a western style-architectural design with a more open floor plan, further reduced demand for the lumber produced by these smaller sawmills. The demographic sawmill data presented in Table 11 substantiates the small size of most sawmills in Japan, even in 2010. Despite the closure of a huge number of sawmills over the past decade, fully 66.6% of the sawmills in Japan still employ four or fewer workers while an additional 21.4% employ between 5 and 9 workers. In contrast, less than 4% of all sawmills operating in Japan in 2010 employed twenty or more workers. Clearly the sawmill industry in Japan continues to be characterized by the small "mom-and-pop" sawmills located primarily in rural areas, which are processing domestic *sugi* and *hinoki* logs for use by local builders. Without a doubt there is still much room for industry consolidation and the closure of small, inefficient sawmills.

Table 11 Number of sawmills in Japan, by number of employees and region, 2010.

Region	Sawmills	<4	5-9	10-19	20-29	30-49	50+
Total	**6,519**	**4,344**	**1,398**	**555**	**134**	**54**	**34**
Hokkaido	192	30	74	67	11	6	4
Tohoku	933	597	217	80	29	7	3
Kanto	767	565	139	51	6	3	3
Chubu	1,606	1,182	300	105	11	7	1
Kansai	1,133	828	228	56	9	9	3
Chugoku	471	313	104	30	12	5	7
Shikoku	404	233	106	39	16	8	2
Kyushu-Okinawa	1,013	596	230	127	40	9	11

Source: Japan Ministry of Agriculture, Forestry and Fisheries, various years.

Summary of Trends in the Japanese Sawmill Industry

Japanese self-sufficiency in lumber dropped from 98% in 1961 to 59% by 2012 (Figure 23). While some of this drop can be attributed to rising imports, the biggest factor has been a huge drop in domestic production as described earlier. Between 1973 and 2012, lumber consumption in Japan dropped by two-thirds from 48.3 million m^3 to 15.9 million m^3.

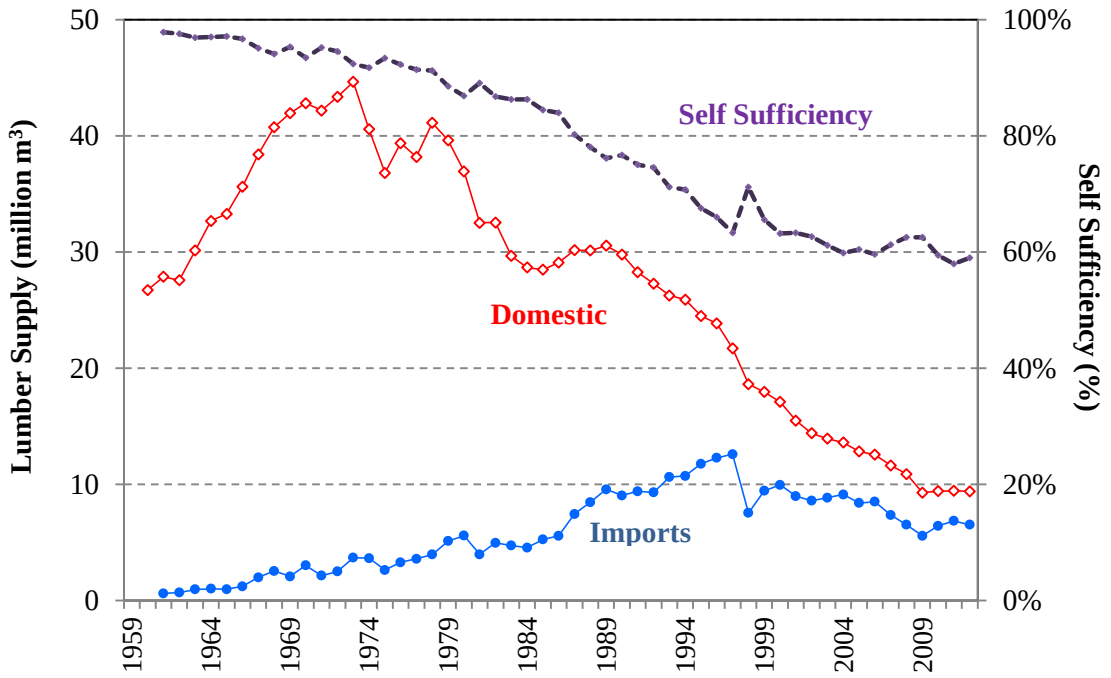

Figure 23 Trends in the Japanese lumber supply and self-sufficiency.

There are a variety of factors that adversely affect the competitiveness of Japan's sawmill industry. These factors include the structure of the industry itself, including rising production costs and the small, regional structure of the sawmill industry, lack of coordination within the supply chain, lack of investment in efficient processing and kiln-drying technology, regulatory reform within the residential construction industry that has affected the demand for lumber produced from domestic species like *sugi*, the transition to pre-cut structural components in the post and beam industry, the continued strength of the yen, and imports of low cost, high quality logs and lumber.

Foreign suppliers continue to export large volumes of wood products to Japan. Generally these imported wood products are lower priced with less price volatility and higher quality than domestically produced wood products and local Japanese sawmills find themselves at a competitive disadvantage in many of the larger urban markets, particularly within the new price sensitive market environment that exists within the homebuilding sector. While competition is somewhat less intense in rural markets, many foreign suppliers are actively looking to expand their sales into these markets as well. There is little doubt that competition within the Japanese lumber market will continue to increase. The increasingly competitive business environment will force more consolidation and closures within Japan's sawmill industry, particularly within the huge 'mom-and-pop' segment of the industry.

Thus, in order to remain viable, domestic lumber manufacturers must develop a strategy that will allow them to compete within the new business environment. However, rather than undertake the reforms and consolidation required to become internationally competitive, many companies and industry associations within the Japanese sawmill and forestry sectors continue to seek regulatory relief from competition

through a variety of non-tariff regulatory constraints and subsidies. For example, the pre-cutting industry, which manufactures the structural components for over 80% of the post and beam houses built in Japan, requires kiln dried lumber that is straight and machined to highly accurate tolerances as a raw material input to their manufacturing process. In response, most imported lumber is now kiln-dried and cut to the specifications required by pre-cut manufacturers. However, despite this change in material specification within the largest demand segment for structural lumber, the domestic Japanese sawmill industry has been extremely slow to change. In fact, by 2007, less than one-quarter of the structural softwood lumber produced in Japan was kiln-dried (22.6%) and only 16.5% of Japanese sawmills had invested in kiln drying facilities.

Regulatory constraints and subsidies designed to protect the domestic wood manufacturing industry cover a range of options. For example, in 2004 a new association was formed to promote the use of domestically produced timber, particularly *sugi* and *hinoki*, within the Japanese market. This association, (named the Domestic Wood Lumber Association), was also tasked with developing export markets for *sugi* logs, particularly in China (JLR 2005). The initial membership of this association was 27 companies. In response, log exports from Japan to China, while still small, have jumped from 7,000 m^3 in 2003 to almost 115,000 m^3 in 2012. As a result of programs supported by MAFF and MLIT, many prefectures and local governments currently offer subsidies to wooden home builders who utilize a specific percentage of domestic timber in their homes (generally 50% or more). By the end of 2011, it was reported that 42 out of 47 prefectures provide some type of subsidy to encourage the increased use of domestic timber in wooden houses (see Appendix C for a description of the types of subsidy being offered by each prefecture).

Some examples of programs that subsidize the use of domestic lumber include the following. Mie Prefecture has a prefectural certification system for Japanese cedar, Japanese cypress and other wood products manufactured within the prefecture. The new program, Wood of Mie, provides ￥360,000 per single family dwelling with a floor space of between 80 m^2 to 175 m^2 which uses 50% or more certified Mie lumber for posts, beams, wall or floor. Similarly, Ibaraki Prefecture provides a ￥200,000 subsidy through its Wood Care Action Program Ibaraki. In order to qualify for the subsidy, the wooden house must be built in a pre-designated area and must use 50% or more "Ibaraki" wood originating from Ibaraki prefecture. A further aim of the Wood care Action program is to increase the share of wooden houses built within Ibaraki prefecture to 66% by 2010 (AF&PA 2006).

In 2006 the Forestry Agency introduced a program euphemistically called the "New Production System" that is aimed at increasing the demand for domestic lumber through a program of subsidies targeted at streamlining the lumber distribution system and increasing the competitiveness of lumber manufacturers (JLJ 2006). The goals of the program are to: 1) improve the efficiency of the lumber distribution system, 2) encourage consolidation and the formation of lumber processing cooperatives, 3) improve the supply of timber to domestic processors and 4) support the profitability of forest owners practicing sustainable forest management (JLJ 2007). The New Production System Program (a name for the subsidy program) has been followed up with the Revitalization Plan which provides subsidies and support to promote the harvest and processing of domestic timber. To date this program has had mixed results within the sawmill industry. For example, while the production of domestic lumber increased slightly between 2009 and 2012, as did the self-sufficiency rate, the sawmill industry still saw the closure of almost 900 sawmills during this time period.

Japanese Plywood Industry

Plywood production, by product type

In contrast to the lumber industry, the plywood industry experienced a period of rapid growth in the post-war period through the early 1970's. However, similar to the situation in the lumber industry, since 1973 the plywood sector has been characterized by declining domestic plywood consumption and the closure of a large number of plywood mills (Figure 24). The consolidation and closure within the plywood industry is due to a different dynamic than that affecting the sawmilling industry. In the early 1960's, the Japanese plywood sector experienced tremendous growth as it imported low cost tropical hardwood logs from southeast Asia and produced plywood for both domestic consumption and export (Figure 25). The emergence of competing plywood industries, first in South Korea and later in Indonesia, forced the closure of many plywood mills in Japan beginning in the early 1970's. However, the combination of increasing demand for plywood during the Bubble Economy and a shrinking plywood production base resulted in a jump in plywood imports between the mid 1980's and the mid-1990's. Plywood imports remained relatively constant through 2006 when the global financial crisis hit the Japanese economy. Plywood imports have begun rising again since 2009 and particularly in 2011 when the Great Tohoku earthquake destroyed several plywood mills in northern Japan.

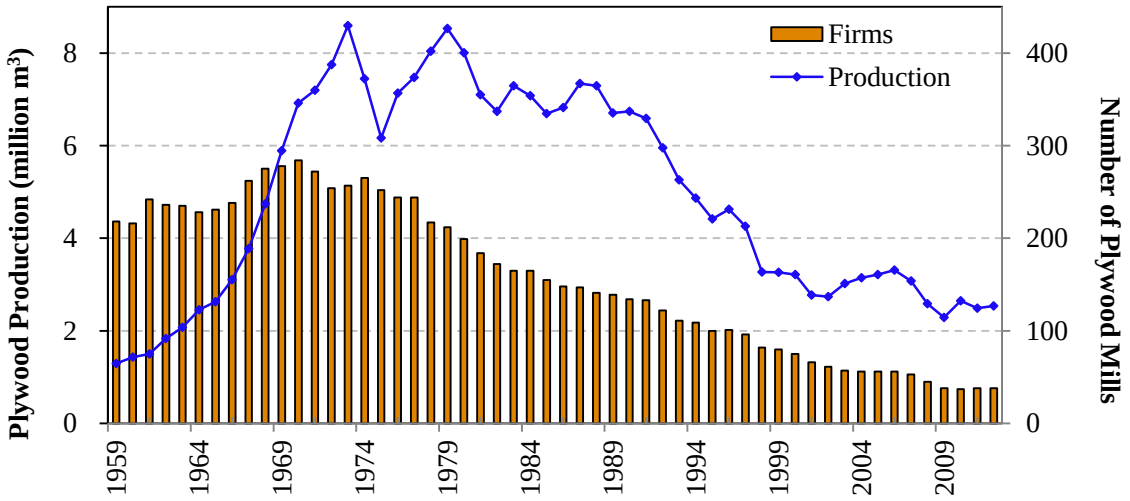

Figure 24 Trend in the number of plywood mills and plywood production between 1970 and 2012.

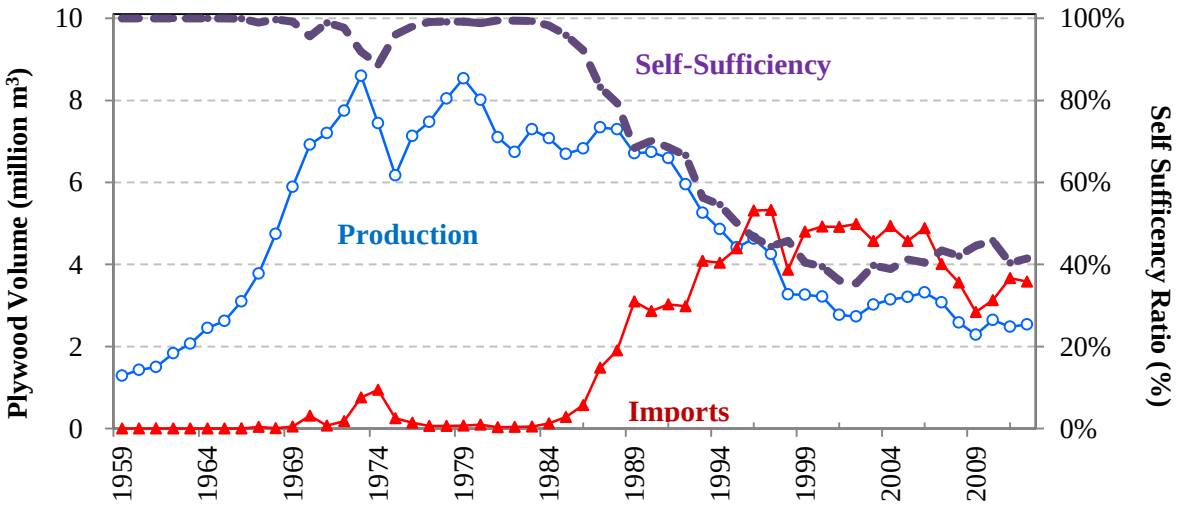

Figure 25 Japanese plywood production, imports and self-sufficiency, 1961-2012.

Since 1970, the number of plywood mills in Japan has declined from 284 to an estimated 38 in 2012, while the plywood production declined from 6.9 million m^3 to 2.5 million m^3, a 63.3% drop. From 1993-2012, hardwood plywood production has fallen from 5 million m^3 to 186,100 m^3, a drop of 96.3%, while the production of softwood plywood has increased from 254,000 m^3 to 2.3 million m^3. The material input statistics provided by MAFF show that the Japanese plywood sector has successfully transitioned from using imported tropical hardwood logs to imported Russian softwood logs to now using primarily domestic softwood logs (Figure 26). In 2012, it is estimated that almost two-thirds of the logs processed by plywood manufacturers were domestically produced with another quarter being sourced from North America. In the space of just twenty years, the Japanese plywood industry has made a dramatic transition in raw material supply and successfully transitioned from the production of hardwood plywood to softwood plywood. During that period, the share of softwood plywood in total plywood production increased from 4.8% in 1993 to 92.5% in 2011, representing a stunning transition within the Japanese plywood industry.

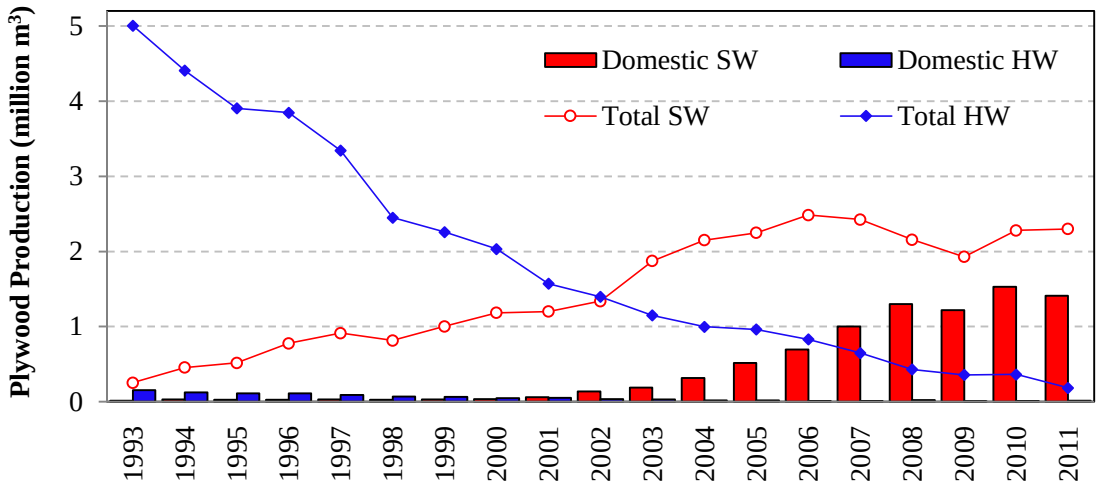

Figure 26 Trends in Japanese production and imports of hardwood and softwood plywood, 1993-2011.

Glue Laminated Lumber Industry

The 1995 Kobe earthquake provided the impetus for change within the Japanese housing industry. Dramatic changes to the building code sped up changes that were already occurring within the post and beam housing sector. One of the biggest changes was the transformation of the home building process from individually built houses that relied on the woodworking skills of small home builders to the use of prefabricated structural components that were machined to high tolerances within a precut facility using CAD-CAM equipment. This transition required the use of high quality structural lumber that was both kiln dried (to minimize shrinkage and warp after machining) and straight (to prevent jams in the precut machinery). These material requirements facilitated the transition from using solid sawn green lumber to build houses to using kiln dried glue laminated posts and beams.

Number of glulam mills, by region

While there has been a tremendous closure of both lumber and plywood mills in Japan since 1960, closures have been less of a problem for the glue-laminated lumber sector, since it developed later and the transition to precut structural components has favored the expanded use of glulam lumber. There were 294 manufacturers of glue-laminated (glulam) lumber in Japan in 2000 while the number of mills had

declined to 181 by 2012 (Figure 27). Despite the reduction in firms, production volumes within the industry have remained consistent at around 1.5 million cubic meters. While glulam manufacturers are located across Japan, over half (58%) are located in the northern and central regions of Tohoku, Chubu, and Kansai (Table 12).

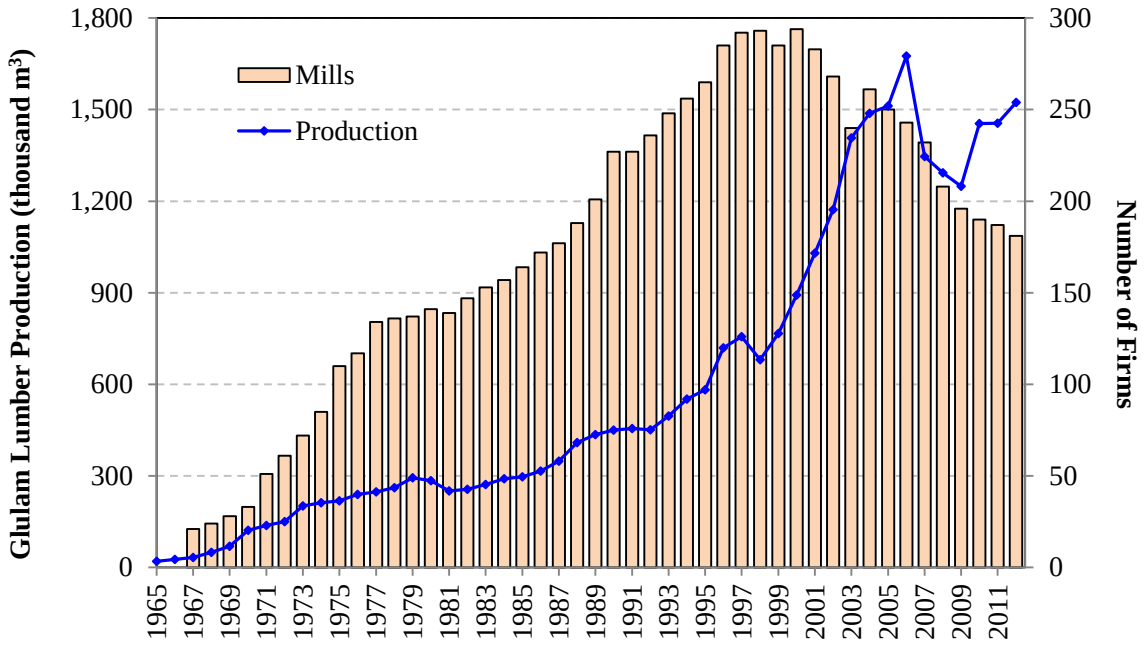

Figure 27 Number of glue laminated lumber mills and production volume in Japan, 1965-2012.

Table 12 Number of glulam manufacturers in Japan, by region.

Region	2010
Hokkaido	16.3%
Tohoku	23.1%
Kanto	5.3%
Chubu	14.4%
Kansai	20.5%
Chugoku	6.1%
Shikoku	4.5%
Kyushu-Okinawa	9.8%

Glulam production, by product type

The production of glulam lumber has increased substantially since 1990, particularly since the Kobe earthquake. From 1991-1995, glulam production increased by 27.9% from 455,000 m^3 to 581,800 m^3. In contrast, between 1995-2012 glulam production jumped by over 160%, rising from 581,800 m^3 to a record 1, 524,000 m^3 in 2012.

The mix of glulam lumber products has undergone a significant change over the past twenty years as well. For example, non-structural glulam lumber production has decreased by 55% while structural glulam lumber production has increased by more than 9 times (Figure 28). Non-structural glulam lumber is classified as overlays and moulding and millwork products. Overlay products are non-structural products used in applications where a high quality appearance is important, for example in a traditional tatami room. The decline in the number of traditional *tatami* rooms included in new residential construction has reduced the demand for non-structural appearance grade glulam lumber products.

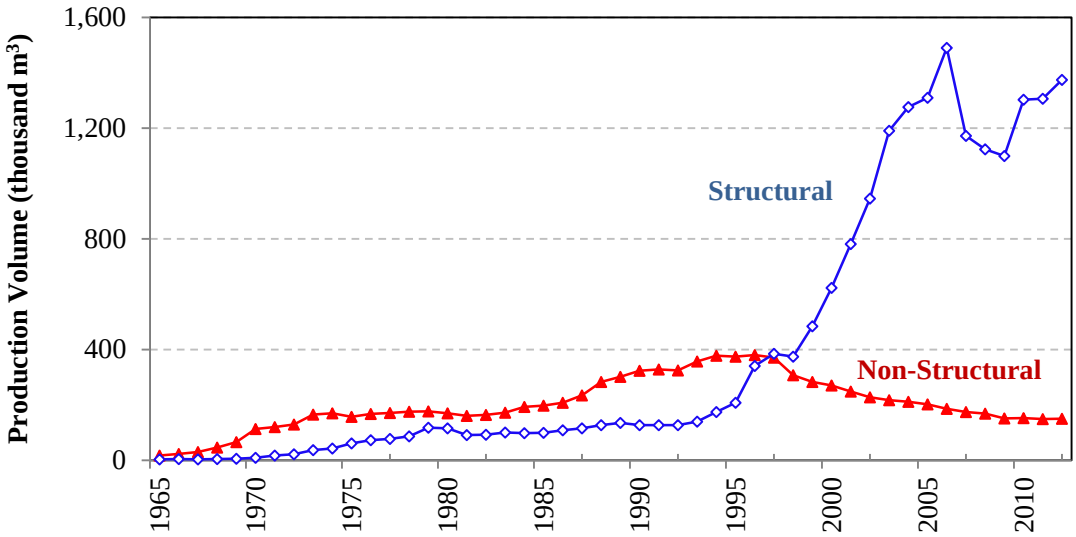

Figure 28 Japanese production of structural and non-structural glulam lumber production, 1965-2012.

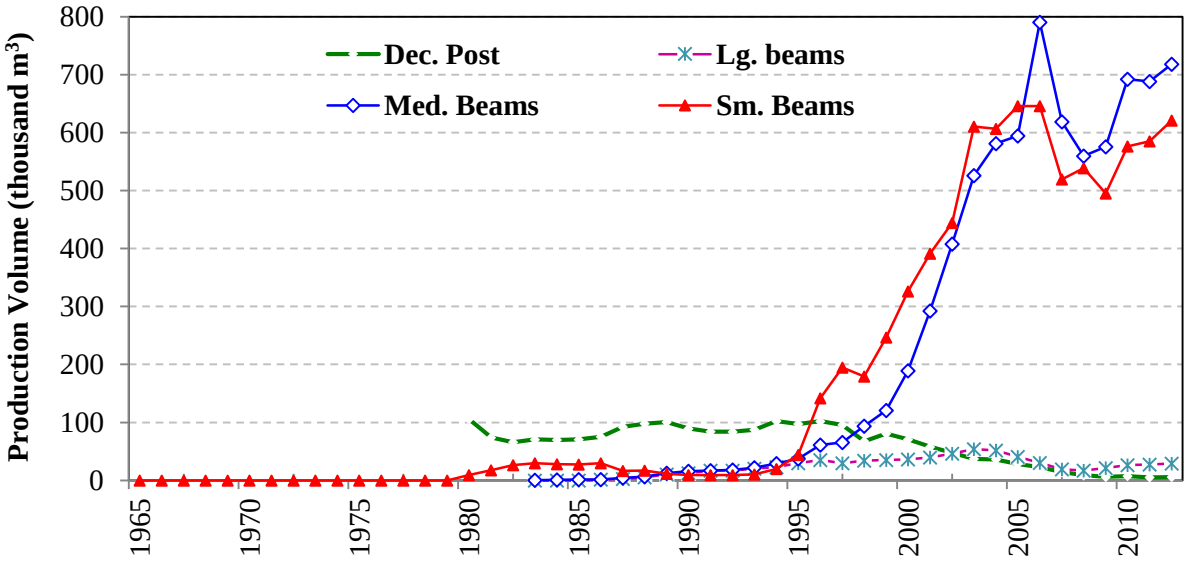

Figure 29 Japanese production of structural glulam lumber, by product, 1965-2012.

In contrast, the rapid transition to precut post and beam housing has led to the tremendous increase in demand for structural glulam lumber (Figure 29). In Japan, structural glulam products are often classified into large beams, medium beams, small beams and decorative posts. Although there is some debate about the exact criteria for each classification, the Japan Laminators Association defines large glulam lumber as

having a cross section of more than 300 cm^2 and these products are often used as horizontal beams (*hirakaku*). In contrast, small glulam lumber usually has dimensions of less than 150mm in width and thickness. Small glulam lumber is usually used in vertical post (*hashira*) applications. Medium size beams fall between the two previously mentioned products and can be used as either vertical posts or horizontal beams. Finally, decorative posts are small size lumber (usually 105mm x 105mm) that is used in exposed applications in *tatami* rooms where high quality and aesthetic appeal are important. Often domestic woods like *sugi* and *hinoki* are used to produce decorative beams.

Despite the rapid development of the glulam lumber sector and the transition towards precut post and beam housing, imports continue to play an important role in the glulam supply (Figure 30). Over the past ten years, imported glulam lumber has made up about 30% of the supply in Japan. This has increased somewhat over the past five years as the combination of a strong yen and the higher quality of imported glulam lumber has helped to increase its competitiveness.

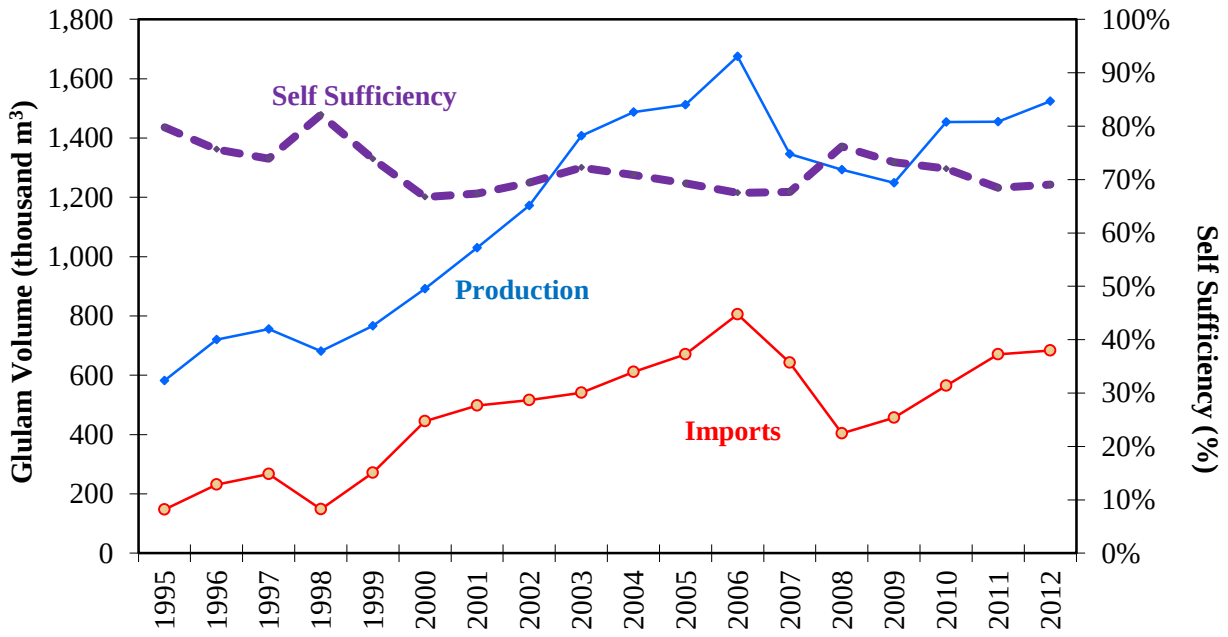

Figure 30 Japanese glulam lumber supply, 1995-2012.

5. Wood Trade

Japanese Wood Imports

Logs

Japanese imports of logs, both softwood and hardwood, rose rapidly during the 1960s and 1970s, with hardwood logs rising from 5.9 million m^3 to a high of 26.3 million m^3, and softwood logs growing from 2.7 million m^3 to 21 million m^3 (Figure 31) Despite their strong growth, the logs were used for different purposes. Hardwood logs were primarily used within the plywood industry, where they were converted into plywood for domestic and export markets. In contrast, softwood logs were converted into a variety of structural and non-structural lumber products for use within the post and beam housing sector.

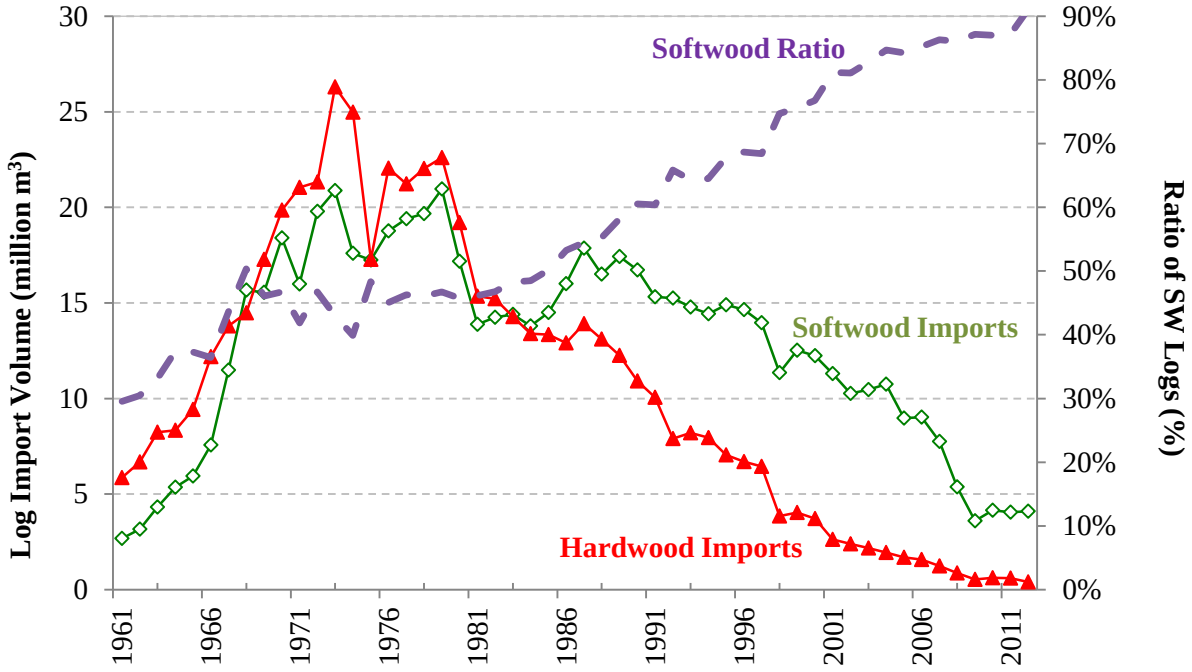

Figure 31 Japanese imports of hardwood and softwood logs, 1961-2012.

Beginning in 1979, the volume of log imports into Japan began a long and steep decline, with hardwood log imports falling to less than 400,000 m^3 by 2012 and softwood log imports falling to 4.1 million m^3 by 2012. Imports of both hardwood and softwood logs appear to have stabilized over the past four years. It is important to note that the ratio of softwood logs imported into Japan has increased consistently for several reasons, including the switch within the plywood manufacturing sector from hardwood logs to softwood logs, as well as a general decline in the number of housing starts. Since 1961 the softwood log ratio has increased from 19.6% to the current 91.2%. More recently (since 2004), imports of softwood logs have fallen by half in response to both the economic crisis as well as government policies and subsidies that have favored the increased use of domestic timber.

Prior to 1990, Japanese imports of softwood logs were largely sourced from the United States and Russia (Figure 32). US log imports were heavily skewed towards Douglas-fir with substantial volumes of hemlock and Sitka spruce also being imported (although imports of these last two species fell dramatically beginning in 1997). Japan also imported substantial volumes of lower cost softwood logs from Russia (mainly larch and red pine) and New Zealand (radiata pine) for plywood as well as (in the case of Russian larch) for non-structural lumber used in the post and beam housing sector (e.g., rafters

and studs). Over the past five years, Japanese log imports have primarily come from the US and Canada, although a recent change in the log export policy in British Columbia could substantially reduce Canadian log exports and provide an opportunity to expand US log exports, particularly to Japan and China. The recent reduction in the Russian log export tariff structure is not expected to have much impact on the log import market in Japan for a couple of reasons. First, the plywood industry has successfully transitioned away from Russian logs, largely substituting domestic cedar and cypress. Second, the implementation of volume-based export quotas on Russian logs means that the majority will flow into China rather than Japan.

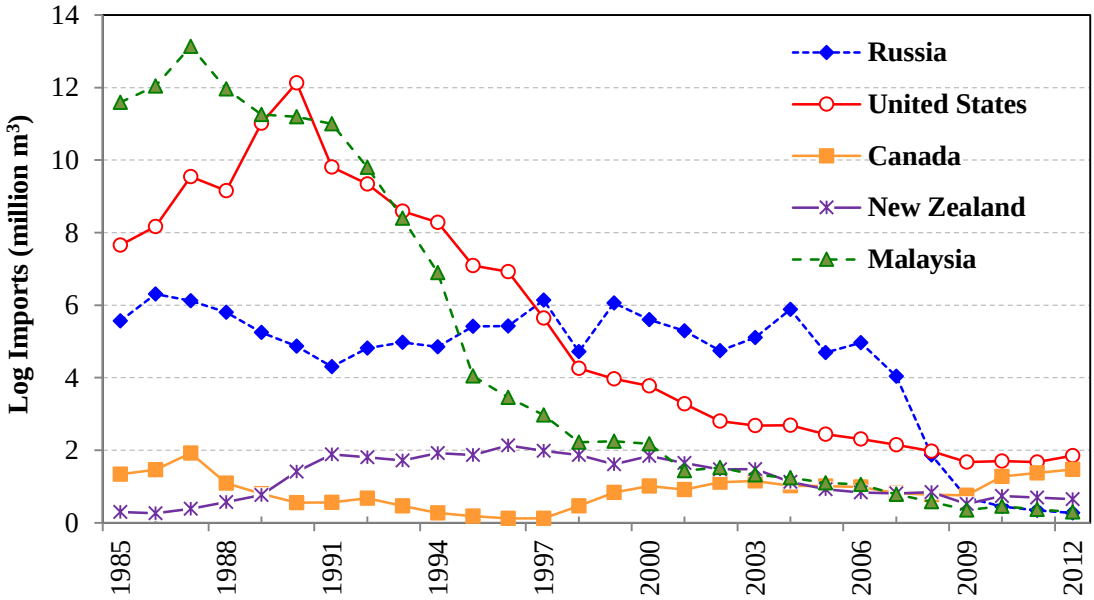

Figure 32 Japanese imports of logs by source country/region, 1985-2012.

Lumber

Japanese lumber imports peaked at approximately 12.6 million m^3 in 1996 (Figure 33). The period 1996-2009 saw lumber imports consistently decline, reaching just 5.6 million m^3 in 2009 before recovering slightly during the period 2010-2012. The vast majority of lumber imports are softwood species, with the ratio of softwood lumber imports exceeding 95% since 2006. The decline in lumber imports is matched by a general decline in domestic lumber production. This is a direct reflection of the dramatic decline in housing starts in Japan following the bursting of the bubble economy, which saw housing starts drop from 1.7 million in 1990 to 788,410 in 2009 before rebounding to 882,797 in 2012. Between 1990 and 2012, lumber production in Japan fell from 29.8 million m^3 to 9.4 million m^3, while lumber imports fell from 9 million m^3 to 6.5 million m^3. As a result, Japan's self-sufficiency in lumber supply over this period fell from 77% to 59%, despite the widespread use of subsidies for domestic wood.

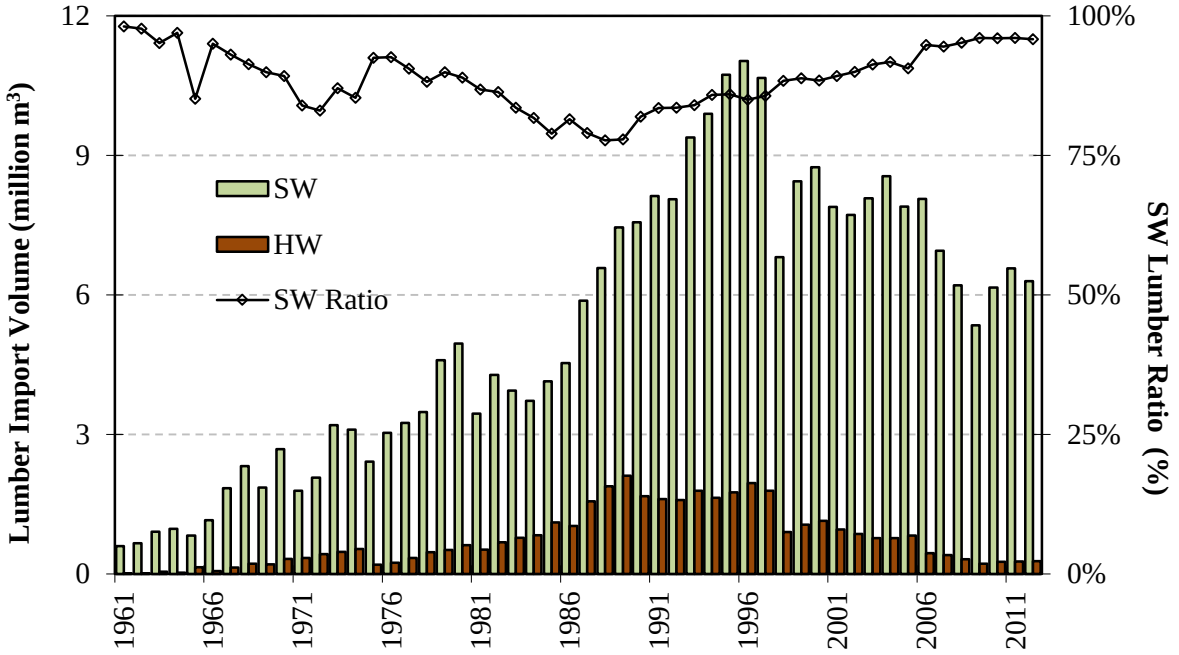

Figure 33 Japanese imports of softwood and hardwood lumber, 1961-2012.

The major suppliers of lumber imports into Japan remain Canada and the EU, although Canadian exports to Japan have been trending strongly downward since 1996 whereas EU exports have risen strongly (Figure 34). Imports from other regions, mainly hardwood lumber from Southeast Asia, have been declining. US lumber exports to Japan, which fell rapidly between 1990 and 2005, have recovered steadily since 2005 although they remain far below the volumes recorded in the first half of the 1990's.

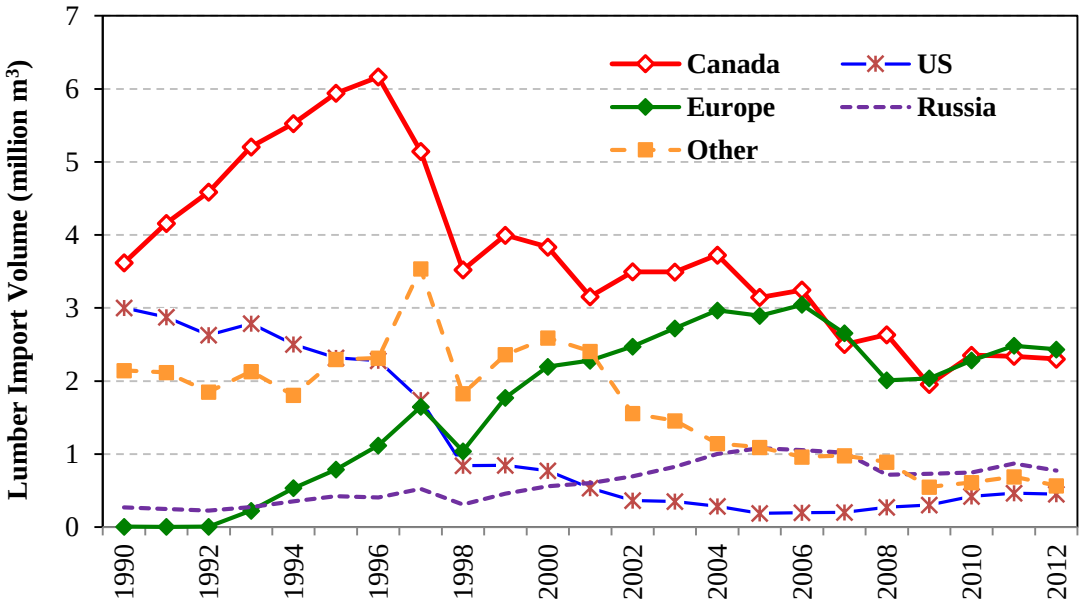

Figure 34 Japanese imports of softwood lumber by source country/region, 1990-2012.

Plywood

Japan was essentially self-sufficient in plywood supply throughout the post-war period until the mid-1980s. However, a strong trend in plywood mill closures beginning in the early 1970s set the stage for the introduction of imported plywood. By the mid-1980s, the continued decline in domestic plywood production, coupled with strong growth in housing starts, led to the rapid growth in plywood imports (Figure 35). Between 1969 and 1996, Japanese plywood imports shot from 50,000 m^3 to 5.3 million m^3, while self-sufficiency fell from 99.2% to 46.5%.

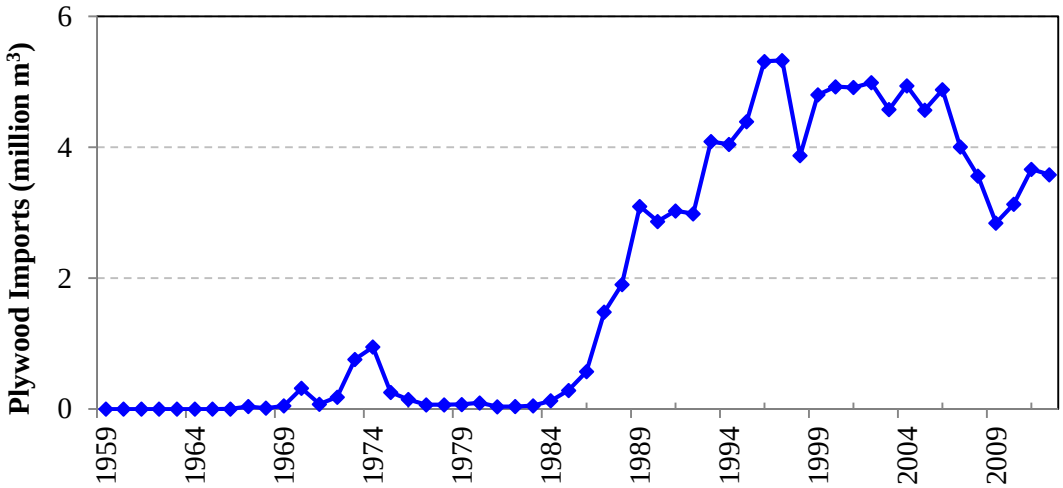

Figure 35 Japanese imports of plywood, 1959-2012.

A strategic relationship between the Japanese and the Indonesians resulted in a virtual monopoly within the plywood import sector with the Indonesian plywood association (APKINDO) controlling plywood exports to Japan while the Japanese plywood association NIPPINDO was responsible for importing and distributing all of the Indonesian plywood within Japan. By the early 1990s, approximately 85% of Japanese plywood imports were sourced from Indonesia (Figure 36). This arrangement began to fall apart towards the end of the Suharto regime and by 2005 the ratio of Indonesian plywood imports to total Japanese plywood imports had fallen below 40% and in 2012 the ratio was 29.1%. Today, Malaysia is the largest supplier of plywood to Japan, while Chinese plywood imports have grown rapidly since 2000.

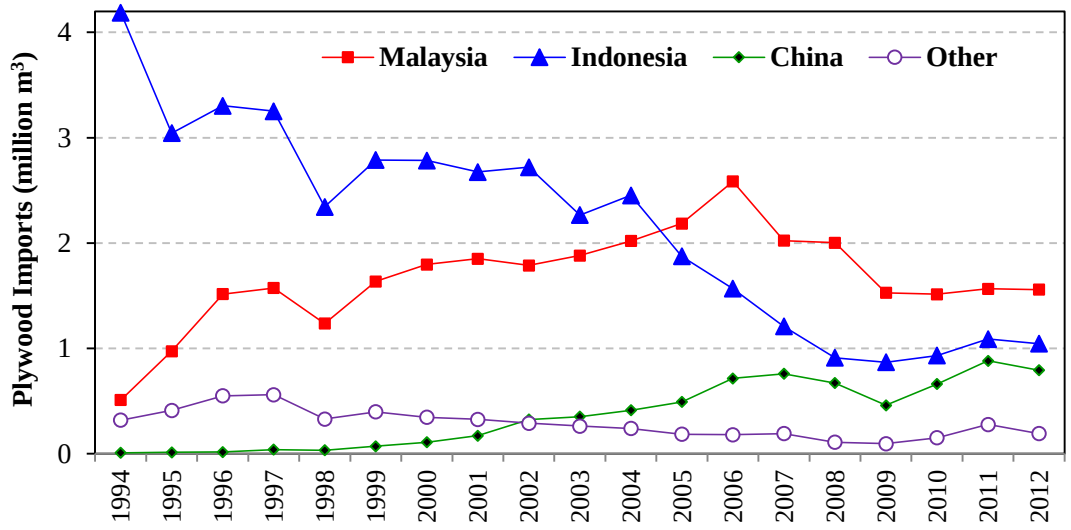

Figure 36 Japanese imports of plywood by source country, 1994-2012.

Glulam Lumber

The Kobe earthquake that struck on January 17th, 1995 highlighted the inadequacy of site-built post and beam houses and sped up a transition towards precut housing that was already underway in Japan. The transition towards pre-cutting of components for post and beam houses relied upon the use of structural glue-laminated timber for both posts (*hashira*) and beams (*hirakaku*). Following the Kobe earthquake the glue-laminated lumber industry underwent a rapid period of transition and growth as more and more pre-cutting firms integrated glue-laminated timber into their homes. Statistics published by the Mokuzai Kenzai Weekly (October 15, 2012) show the rapid adoption of glue-laminated timber during the post-Kobe period, Table 13.

Table 13 Ratio of glue-laminated timber used for structural members in post & beam houses (%)

	Post (*Hashira*)	Beams (*Hirakaku*)	Sill Plate (*Dodai*)
1998	60.8	27.4	0.2
1999	66.2	29.0	6.0
2000	60.2	36.4	12.9
2001	71.5	56.3	15.9
2002	71.9	62.4	24.8
2003	63.6	55.8	28.9
2004	66.1	70.2	30.2
2005	61.5	63.1	27.7
2006	58.8	55.7	21.0
2007	55.0	55.3	18.7
2008	58.1	61.9	27.1
2009	59.5	59.0	36.5
2010	71.5	69.3	36.9
2011	70.1	67.1	34.9

Between 1995 and 2003, Japanese production of glue laminated timber increased from 582,000 m^3 to 1.4 million m^3. In addition, the industry shifted away from the production of non-structural products towards structural lumber. Between 1995 and 2003, the ratio of Japanese structural glue laminated timber increased from 35.8% to 85%. In addition, imports of structural glue laminated timber increased rapidly from just 90,000 m^3 in 1994 to 684,000 m^3 in 2012 (Figure 37). However, in contrast to the trends observed in the lumber and plywood sectors, self-sufficiency within the glue laminated timber sector has remained steady at approximately 70%.

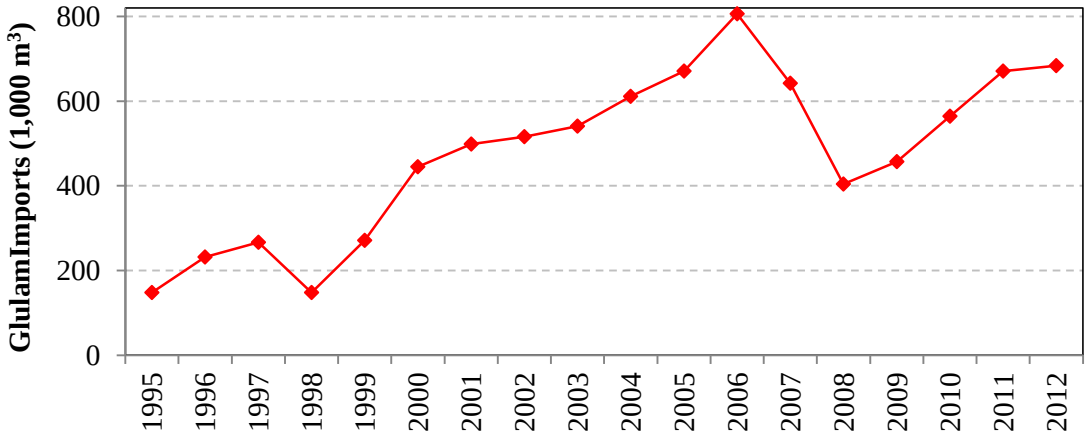

Figure 37 Japanese imports of glue-laminated lumber, 1995-2012.

Prior to 1997, the US was the major supplier of glue-laminated lumber into Japan, with a market share of over 50%. However, as a result of a long-term strategic focus on Japan by several European countries, particularly Austria and Finland, the EU has been the dominant supplier of glue laminated timber since 1999 (Figure 38). While China was a major supplier of glue-laminated timber to Japan between 2002 and 2006, exports from China have fallen off considerably since the global financial crisis.

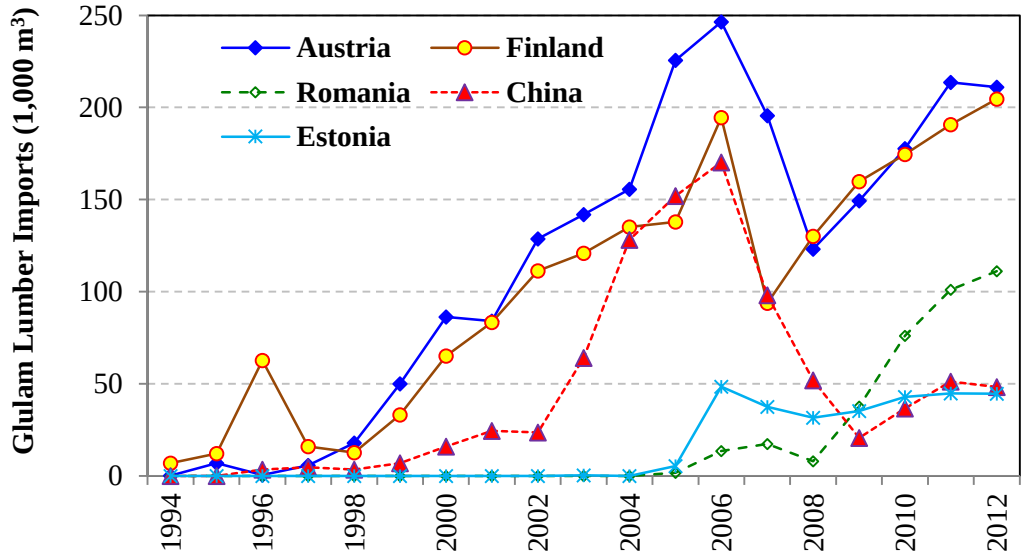

Figure 38 Japanese imports of glue-laminated lumber by source country, 1995-2012.

Japanese Wood Exports

In 2002 Japan aggressively promoted the export of domestic logs and lumber as part of the effort to expand the demand for domestically grown wood. To some degree this effort has been successful, and the total value of Japanese wood exports has almost doubled, growing from $60 million to $117 million between 2001 and 2012 (Figure 39). The vast majority of Japan's wood exports have been to other Asian countries, including China (2012 export share: 22.3%); the Philippines (19.3%); South Korea (11.2%); and Taiwan (10.6%) Exports to the US represent approximately 10% of total wood exports from Japan.

The primary Japanese wood exports on a value basis are lumber ($30 million) followed by logs ($18 million). However, this relationship is reversed when considering wood exports on a volume basis (Figures 39 and 40 and Table 14). This is due to the fact that the unit export value for logs from Japan was $154/m^3 in 2012 compared to an export value of $524/m^3 for lumber. Unfortunately, the export data does not distinguish Japanese log and lumber exports on a species basis.

The primary destination for log exports from Japan is Taiwan (60% share by volume) followed by South Korea (24%) and China (13%) (Figure 39). Looking at unit values for the three top markets suggest that the species/quality mix of logs differs by market. The unit value for log exports to South Korea is $217/m^3, followed by China at $171/m^3 and Taiwan at $114/m^3.

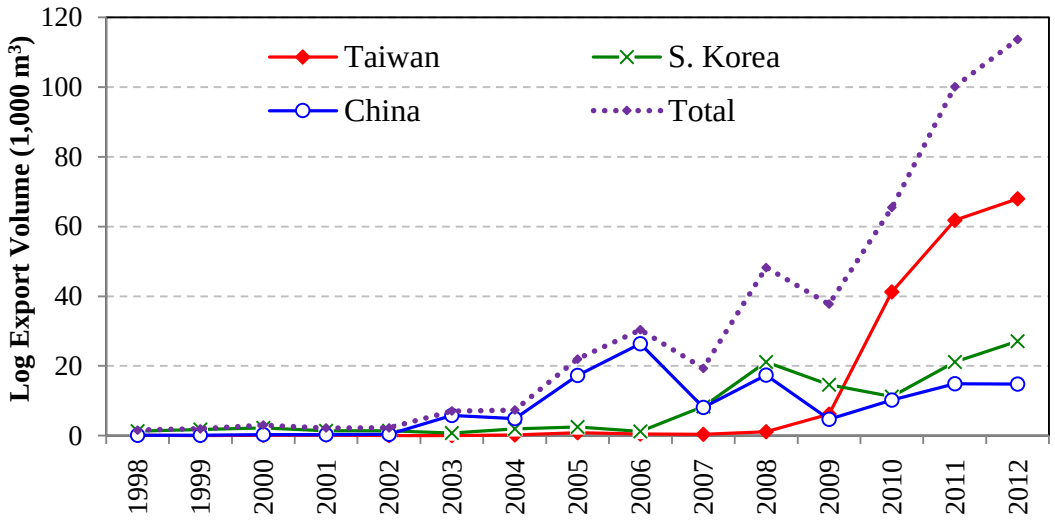

Figure 39 Japanese log export volumes, 1998-2012.

The primary export destinations for lumber from Japan is the Philippines (50% share by volume) and China (34% share) (Figure 40). As with logs, the species/quality mix appears to differ between these two markets with the unit value of lumber exports to the Philippines being $482/m^3 compared to $392/m^3 for China. Interestingly, the unit values for lumber exports to Indonesia, Korea and Vietnam range from $761/m^3 to $840/m^3, although the volume of lumber exported to these markets is substantially less.

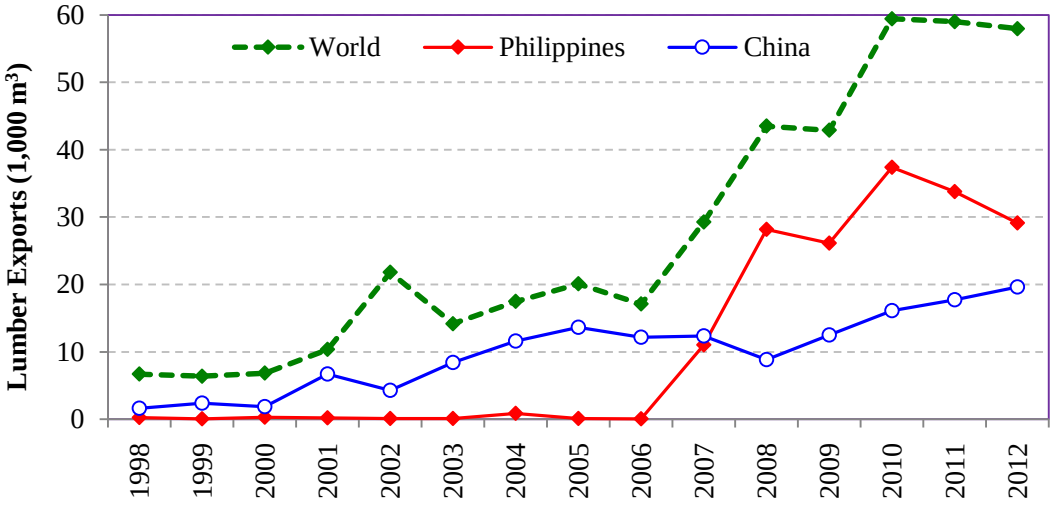

Figure 40 Japanese exports of lumber, 1998-2012.

Table 14 Value of Japanese wood exports, 2001-2012 ($1,000).

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total	**$59,964**	**$66,133**	**$82,727**	**$89,917**	**$95,010**	**$82,534**	**$97,826**	**$115,786**	**$111,437**	**$116,886**	**$122,208**	**$116,945**
Lumber	$7,369	$10,445	$11,749	$13,874	$12,692	$11,239	$15,697	$25,488	$22,747	$31,622	$32,360	$30,348
Logs	$526	$708	$1,312	$1,367	$3,326	$3,666	$3,429	$6,960	$5,844	$9,981	$17,006	$17,547
Plywood	$7,956	$9,030	$11,137	$8,134	$6,729	$7,475	$6,474	$6,452	$5,471	$6,464	$7,086	$8,783
Veneer	$10,332	$10,359	$10,788	$10,549	$13,067	$10,586	$10,947	$10,315	$8,254	$7,693	$6,854	$7,322
Builders' Joinery	$9,270	$9,134	$12,075	$15,147	$13,766	$11,989	$15,336	$14,382	$10,385	$10,524	$8,646	$6,356
Fiberboard	$4,030	$4,833	$5,878	$2,359	$1,592	$1,703	$3,341	$5,322	$6,638	$5,951	$6,353	$6,171
Other Products	$20,480	$21,624	$29,788	$38,487	$43,838	$35,876	$42,601	$46,867	$52,098	$44,651	$43,902	$40,418

6. Housing Sector

Residential Construction Industry and Housing Starts

The single greatest end use for imported wood in Japan is residential housing construction. A recent analysis by CINTRAFOR for this paper estimates approximately 61% of total lumber consumption in Japan in 2010 was for wooden houses (Eastin 2013). Japan's residential housing market has consistently been one of the largest and most dynamic in the world. Between 1965 and 2012, Japan's average annual number of housing starts (1,302,324) was approximately equal to those of the United States (1,470,558), even though Japan has only 46.9% of the population and 3.9% of the land area of the US (Figure 41). In fact, since the housing crash in the US in 2007, Japanese housing starts have exceeded those in the US, averaging 912,113 units per year in Japan compared to 799,817 units per year in the US.

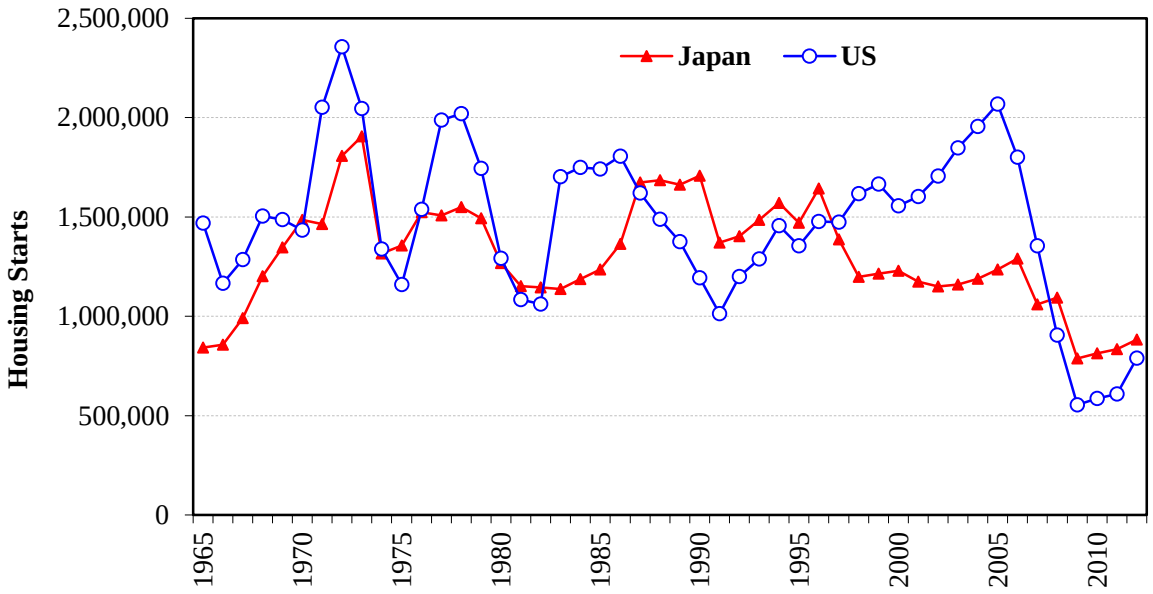

Figure 41 Comparison of Japanese and US housing starts, 1965-2012.

A combination of factors has historically supported the relatively high number of housing starts in Japan. Since 1950, the population in Japan has doubled while average household size has fallen from 5.02 to 2.42 in 2010, suggesting that smaller nuclear families are replacing traditional extended family living situations. In Tokyo, the average household size fell below 2.0 (1.99) for the first time ever in 2012. While the previous long-term trend had been an increase in Japan's population, recent population statistics and demographic projections clearly show that the population in Japan is already declining, household formations will begin declining in 2015 and average life expectancy is increasing. As a result, demand for new housing is also expected to decline and CINTRAFOR estimates that housing starts in Japan will stabilize at around 850,000 units per year during the period 2012 through 2025 (although announced changes in the consumption tax could affect the number of houses built in any single year).

In Japan, the number of housing starts built was very high during the late 1980s (the so-called Bubble Economy). They also jumped in 1996, which was the first time since the *bubble economy* when housing starts increased at double-digit rates over the previous year. The high number of housing starts in 1996 has been attributed to, in part, the rebuilding effort that occurred following the 1995 Hanshin Earthquake in Kobe. The Kobe earthquake damaged approximately 147,600 houses (Japan Lumber Reports 1995) and displaced over 400,000 households (Pacific Rim Wood Market Report 1996). The jump in housing starts in 1996 has also been attributed to the widely anticipated increase in the consumption tax as homeowners rushed to purchase houses before the Ministry of Finance increased the national

consumption tax from 3% to 5% on April 1, 1997. Since the increased consumption tax applied to housing construction and building materials, consumers wanted to avoid paying hundreds of thousands of yen in extra taxes.

Since 1997, Japan's continuing economic difficulties and poor demographics have had a devastating impact on the country's housing industry. Thousands of contractors have gone out of business and the number of new housing starts has declined from 1.66 million units in 1996 to just 788,410 units in 2009 before rebounding to 882,797 in 2012.

Residential Housing Types

Wood has always been an important part of the Japanese culture and trees were thought to be the places where the native gods first descended to earth. As a result, wood has traditionally had strong religious meaning in Japan and most temples and shrines are built using wood. The Japanese people are deeply drawn to the aesthetic beauty, strength and aroma of wood, and Japanese consumers place a high value on using wood in their homes. A recent survey conducted by the Japanese Prime Minister's Office showed that, if given a choice, over 80% of Japanese homeowners would prefer to live in a wood house.

Traditionally, residential construction was dominated by wooden housing well into the mid-1970s, accounting for almost two-thirds of all housing in 1976 (Figure 42). However, continued growth in multi-story, multi-family housing and prefabricated single-family housing, combined with restrictive fire codes in urban cities, contributed to the declining share of wooden housing between 1975 and 2006 when the share of wooden housing hit a low of 43.3%. Subsequently, government programs designed to increase the use of domestic wood in housing, as well as an effort to promote the environmental benefits of wood housing, have helped to increase the use of wood in housing. As a result, between 2006 and 2012 the share of wood houses increased from 44.3% to 55.1%.

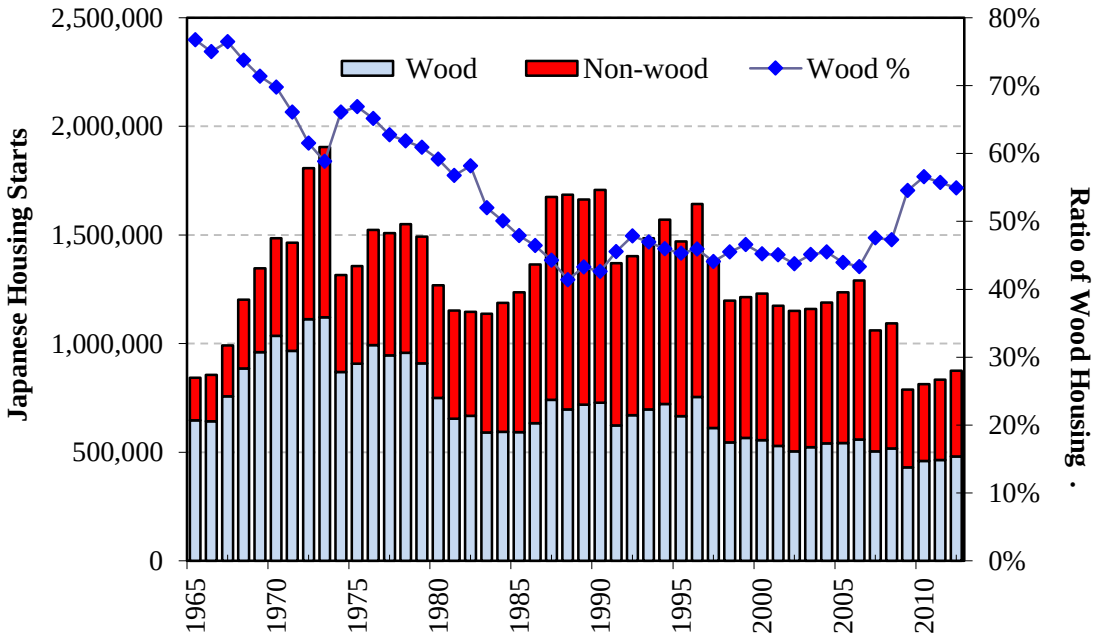

Figure 42 Wooden housing starts as a percentage of total housing starts, 1965-2012.

There are three main types of wooden housing built in Japan: traditional Japanese post-and-beam houses, 2x4 (which was introduced in 1974) and prefabricated houses. In 2012, post and beam houses accounted for 74.8% of total wooden housing starts followed by 2x4 (22.1%) and prefabricated (3.1%). Japanese houses are typically replaced every 20-25 years and there is virtually no resale market for used homes. Most new homes are built on a location where the previous home has been demolished. While population demographics suggest that housing starts will continue declining over time, this trend must be tempered by the fact that there is a huge inventory of aging and substandard homes that were built prior to 1980 (Figure 43). Given the poor quality of most of the older post-war housing, it is generally considered more cost-effective and efficient to demolish these older homes rather than try to repair or remodel them. This inventory of almost 1.6 billion square meter of poor quality homes as of 2013 will help to support housing starts in Japan in the near to mid-term even as population and household formations decline.

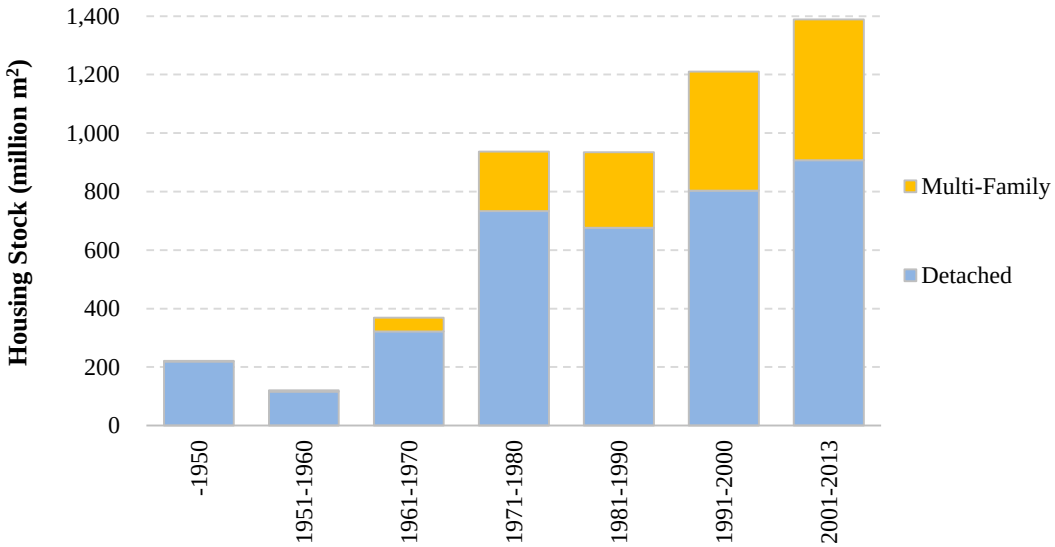

Figure 43 Housing stock by year built as of 2013.

Residential Housing Industry Structure

There are three main types of residential home builders in Japan: 1) large, national home manufacturers, 2) medium-sized, regional home companies (including power builders), and 3) small, local homebuilders (*kohmuten*) and/or carpenters. The large housing manufacturers have powerful nation-wide sales networks. In 2011, there were ten large housing manufacturers who each built more than 3,000 post and beam homes (Table 15). These firms often supply building materials manufactured in their own factories even though the actual construction of the house may be subcontracted out to smaller companies. Similarly, the ten largest 2x4 home builders all built more than 590 houses in 2011 (Table 16). On many occasions, the actual construction of single family houses is subcontracted to smaller *kohmuten* or house building companies.

Table 15 Top ten wooden residential home builders (post & beam) in 2011.

Rank (previous year)	Company Name	FY 2011
1(2)	Tama Home	10,016
2(1)	Sumitomo Forestry	9,232
3(4)	Ichijyo Komuten	8,596
4(-)	Misawa Home	8,306
5(3)	Hajime Kensetsu	7,550
6(6)	Arnest One	7,050
7(8)	Sekisui House	4,296
8(-)	Mitsui Home	4,159
9(9)	Iida Sangyo	4,143
10(-)	Toei Jyutaku	2,977

Table 16 Top ten wooden residential home builders (2x4) in 2011.

Rank (previous year)	Company Name	FY 2011
1 (1)	Mitsui Home	4,159
2 (-)	Ichijyo Komuten	2,286
3 (2)	Sekisui Chemical	2,100
4 (3)	Sumitomo Real Estate	1,872
5 (4)	Sweden House	1,250
6 (6)	Shin Showa	1,086
7 (-)	Seibu Kensetsu	780
8(8)	Tokyu Homes	728
9 (-)	Toyota Wood yu Homes	608
10 (5)	Mitsubishi Real Estate Home	591

The smaller construction companies do most of the actual construction of houses for themselves and for the larger home building companies. Small companies include self-employed carpenters who work as labor subcontractors. Most small companies build roughly three to five houses annually, yet they have historically controlled the largest share of the housing industry. The Japan 2x4 Homebuilders Association reports that small- and medium-sized companies build most of the 2x4 houses, and large companies primarily build Japanese-style 2x4 houses, based on the 3'x6' tatami mat module.

Changing Nature of the Residential Housing Market

Historically, post-and-beam housing had dominated the residential housing market. In 1963, 86.2% of all residential housing starts were traditional post-and-beam construction. However, by 2012, they represented only 41.2% of all new residential housing starts as substantial inroads have been made by the steel and ferro-concrete construction industry.

Inroads by prefabricated and 2x4 houses have further reduced the market share of post-and-beam houses. For example, 2x4 units comprised about 12.2% of total residential housing starts in 2012. Post-and-beam housing construction has also decreased due to the aging labor force. Many young people do not want to work in the construction industry because it is viewed as being dirty, dangerous and demanding. The construction industry is not viewed as a favorable place to work because of a poor industry safety record in past years. It can also take up to seven years of apprenticeship training to become a post-and-beam carpenter-another factor that discourages entrance into this profession. As a result, the average age of a carpenter is now approaching 60 years of age.

Although Japan might have traditionally been characterized as a culture that shuns outside ideas and people, consumers in Japan increasingly prefer the look of western-style architecture and the open floor plans of western homes. This is especially true of the younger generation where a greater proportion of the population has lived, studied or traveled overseas. The strong yen that accompanied the *bubble economy* of the 1980s and early 1990s allowed many Japanese to travel overseas and experience other cultures and lifestyles. In addition, there are significant numbers of Japanese who have lived overseas through business transfers within multinational corporations, overseas study, and home-stay visits. These Japanese have seen the quality of housing in other cultures and are now demanding this same high quality for their own houses to improve their standard of living. There is great interest in matching the quality of their housing with their wealth and consumer spending power. In addition, a recent article in the Japan Times cited the increasing number of homeowner complaints about shoddy construction practices in new homes.

Regulatory reforms

Building Standard Law

In May 1998 the Building Standard Law of Japan (BSL) received its first major revision since 1950. The major revisions to the BSL were to: (1) specify interim and final building inspections and (2) transform the BSL from a specification-based building code to a performance-based building code. The first revision of the BSL requires that all residential housing units receive an interim and final inspection. Further, completion of the interim inspection is required before a building is eligible to receive its final inspection. The second revision transformed the BSL from a specification-based standard to a performance-based standard whereby any building material that meets the specified performance standards can be used in residential construction.

Housing Quality Assurance Act of 2000

In addition to revising the BSL, the Housing Quality Assurance Act (HQAA) was promulgated to provide homebuyers with specific safeguards in resolving disputes with building contractors. The four objectives of the HQAA were to:

(1) improve the quality and performance of residential homes;

(2) provide homebuyers with a mechanism for resolving disputes with building contractors;

(3) establish a system of "Housing Performance Indication Standards" against which specific houses can be compared; and

(4) establish a housing completion guarantee system.

The HQAA, which went into effect in April 2000, significantly changed the nature and structure of the residential construction industry in Japan, including the specification and use of domestic and imported wooden building materials.

The first objective of the HQAA was aimed at improving the quality and performance of new homes by requiring homebuilders to provide homebuyers with a ten-year warranty against structural defects and low durability (e.g., water infiltration into the structure). The second objective of the HQAA was to establish a mechanism for resolving disputes between homebuyers and builders, particularly with respect to defective construction details. If a defect is judged to be in excess of an allowable standard, the builder will be required to correct the defect or compensate the homeowner.

The third objective of the HQAA established a voluntary system of "Housing Performance Indication Standards (HPIS)" against which the performance and features of individual houses can be compared. While meeting some or all of the criteria of the HPIS is not required, many home builders have adopted them as a strategy for differentiating their homes in the marketplace. The specific types of performance characteristics contained in the HQAA include: (1) structural performance, (2) fire safety, (3) durability, (4) ease of maintenance and management, (5) energy efficiency, (6) air quality, (7) ratio of exterior openings to total wall area, (8) noise transmission, (9) barrier free design, and 10) security against break-in. The performance of individual houses is assessed by a "Designated Evaluation Body" using the criteria established in the "Japanese Housing Performance Indication Standards". These evaluation bodies are responsible for approving the architectural design of the house and performing inspections of the home during construction; including the foundation process, structural framing process, and the interior finishing phase of the project. Houses that meet or exceed the performance indication standards receive a "Performance Recognized House" certification. This certification allows homebuyers to compare two homes on the basis of availability and rating of specific features.

Finally, the HQAA included a provision for a Completion Guarantee System to protect homebuyers against default by, or the bankruptcy of, their contractor before the home is completed. The aim of the Completion Guarantee System is to provide homebuyers with a form of insurance to help them complete

the construction of their house in the event their builder goes bankrupt. This provision was included in the HQAA because it is typical in Japan for the homebuyer to provide financing to the contractor up front. For example, it is not unusual for the homebuyer to pay the contractor one-third of the price of the home before construction begins, with an additional third due after the house has been framed, and the remaining funds due upon completion of the house. This system may have worked well in the past but, given the drawn out nature of the economic recession in Japan, many contractors file for bankruptcy, leaving homebuyers with partially completed homes and outstanding payments due on building materials.

Building Standard Law Amendment of 2003

Beginning around 1995, a new term was being used within the Japanese media: "*sick house syndrome.*" This term referred to the phenomenon whereby volatile organic compounds (VOC's) off-gas and build up within newly built homes (Eastin and Mawhinney 2011). In some cases, the problem became so serious that it triggered a variety of ailments and caused some families to abandon their homes because of health concerns. The occurrence of sick house syndrome is generally attributed to off-gassing of VOC's from construction materials including carpet, paint, vinyl wall coverings, and their glue. In addition, some wooden building materials (such as plywood and particleboard manufactured in Indonesia, Malaysia and China) have been found to emit high levels of formaldehyde. The relatively sudden occurrence of sick house syndrome is widely thought to be associated with improved construction techniques that resulted in a tighter building envelope, which reduced the flow of air through the house unless a mechanical air circulation system was used. Sick house syndrome reached a peak in May 2002 when the Labor Standards Inspection Office awarded monetary compensation to a group of pre-school employees suffering from chemical exposure attributed to their being temporarily housed in a prefabricated building. During the course of the case it was found that high levels of formaldehyde were off-gassing from the building materials used in the prefabricated building.

The attendant publicity associated with this and other cases of sick house syndrome led the Ministry of Construction to amend the Building Standards Law by implementing the Sick House Regulations effective on July 1, 2003. The Sick House Regulations were designed to ban the use of chloropyrifos and regulate the acceptable levels of formaldehyde emissions in a house. It also required the use of ventilation equipment in new home construction.

The Japanese housing industry has gone through a rapid period of change with site-built traditional post and beam wooden houses giving way to pre-cut post and beam houses and the emergence of 2x4 housing as a major force in the industry (Eastin and Braden 2009). In addition, increasing numbers of post and beam houses incorporate elaborate systems of reinforcing metal connectors to provide strength, tie houses to their foundations and improve earthquake performance. The widespread perception that the durability of Japanese houses needs to be improved has led to the widespread success of the 200 year house program.

7. Programs to Expand the Demand for Domestic Wood in Japan

The Japanese have long recognized the dilemma they face regarding the need to more effectively utilize their domestic wood resource in the face of lower cost imported wood products. The combination of small forest holdings, undercapitalization and a poor forest road infrastructure has translated to high log prices. Lack of forest management activities in post war Japan has resulted in trees with poor form and many branches, which results in both low lumber yields and low lumber quality. Similarly, the sawmill industry has been (and largely continues to be) skewed towards small "mom-and-pop" sawmills that are inefficient and undercapitalized. Finally, a strengthening currency made it possible to import increasing volumes of high quality timber from around the world which further reduced the demand for domestic wood. In the post-Kyoto Protocol era, the Japanese are increasingly looking to their forests and carbon storage function to help them meet their CO_2 emission reduction targets. In addition, the process of depopulation in rural areas has made it extremely difficult to recruit young workers into the forestry sector, undermining MAFF's efforts to more actively manage forests, increase domestic timber harvests and improve forest health. It is against this backdrop that a number of government Ministries have begun to develop policies and programs designed to increase forest management activities (including thinning) and stimulate the demand for domestic wood.

Over the past several years, at least five programs have been adopted in Japan to promote the use of domestic wood. In several cases these programs have been specifically designed to expand the demand for domestic wood products, often by promoting domestic wood as a substitute for imported wood (Aga 2014). This goal is either explicitly stated in the legislation or is implicitly understood to be the goal of the legislation. In some cases, government officials have met with industry associations to explain the intention of a particular piece of legislation to increase the use of domestic wood. On numerous occasions, industry publications have reported comments by Ministry officials to industry associations noting that a specific piece of legislation has been designed to increase the use of domestic wood. This is an important point to note. In a consensus-building society like Japan, where there is a strong relationship between the government and industry, industry is often unofficially, and culturally, predisposed to following the government's lead. For example, referring to the Public Procurement Law, an industry newspaper reported that *"Since the government decided to promote using low environmentally impacted material, not only local governments and local independent administrative institutions, but also private businesses such as house builders and contractors should follow suit in procuring authorized materials"* (JLR 2006, N452, p.1).

The first program, introduced by Prime Minister Yasuo Fukuda in 2007, was designed to improve the quality and longevity of residential housing in Japan. This program is referred to as the ***200 Year House*** or ***the Long-Term Superior Housing Program***. A second program, the Housing ***Eco-Points Program***, primarily developed as an economic stimulus measure in 2009, was designed to encourage builders and consumers to purchase energy efficient building materials, although a secondary focus of the program was to improve the environmental performance and energy efficiency of Japanese homes and condominiums. This program has been continued every year since its introduction. The current version being proposed by MAFF would provide 40-50 billion yen in subsidies for using domestic wood in both new home construction and renovation projects. The third program is the ***Promotion for the Use of Wood in Public Buildings Act***. This Act is an important change in the building and renovation policies of Japan's central government and municipalities. Implemented in October 2010, the act seeks to primarily (and essentially) increase the use of Japanese domestic wood by requiring all national, prefectural and municipal government building projects (up to 3-story buildings with less than 3,000 square meters in floor area) to either be constructed with wood, or at least utilize wood materials for the building interiors. The Act has been accompanied by an increase in wood used for private non-residential construction such as nursing homes, kindergartens, and commercial facilities.

The fourth program is referred to as the ***Forest and Forestry Revitalization Program***. Initially introduced in 2009, the Revitalization Plan was approved by the Cabinet in 2011[4]. The Revitalization Plan was designed to increase the market share of domestic wood from its current 26% to 50% by 2020 (Figure 44). A central component of the Plan is to provide government subsidies (both from the central and prefectural governments) to promote the use of domestic wood over imported wood, particularly within the housing and public building sectors. The Revitalization Plan also provides huge subsidies for forest management activities (e.g., building forest roads, timber harvesting and replanting activities). The fifth program is called the ***Feed-in Tariff System*** that was implemented in July 2012. In an effort to increase the competitiveness of high cost, low value, low quality forest residuals derived from forest thinning operations, the Japanese government has established a "Fixed Price Purchasing System for Renewable Energy" that essentially subsidizes the removal of forest residuals for the production of renewable energy. The price of ¥8,000 per m^3 of woody biomass (33.6 yen per kilowatt-hour) was established to ensure the profitability of operations to remove forest thinnings and residuals. The program aims to use up to 20 million cubic meters of forest thinnings per year by 2020. Each of these programs is discussed in more detail below with specific examples used to highlight how each program has been designed to promote the use of domestic wood in preference to imported wood.

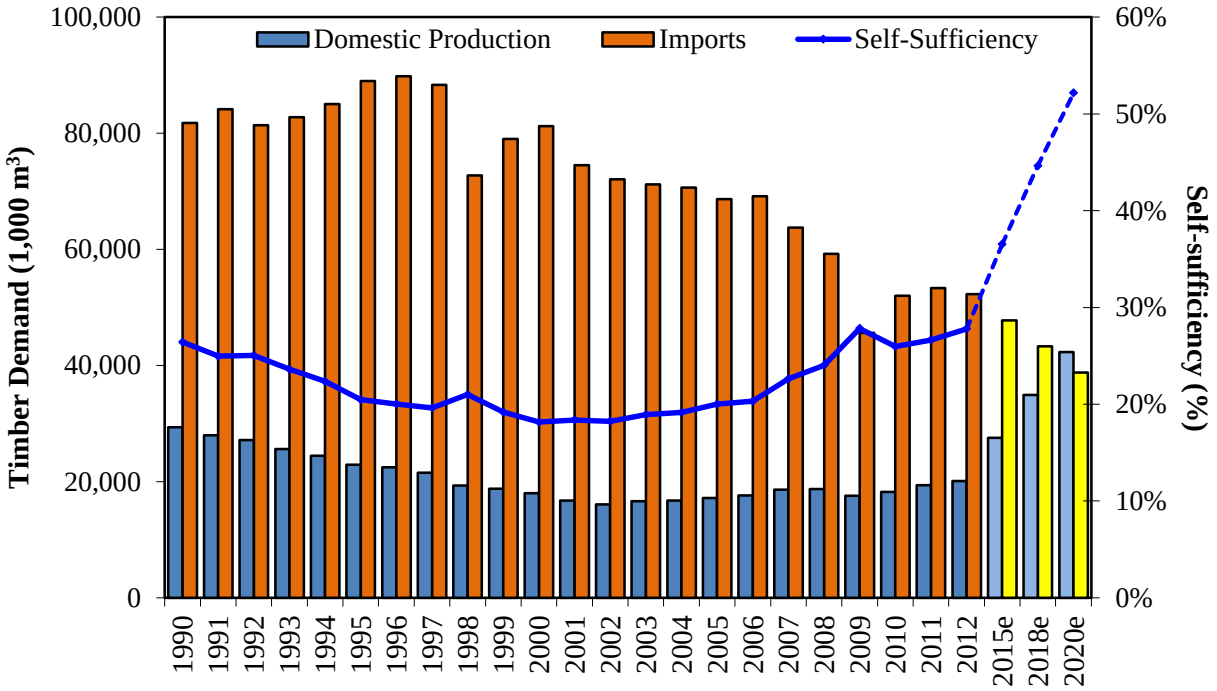

Figure 44 Japan production, imports and self-sufficiency in forest products.

Long-Lived Superior Housing Law (based on 2007 LDP Vision (JLR 484, p7)

The housing stock in Japan remains heavily weighted towards older, poor quality houses that were built prior to 1980. The most recent estimate is that over 30 million homes built before 1980 will need to be replaced rather than repaired, with 14 million of these houses being built prior to 1970. This older housing stock represents 45.8% of the total housing stock in Japan and this inventory of older homes will continue to influence annual housing starts into the future. Considering these older homes, almost 18

[4] *The Revitalization plan is not a legislation, but just a plan approved in a Cabinet meeting as a part of the "New Growth Strategy" established under the DPJ government. Since the Revitalization plan was more like a comprehensive strategic plan, not a law, it was not needed to be approved by the Diet.*

million (58.7%) are single family dwellings. Traditionally, Japanese houses are replaced every 20-25 years and most new homes are built on the same site where the previous home has been demolished. Given the poor quality of most of the older post-war housing (1945-1979), it has generally been considered more cost-effective and efficient to demolish older homes rather than repair or remodel them. For this and other (cultural) reasons, a resale market for used housing has never developed in Japan. The lack of a resale market for used housing in Japan is illustrated by the comparative sales data for new and used houses in Japan, the US, the UK and France. Whereas only 13.1% of the total annual home sales in Japan in 2010 were for used homes, in the US, the UK and France this ratio is significantly higher at 77.6%, 88.8% and 66.4%, respectively. A Japanese policy to promote more durable, longer lived homes (the so-called 200 Year House program) and replace older homes with more energy efficient and environmentally friendly homes should continue to support annual housing starts into the future.

The Long-Term Superior Housing System (200 Year House program) provides a variety of incentives and tax breaks to encourage homebuyers and homebuilders to favor factors such as high durability, seismic resistance, ease of maintenance or repair and ease of renovation or retrofitting; which all help to improve the lifespan and resale of a house. While these incentives and tax breaks apply to standard housing and houses built under the 200 Year House program, the size of the benefits are substantially larger for durable housing. For example, homebuyers who purchase a durable house will be able to increase the amount of their home loan that can be deducted from their income taxes (the increase will be approximately ¥1,000,000), homebuyers will be able to obtain longer mortgages (extending up to 50 years vs. the usual 35 years), and they could see their property taxes reduced by between 25% to 50% for up to seven years.

In addition, if the total mortgage deduction exceeds the amount of income tax owed by the homeowner, then they can apply up to ¥97,500 of the excess per year to their property taxes (jyumin-zei). Finally, there are several other financial incentives that buyers of long-term durable houses can benefit from, including: 1) The tax for registering a new 200 Year House is reduced from 0.15% to 0.10% and the tax for transferring the registration of a 200 Year House is reduced from 0.30% to 0.10% (until March 31, 2010 with annual extension to be considered); 2) the tax exempt portion of the real estate acquisition tax is increased from ¥12 million to ¥13 million (until March 31, 2010 with annual extensions to be considered); 3) for single family housing, the fixed property tax is reduced to half for three years for a standard house and for five years for long-term superior housing (until March 31, 2010 with annual extension to be considered); and 4) the Japan Housing Finance Agency (former Government Housing Loan Corporation) has established a 50 year loan for long-term superior housing. The interest rate can be reduced by one percent for the first ten years and 0.3 percent for a subsequent ten years when it meets the Flat 35S criteria (Hi-Spec Technical Criteria for a durable house).

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The 200 Year House program has just begun and the success of the program will hinge upon a variety of things, not the least of which is the development of a housing resale market. This is an idea which Japanese homebuyers have resisted in the past; preferring to regard housing as a depreciating consumer good rather than as an appreciating investment asset. Given the cultural stigma associated with used homes, consumer resistance to buying used homes, and difficulty in obtaining a mortgage for a used home, the establishment of a growing and healthy resale housing market is uncertain at best, particularly at a time of a declining population.

Despite these concerns, recent housing start data compiled by the Ministry of Land, Infrastructure and Transportation suggests that the 200 Year House program has been much more successful than expected (Figure 45). For example, the total number of housing starts approved under this program in February 2010 totaled 5,854 units (of which 99.8% were single family homes). This represents 8.5% of total housing starts for the month. Overall, there have been a total of 347,652 units approved since the program was initiated on June 4, 2007 through December 2012, of which over 97% have been single

family residences. However, houses built under this program still represent just 11.6% of total housing starts since the start of the program and the ratio of durable houses within total housing starts has been declining since July 2011 (dropping from a high of 13.9% to just below 12%).

Over the years, a number of efforts have been made to tie the use of domestic wood with the 200 Year House Program. For example, in 2008 the plan was revised prior to approval by the House of Representatives. The revised plan is the first time that *"consideration is being made to ensure the proper use of domestic species material and is the first time that the term 'domestic material' is clearly being adopted. By ensuring the appropriate use of domestic material (lumber that is produced within the country) when determining basic policies, MLIT will…[be] planning the spread of long-lasting and excellent housing that uses domestic material. The contents, which were not originally in the government's plan, were decided upon and clearly showed that the road to promoting the use of domestic material was chosen"* (JLJ 2008: V49 N24, p.11). Further in announcing model projects for the 200 Year House Program in July 2010, it was reported that "*both regional and national model projects that emphasize the use of domestic wood were "highly evaluated" and "well rated for the high possibility of becoming widespread in terms of expanding demand for domestic lumber"* (JLJ 2010: V51,N14,pp6-7). Similarly, an article summarizing MLIT's budget request for FY2012 noted that *"For long-life quality housing, …1.2 million yen is subsidized to each contractor, which builds long life quality houses with locally produced wood"* (JLR 2011: N575, page 1).

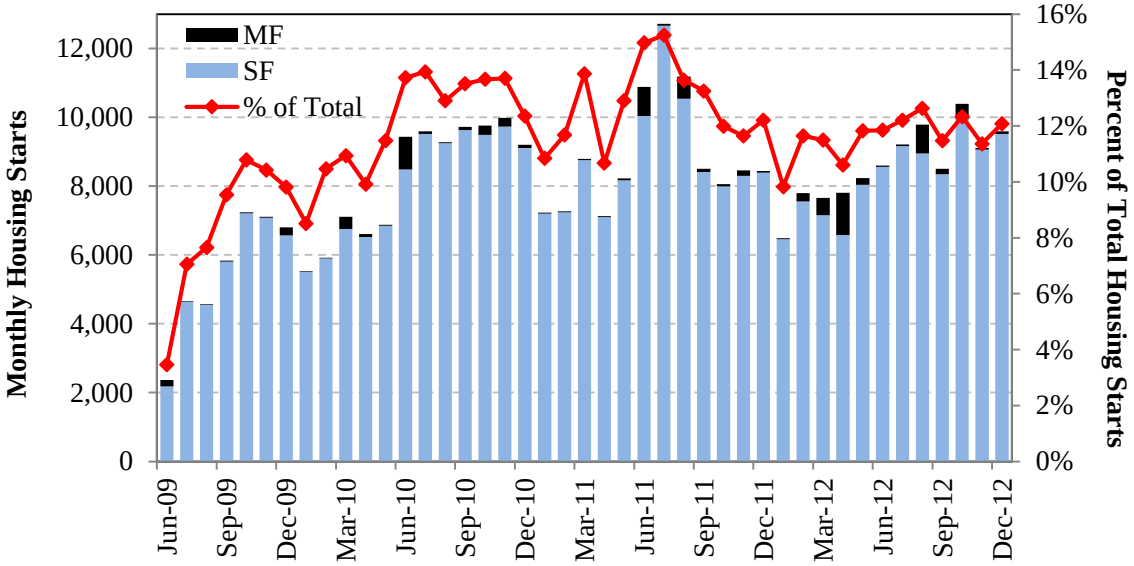

Figure 45 Number of housing units built under the Long-Term Superior Housing Act.
Note: MF: multi-family house SF: single-family house
Source: (MLIT 2013): http://www.mlit.go.jp/common/000990935.pdf

Housing eco-points program

Another new program that has recently been extended into the housing sector is the Eco Point program (Eastin et al.2010). Originally implemented in July 2009, the Eco Point system was designed to: (1) reduce CO_2 emissions, (2) provide a stimulus for the economy and (3) encourage the adoption of ground-wave digital television. The idea behind the original ¥290 billion program was that consumers who purchased approved energy efficient appliances would receive eco-points (worth 5% of the price of an air conditioner or a refrigerator and 10% of the price of a digital television) that could be used to purchase a variety of eco-friendly consumer goods, including transportation passes and gift cards.

For example, purchasing an energy efficient air conditioner can earn between 6,000 and 9,000 eco-points (each eco-point is worth ¥1), an energy efficient refrigerator can earn between 3,000 and 10,000 eco-points, and an energy efficient digital television can earn between 7,000 and 36,000 eco-points (based primarily on screen size). The Eco Point program, which was originally scheduled to end on March 31st, 2010 has been extended numerous times because of its popularity and the larger than expected stimulus to the economy. The most recent renewal of the program came on January 25th, 2012.

In December 2009, the Japanese government expanded the eco-point program to include green building materials used in new and remodeled homes. The program began on March 8th, 2010 and applies to all construction projects begun after January 1st, 2010 and completed by December 31st, 2010. The program provides an additional ¥100 billion in funding for the residential housing sector. The intent of this program has been to help stimulate the economy and to encourage home owners to recognize the need to reduce greenhouse gas emissions by choosing environmentally friendly building materials and construction technologies (Eastin, Sasatani and Braden 2010).

The program applies to new construction and three types of renovation projects, including the installation of energy efficient double-paned windows (earns between 2,000 and 18,000 eco-points), the installation of insulation in exterior walls (earns 100,000 eco-points), ceilings (earns 30,000 points) or floors (earns 50,000 points), and installation of barrier free features in conjunction with either of the two previous energy efficiency improvements. The maximum number of eco-points awarded per house or condo is 300,000.

Unlike the original Eco Point program, home improvements require third-party verification before they are certified to receive eco-points. The program is expected to have a bigger impact on the remodeling sector, since home owners are likely to delay building a new home during the current economic slump in favor of undertaking remodel projects that improve the energy efficiency of existing homes and reduce heating and cooling costs (Eastin et al. 2011).

On February 18th, 2013 the Forestry Agency began soliciting comments on an "Outline of the Wood-Use Point System" that is based on the Eco-Point program and would award points to home builders or home buyers who use a specified amount of domestic wood when building a new home. While the original FA budget request for this program was 5.5 billion yen (US$58 million), the LDP government approved 41 billion yen (US$432 million) as part of the FY2012 Supplemental Budget. While the Wood-Use Point System is still out for comment, it is expected to be implemented in April 2013. The program expects to award 300,000 points per eligible home (1 point equals 1 yen) and could potentially apply to over 135,000 homes in 2013 (approximately 28% of total wooden housing starts based on 2012 data). The Wood Points would be awarded in addition to any relevant subsidies which may be offered at the prefectural level (most of which require the use of domestic wood to qualify). By combining the Wood Points program with existing prefectural programs, the Forestry Agency has developed a program that strongly favors the use of domestic wood species over imported species.

The stated goal of the Wood Points program is to "*boost the demand for local wood products. In this program, points are granted for wooden houses, wooden products, etc. that use local wood products…*" (FA 2013). More importantly, this program directly links the housing sector with the Revitalization Plan: "*In order to achieve the 50% self-sufficiency ratio of wood use by 2020, as stipulated in the "Basic Plan for Forests and Forestry," and promote farm and mountain villages with abundant forestry resources, it is important to expand the use of the ever-increasing amount of forestry resources in the field of housing where the demand for wood is large*" (FA 2013). On its face, the draft Wood Points program would appear to violate WTO trade rules by using federal subsidies to provide domestic wood products with

preferential treatment in order to obtain a competitive advantage over imported wood products. This program will be closely monitored as it evolves in the near future.

Wood in Public Buildings Law

MAFF, in recognition of the need to expand the demand for domestic wood, faced a dilemma: the primary demand for lumber and plywood was in residential housing with little being used in public buildings. This was noted when "the Minister commented that time is shifting from concrete to natural wood for building…but the government cannot force citizens to use wood for housing so it decided to promote using wood for public buildings" (JLR 2010: N536, p.1).

It appears that a predecessor to the Wood in Public Buildings Law was introduced in Kochi Prefecture in 2000. The goal of the Kochi policy was to increase the use of wood in public buildings from just 3.9% in 1999 to 5.8% in 2003 with a final goal of 7% (JLJ 2005: V46, N5, p. 11). The "Law Concerning the Promotion of the Use of Wood in Public Buildings" was approved on May 19th and officially announced on May 26th, 2010 while the companion "Basic Policy Concerning the Promotion of the Use of Wood in Public Buildings" was implemented on October 4th, 2010 (JLJ 2011: V52 N1, page 1-2). Fundamentally, the Law was designed to increase the use of wood, both structural and non-structural, in publically funded building at all levels of government from the national to prefectural to municipal level by requiring governments at each level to adopt a plan to increase wood use in public buildings. The Law targeted public buildings *"including schools, senior citizen care facilities, child care centers, health clinics, gymnasiums, swimming pools, libraries, community centers, public housing and government facilities."* Basically it required that all low-storied (one and two story) structures be built from wood. The Law defined low-story buildings as *"those with 13 meters or less in height from the top of the roof, nine meters or less from the eaves, 3,000 square meters or smaller total floor area and two or single stories"* (JLJ V51N20, page 12). The goal of the Law is to expand the share of wood construction in public buildings from 7.5% in 2009 to 20-30% (24%) and ultimately expand the demand for wood used in public buildings to 700,000-800,000 m^3 per year (JLR 2010: N539, page 1; JLJ 2012: V53N3, p.11).

By February 28th, 2013, wood-usage policies had been adopted by the national government, all 47 prefectural governments and by 971 of 1,742 municipal governments (55.7%). Construction data compiled by MLIT regarding wood use in public buildings from 2009 through 2011 is summarized in Table 17 (data for 2012 will not be available until November 2013). The information collected by MLIT is only for total wood usage and does not specify wood used in structural vs. non-structural applications, nor does it provides demographic information on the projects (location, number of stories, type of building, level of government awarding contracts). The summary data does show a couple of interesting things. First, the bulk of the wood used in the program has gone into riverbank stabilization projects with little being used in government buildings. Second, the volume of wood used is small, in the range of 50,000-60,000 m^3. Third, the bulk of the wood used in these projects (over 87% in the first three years) was domestic wood. Wood use under this program is expected to grow rapidly as construction contracts in the pipeline get approved and construction on these projects begins.

Under the DPJ platform to increase the use of domestic wood, MAFF noted in their 2010 budget request that *"use of domestic wood should be obligated to build public buildings"* (JLR 2009: N532, p.7). In the previous year, the Education Ministry earmarked ¥4 billion for the construction of martial arts gymnasiums in approximately 2,300 junior high schools. It was reported that *"a lot of demand for lumber is expected to be created and the lumber industry will contribute to the project by making active use of local timber"* (JLJ 2009: V50, N7, p.10) and that the Forestry Agency was *"offering support such as financial assistance of ¥135,000 per cubic meter of regionally produced lumber is used…"* (JLJ 2009: V50 N19, p.12). Indeed, there appears to be an expectation that domestic wood will be favored in public building projects, *"In the construction [of the Kumamoto Airport Terminal], there is the spirit of 'Making*

use of the local materials,' which is the aim of 'the law for the promotion of use of wood in public buildings'" (JLJ 2011: V52N24, p.1). This idea was also referenced by the Minister of MAFF, Michihiko Kano, in 2011 when he was quoted as saying that *"The government has passed a bill that makes use of lumber in public facilities. In the future, we'll put into practice new, drastic measures and work on actively using wood taken from forest thinning more than ever"* (JLJ 2011:N52V4, p.10). This perception was reinforced by the Deputy Director of the Wood Industry Division of the Forestry Agency when he *"spoke about the current situation of various measures and processes related to the Law Promoting the Use of Wood in Public Buildings…and he emphasized 'the significance in promoting the use of domestic lumber is big, and various policies will be implemented in the future leading to the expansion of its use*" (JLJ 2012: V53N16, p.3).

Table 17 Usage of wood under MLIT/Wood Use in Public Buildings Law through 2011.

Type of Public Buildings	Quantity Consumed	2009	2010	2011	Main Application
Government Building Department	**Use of Wood**	278m³	481m³	546m³	Government Building
	Amount for Domestic Wood (% for Domestic Wood)	—	—	—	
Park	**Use of Wood**	10,076m³	6,752m³	7,890m³	Buildings, Rest Area Play Facility, Admin.Office
	Amount for Domestic Wood (% for Domestic Wood)	8,770m³ (87.0%)	5,631m³ (83.3%)	6,122m³ (77.6%)	
River	**Use of Wood**	39,050m³	28,180m³	28,241m³	Revetment Work Slope Protection
	Amount for Domestic Wood (% for Domestic Wood)	37,890m³ (97.0%)	27,020m³3 (95.9%)	26,120m³ (92.5%)	
Road	**Use of Wood**	2,880m³	2,920m³	4,140m³	Poles for tree Fence, etc.
	Amount for Domestic Wood (% for Domestic Wood)	2,870m³ (99.7%)	2,900m³ (99.3%)	4,100m³ (99.0%)	
Housing	**Use of Wood**	11,807m³	9,828m³	10,764m³	Low-rise Wooden Public Housing
	Amount for Domestic Wood (% for Domestic Wood)	8,703m³ (73.7%)	6,440m³ (65.5%)	7,519m³ (69.9%)	
Railroad	**Use of Wood**	348 m³	402m³	275m³	Station Facility (Waiting Roon, Toilet, etc.)
	Amount for Domestic Wood (% for Domestic Wood)	211m³ (60.6%)	350m³ (87.1%)	214m³ (77.9%)	
Port	**Use of Wood**	553m³	251m³	388m³	Rest Space, Bench, etc.
	Amount for Domestic Wood (% for Domestic Wood)	220m³ (41.1%)	177m³ (70.5%)	288m³ (74.2%)	
TOTAL	**Use of Wood**	64,974m³	48,814m³	52,244m³	
	Amount for Domestic Wood (% for Domestic Wood)	58,644m³ (90.7%)	42,581m³ (88.0%)	44,363m³ (85.8%)	

The high rate of domestic wood use in the initial stage of the Law is problematic, particularly since the government has often noted that the Law applies to all types of wood, both imported and domestic. However, the fact that the Law was derived from the Wood Promotion Bill which *"contains a target of a degree of self-sufficiency in wood in every five years"* suggests a tie-in, at least within the legislative group, between increasing the demand for domestic wood and increasing wood use in public buildings. Along this line, MAFF submitted a companion bill to the Diet promoting the use of local wood for public buildings and *"With this bill, both supply and demand side are bound by law so whether there is penalty*

or not, the bill practically makes obligation of using local wood for public buildings of certain height and space" (JLR 2010: N536, page 1). Subsequently, US and Canadian wood industry associations, as well as the Japan Lumber Importers Association, all requested clarification on the intent of the Law with respect to "local wood" versus imported wood. MLIT went to great lengths to assure these groups that both types of wood would be treated equally under the Law and in practice, responding that *"the act doesn't necessarily recommend use of domestic wood only but Japan expects wood supply (from other countries)"* (JLR 2010; N541, page 1). However, while MLIT and MAFF have stated that the Law allows the use of any wood, imported or domestic, an industry report in January 2010 noted that the MAFF bill *"is aiming to revitalize and further develop the forest industry"* and *"the bill practically makes obligation of using local wood for public buildings of certain height and space"* (JLR 2010: N536, p.1). As a side note, in an article describing the Forestry Agency budget for FY 2011, the Japan Lumber Journal reported that: *"In the fourth important item* (¥1.4 billion is allocated to double the supply of domestic lumber), *the measures to double the supply of regional material will promote the expanded use of regional material for public buildings, the revitalization of the lumber industry, and the stable supply of logs in order to target a 50% self-sufficiency rating for lumber that was raised in the 'Forest and Forestry Revitalization Plan'"* (JLJ 2010: V51 N19, page 1-2).

Subsequent comments by both MLIT and MAFF officials to industry groups further suggest the linkage between the Public Building Law and the effort to increase the use of domestic wood. For example, Japan Lumber Reports noted that *"large sized cross sectional lumber, using domestic made lamina is becoming standard since the government is promoting use of domestic wood for public buildings"* (JLR 2010: N547, page 12). On March 31st, the Minister of MAFF, Hirotaka Akamatsu stated at an industry news conference that *"With the way I feel, I would like to see the use of wood* (in public buildings) *centering on domestically produced lumber"* (JLJ 2010: V51,V6, page 12). The Japan Lumber Journal, while reporting about the use of domestic wood to remodel Kumamoto Airport, stated that *"Making use of the local materials which is the aim of 'the Law for the Promotion of Use of Wood in Public Buildings…'"* (JLJ 2011: V52,N24, page 1). Speaking at the Nagoya Seminar on the Expansion in Lumber Use, a Forestry Agency Deputy Director speaking in reference to the Law Promoting the Use of Wood in Public Buildings, noted that *"the significance in promoting the use of domestic lumber is big, and various policies will be implemented in the future leading to the expansion of its use"* (JLJ 2012: V53,N16, page 3). A report in an industry journal on a MAFF program to expand the demand for domestic wood noted that *"Work will also be conducted into expanding actual demand in the use of regional lumber for wood-constructed, public buildings"* (JLJ 2010 (V51, N21, page 4). Finally, the Director-General of the Forestry Agency, speaking at a news conference for the UN International Year of Forests was quoted as saying: *"The (Japanese) government has passed a bill that makes use of lumber in public facilities. In the future, we'll put into practice new, drastic measures and work on actively using wood taken from forest thinning more than ever"* (JLJ 2011: V52 N4, page 11).

As noted previously, industry often takes their lead from the government and there are numerous cases where industry managers have carried the domestic wood message back to their member companies. The Director of the Japan Laminated Wood Products Association noted that *"domestic wood will be used more and more as the promotion law of wood utilization for public buildings will become widespread"* (JLJ 2011: V52,N9, page 3). Speaking at a general meeting of the Wooden House Builders Association, the Chairman noted that *"when the government encourages the usage of domestic timber, the role of our association has increasingly become important"* (JLJ 2010: V51, N12, page 12). Finally, in an article on the Owase Timber Cooperative, the Japan Lumber Journal reported that *"…a law promoting the use of lumber in public buildings was established. In the case of constructing wood-built school buildings, there is a high possibility that regionally certified material and performance displays will be necessary."* (JLJ 2010: V51, N15, page 12).

At the end of the day, it would appear that there is an implicit understanding in Japan within the legislative and business communities that a major goal of the Wood in Public Buildings Law is to promote the use of domestic wood in building public structures. There also appears to be a clear relationship between the Wood Use in Public Buildings Law and the Forest and Forestry Revitalization Plan to increase the use of domestic wood as described in the following quote: *"As a basic understanding, a reformation in the processing and distribution system of domestic lumber, which is needed to overcome foreign (imported) lumber, is underway, and in the near future, by promoting the use of lumber in public buildings, use of lumber will expand in the housing and construction field"* (JLJ, 2010: N51 V14, page 1-2). Similarly, in its 2011 budget request, MAFF notes that, with reference to the Revitalization Plan, that *"the measures to double the supply of regional material will promote the expanded use of regional material for public buildings, the revitalization of the lumber industry, and the stable supply of logs in order to target a 50% self-sufficiency rating for lumber that was raised in the 'Forest and Forestry Revitalization Plan'"* (JLJ 2010: V51N19, p.2). This was further underscored in the Japanese Budget for Fiscal 2011 where the Forestry Agency received "*¥1.4 billion for measures to double the supply of regional timber, including…measures to double the supply of regional material to promote the expanded use of regional material for public buildings*…" (JLJ 2010. V51, N19, page 1-2).

Forest and Forestry Revitalization Plan

While the Forest and Forestry Revitalization Plan (referred to in this section as "the Revitalization Plan") was developed in December 2009 as an outgrowth of the landslide victory of the Democratic Party, variations of the Revitalization Plan had been circulating since at least 2005. To some degree, these early plans were designed to help Japan meet its carbon reduction goals under the newly signed Kyoto Protocol. The Forestry Agency recognized early on that forest management activities could help meet the carbon reduction goals while improving forest health and providing a large increase in volume of domestic log harvest. The challenge would be increasing the demand for domestic logs. This situation was aptly summarized by the President of Kanazawa Housing Company, Atsushi Nakajima, commenting on the potential to increase the use of domestic wood in housing: *"A favorable wind is blowing. In Feb. 2005, the Kyoto Protocol…will come into effect. The amount of greenhouse effect gas absorbed by mountain forests has been recognized as reducing the amount of greenhouse effect gas. Because of this, the Forestry Agency was the first part of government to formulate actively a policy to raise and utilize mountain forests and domestic wood. [Kanazawa Housing] hopes to get on this larger trend successfully…[I] think that these kinds of activities act to support building firms that work on housing made of domestic wood"* (JLJ 2005, 46, 4 p6).

In 2006, the "Basic Plan for Timbers and Forestry" was approved by the Cabinet. The Basic Plan aimed to *"Expand demand to 23 million m^3 by 2015"* as proposed by the Forestry Policy Council of MAFF. Specifically, it was proposed that demand for domestic logs *"is expected to grow from current 11,000,000 m^3 to 14,000,000 m^3 … and for plywood is 1,000,000 m^3 to 3,000,000 m^3, respectively"* (JLJ 2006: V47,N20, p8). Reflecting the trend of industry taking its lead from government, the president of the Plywood Manufacturers Association noted at a general meeting of the membership that *"At present Forestry Agency is promoting a campaign to expand the usage of thinned cedar timber which continues to mount. Because it can consume a big volume, the usage of plywood is drawing a great deal of attention. Japan Plywood Manufacturers Association …announced that it would consume 1,000,000 m^3 of domestic timber as the material for plywood in this year"* (JLJ 2006: V47N12, p10). A year later, the Chairman of JPMA, referring to the Basic Plan, noted that "*I'd like to achieve the mark of 3 million m^3 of domestic logs, which we promised, earlier than 2015*" (JLJ 2007: V48N11, p.13).

As part of the Basic Plan, it was reported that the *"Forestry Agency, to promote more active use of domestic wood,…decided to designate 11areas..as the model areas of 'New Production System' which creates new ways of producing lumber and distribution system in order to promote active use of domestic*

wood products" (JLJ 2006: V47N9, p.11). In mid-2007 it was reported that the Forestry Agency announced that a goal of the Basic Plan was *"for traditionally constructed homes, raising the percentage of domestic timber used from 30% in 2005 to 60% ten years later in 2015 is being targeted"* (JLJ 2007: V48N11, p.11).

Shortly after the announcement of the Basic Plan, Kanazawa Prefecture announced a program to promote the supply and demand for wood products sourced from the prefecture, including a combination of national and prefectural subsidies. Under the program, *"Kanagawa Prefecture invited public participation in serving supply bases of its home produced timber…This project accepts applicants from the public who offer bases to produce and supply material for houses and furniture made from the Kanagawa-grown timber. The prefecture itself will support the project based on the state subsidy in addition to offering the prefectural land"* (JLJ 2006: V47N11, p.10). Similarly, a project to expand the production of domestic wood in Takayama City in Gifu Prefecture was announced for completion by the end of 2006. The project *"aims to promote local production for local consumption responding to the needs of 'housing with familiar and identifying timbers". Gross amount of sawmill construction is ¥9 billion except land cost. It receives a grant of 57% of total expenditure as 'improvement project' by national, provincial and local government"* (JLJ 2006: V47N4, p.6-7).

In 2009, the Democratic Party platform emphasized meeting Japan's carbon emissions reductions targets, as mandated under the Kyoto Protocol, partially through intensive forest management. To achieve Japan's carbon reduction goal, the Forestry Agency conceived a comprehensive program designed to transform the old inefficient structure within the forestry and forest products sector at every level from the forest to harvesting, production, distribution, and through to the end-use market. In developing the Revitalization Plan, the government constituted a Forest Regeneration Business Study Group in 2010 comprised of 32 business groups, 8 local economic groups and three government Ministries to develop *"a common platform to achieve and realize regeneration of forestry by participation of many private enterprises together with government organizations as a national undertaking…to achieve self-sustenance of 50% of wood…"* (JLR, 2010: N540, p.7). The impact of this Study Group cannot be underestimated. Several months after the first meeting of the Study Group, the Japan Wooden Housing Precut Association (a member of the Study Group) announced that it would *"implement a project to expand the share of regional lumber supply for* [precut] *houses with a budget of ¥19,500,000"* (JLJ 2010: V51 N14, page 11). In fact, MAFF noted that *"by following the [Revitalization] plan, person in the forestry industry is expected to actively generate ideas appropriate to one's each area to contribute to 'revitalize the forest and forestry'"* (JLJ 2011: V52N14, p.1).

Following the recommendation of the Business Study Group, MAFF put together a Task Force to Promote the Forest and Forestry Management Revitalization Plan. The Revitalization Plan contained *"three basic ideas: 1) show continuously the multifaceted functions of forests, 2) to revitalize forestry management and the lumber industry in a form that creates regional resources, and 3) to contribute to a low-carbon society by expanding the use of lumber and energy of forests and the forest industry. The plan also looks to shift the structure of Japanese society 'from a concrete society to a wood society' and aims to raise the lumber self-sufficiency rating to over 50% in ten years. At the meeting the items that were examined were classified into 5 categories: 1) basic policy for forests and forest industry, 2) network and operating systems, 3) reorganization of forestry associations and development of the forest industry business, 4) employee development, and 5) production, distribution, and use of domestic material"* (JLJ 2010: V51N3, p. 10).

A comprehensive discussion of the Revitalization Plan is beyond the scope of this report, but a thorough discussion of the Plan can be found in the Annual Report on Forest and Forestry in Japan FY 2011 (Forestry Agency 2012: *http://www.rinya.maff.go.jp/j/kikaku/hakusyo/23hakusho/pdf/23_e.pdf*) and FY 2010 (Forestry Agency 2011: *http://www.rinya.maff.go.jp/j/kikaku/hakusyo/22hakusho/pdf/22_e.pdf*).

The targets for reaching 50% self-sufficiency in timber supply are summarized in Tables 18 and 19. The following paragraphs will give a brief overview of the background of some of the goals of the Revitalization Plan.

The Revitalization Plan, while breathtaking in its scope, relies on massive subsidies and related programs to achieve its goals. For example, in order to meet the goals of the Revitalization Plan as well as those of the Kyoto Protocol, it was determined that annual harvest volumes would have to be increased substantially to approximately 550,000 hectares)[5]. In order to achieve the harvest level goal of the Revitalization Plan, it was imperative that the Forestry Agency take into account the demographics of forest owners: small forest owners who were aging, often living far from the forest with little interest in, or capital to, actively managing their forests. To address this problem and *"prevent disorderly harvest"* (JLR 2010: N546, p.1), the Revitalization Plan stated that forest owners are *"under obligation to perform proper management of the forest such as thinning. The expenses to perform such obligation are paid directly by the government"* including conducting thinning operations (JLR 2009: N528, page 1). The Revitalization Plan introduced a direct payment system for forest management and environmental preservation that essentially subsidizes up to 100% of thinning operations (including road building) in private forests. The Revitalization Plan *"mandates forest owners to manage their forests adequately, and in return, they will be subsidized when they conduct forest management such as tree thinning"* (JLR 2010: V51N18, p.11). The Revitalization Plan also works to group together adjacent small forest plots for the purpose of performing thinning operations on the larger consolidated forest (JLR 2010: N546, p.1).

Table 18 Japan's projected wood supply (under the Revitalization Plan) (million cubic meters).

	Domestic Supply			Total Supply		
	2009	**2015**	**2020**	**2009**	**2015**	**2020**
Lumber	11	14	19	26	27	30
Plywood	2	4	5	8	8	9
Chips	5	9	15	29	36	37
Other	1	1	1	2	2	2
Total	18	28	39	65	72	78

Table 19 Domestic and imported market share in various wood product categories (under the Plan).

	Domestic Share			Imported Share		
	2009	**2015**	**2020**	**2009**	**2015**	**2020**
Lumber	42.3%	51.9%	63.3%	57.7%	48.1%	36.7%
Plywood	25.0%	50.0%	55.6%	75.0%	50.0%	44.4%
Chips	17.2%	25.0%	40.5%	82.8%	75.0%	59.5%
Other	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Total	27.7%	38.9%	50.0%	72.3%	61.1%	50.0%

Another goal of the Revitalization Plan is to restructure and revitalize the sawmill industry away from an industry where *"lumber manufacturing depends on inefficient small sawmills."* (JLR, 2010: N540, page 2). To achieve this goal, the Revitalization Plan *"introduces and promotes a new production system for effective supply and distribution system* [for wood products]. *…To use forest resources more efficiently*

[5] *In the amendment of the "Kyoto Protocol Target Achievement Plan" by the government in 2007, FA estimated that 3.3 million ha of thinning would be needed between 2007 and 2012 (which is equivalent to 550,000 ha annually) in order to achieve the goal of sequestering 13 million tons of carbon annually.*

and to supply required lumber for house builders steadily, the Forestry Agency designated eleven model areas all over Japan, where large capacity sawmills are being built with streamlined distribution system…" (JLR 2010. N540, page 2). The Revitalization Plan also proposes substituting domestic logs for imported logs within Japanese sawmills. In describing efforts to expand the demand for domestic timber within the sawmill sector, a MAFF Committee noted that *"With the effects of the promotion in the use of domestic lumber for beams, cross beams, and 2x4 structural parts, of the development of new demand in civil engineering use, and of the promotion in the shift in resources to domestic material at factories manufacturing foreign lumber in the future, the amount of increase in demand for domestic lumber is expected to be about 10.0 million m^3 in 2020 (compared to 2009)"* (JLJ 2010: v51N22, p.3). Efforts to revitalize the sawmill industry, which had been underway since the early 2000s, were fairly successful. The Japan Forest Products Journal, reporting the results of a survey conducted in 2001 and 2011, noted that the number of sawmills consuming over 50,000 m^3 annually had increased from 4 to 31. Similarly, the top 10 domestic sawmills reported that their log consumption had jumped from 416,760 m^3 in 2001 to 1,386,091 m^3 in 2011 (JLR 2011: N572, page 7).

Taking their lead from MAFF, some prefectures began to develop their own programs designed to increase the use of locally produced lumber. In early 2011 the Japan Lumber Journal described a project in Akita prefecture designed to subsidize the expanded use of domestic lumber in wooden housing. The Akita program stated that *"to meet the demand for cedar logs in Akita, the projects that promote the commercialization of lumber production from privately owned forests will be provided assistance (assistance percentage of 50%) in cases in which high performance machinery is introduced at a business unit that is planning to convert its business type to one that produces lumber material. …A target is the conversion of businesses so that new blood is pumped into the creation of new jobs in local areas. In addition, as a link to "Akita Safe and Worry-Free Housing Project", subsidies will be provided for new construction and reconstruction of wooden homes that use cedar from Akita for more than 70% of its structural lumber. The subsidy will amount to ¥200,000 targeting 200 homes"* (JLJ 2012: V53N7, p.11).

Despite the use of massive subsidies to restructure and revitalize the sawmill industry under the Revitalization Plan, these new sawmills, often lacking a clear competitive advantage against imported lumber, found themselves losing market share as the yen strengthened in 2011 and early 2012. Referring to the strong yen, the Japan Lumber Report noted that *"This would ruin the government project to develop domestic wood processing facilities to meet the target of wood sufficiency rate of 50%. Actually many large domestic wood processing facilities have started running with government subsidy in the last two years. However, low priced imported products limit ceiling of domestic made product sales prices while domestic log prices continue climbing because of expanding demand with many large log consuming sawmills and plywood mills. Some sawmills have started curtailing the production due to high log cost and low lumber sales prices, so domestic wood business will face desperate battle this year while Euro and dollar remain depreciated"* (JLR, 2012: N580, page 1).

Feed-In Tariff System

Another new subsidy program was recently developed to focus on increasing the demand for small diameter timber developed during the course of forest thinning operations. Previously left in the forest, this low quality timber was envisioned as providing the feedstock for a new bio-energy sector. This new program, called the ***Feed-in Tariff System,*** was implemented in July 2012. In an effort to increase the competitiveness of low value, low quality forest residuals derived from forest health operations, the Japanese government has established a "Fixed Price Purchasing System for Renewable Energy" that essentially subsidizes the removal of forest residuals for the production of renewable energy. The price of ¥8,000 per m^3 of woody biomass (33.6 yen per kilowatt-hours) was established to ensure the profitability of operations to remove forest thinnings and residuals. The program aims to use up to 20 million cubic meters of forest thinnings per year by 2020. This goal includes not only electricity utilization, but also

material utilization (ex. particle board). It seems that the current volume of forest residuals used to produce electricity is approximately only 0.5 million m^3/yr in Japan.

Several projects have already been announced, and 20-30 projects are in the planning stage in Japan. Six woody biomass projects have already been certified by METI (as of December 31st, 2012). MAFF and the government don't have the target for the percentage of power that should be produced from woody biomass. If the forest residuals in Japan (20 million cubic meters) are only used for electric generation, the scale of electric generation is comparable to a million kWh per plant. So, it seems that the share of power from woody biomass in Japan will likely remain small.

8. Results of a Survey of Japanese Residential Construction Professionals

To get a better understanding of how Japanese home building professionals perceive domestic wood, imported wood, and the various policies, a survey was carried out at the Japan Home Show held in Tokyo in 2012 (both the English and Japanese translation of the survey are located in Appendix B). The survey was administered to 257 building professionals during the course of the three day Japan Home Show. The objectives of the survey were to: 1) get a better understanding of how regulatory policy influence builder's perceptions and use of domestic wood and 2) assess which timber species are perceived as being best in specific end-use applications in both post and beam and 2x4 construction.

Builders were asked about their awareness and use of domestic wood subsidy programs that are offered at the prefectural level, Figure 46. Almost 60% of respondents indicated that they had heard about prefectural subsidy programs designed to encourage the use of local wood products. Despite the fact that most builders had heard about regional subsidy programs, only about a third indicated that they would increase their use of domestic wood in order to obtain the subsidies. Anecdotal data suggests that many builders have not increased their use of domestic wood for several reasons. First, they perceive that the quality (both in terms of strength and dimensional stability) of domestic wood is poor compared to imported wood. Dimensional stability is a big issue for Japanese builders since it is expensive (and embarrassing) to have to replace wall studs that warp after the house has been completed. Second, they may not be able to obtain a reliable supply of domestic wood when they need it. Third, they perceive that the problems of applying for the subsidies are not worth the effort. Finally, they perceive that imported wood is better in terms of price, strength and quality relative to domestic wood and that it represents a better value to them and, more importantly, their customers.

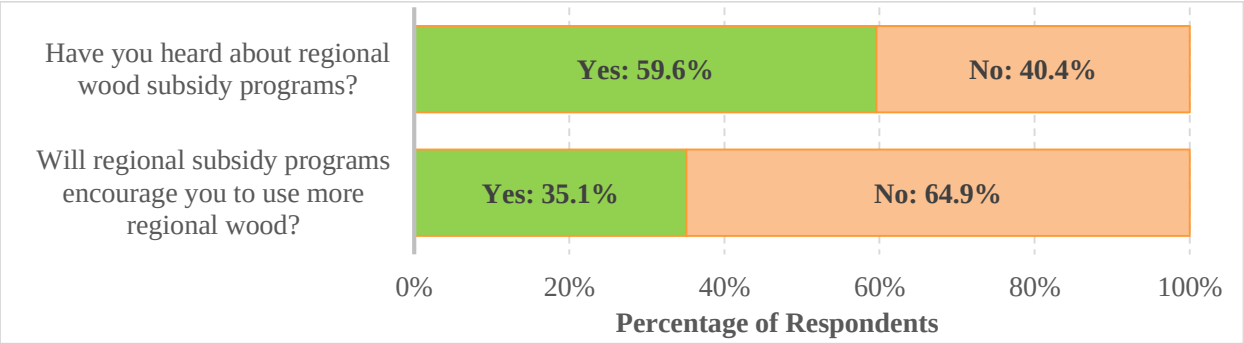

Figure 46 Respondent's familiarity and use of domestic wood subsidy programs.

Builders were also asked to compare domestic wood and imported wood across a variety of product attributes, Figure 47. The largest proportion of builders reported that imported wood is better than domestic wood across every product attribute with the exception of quality. The largest proportion of builders felt that the quality of domestic wood and imported wood was the same, although a large number of respondents felt that domestic wood quality exceeded that of imported wood. This result is interesting since informal discussions with builders and precutters over the past several years has consistently suggested that domestic wood quality is perceived as being substantially lower than imported wood.

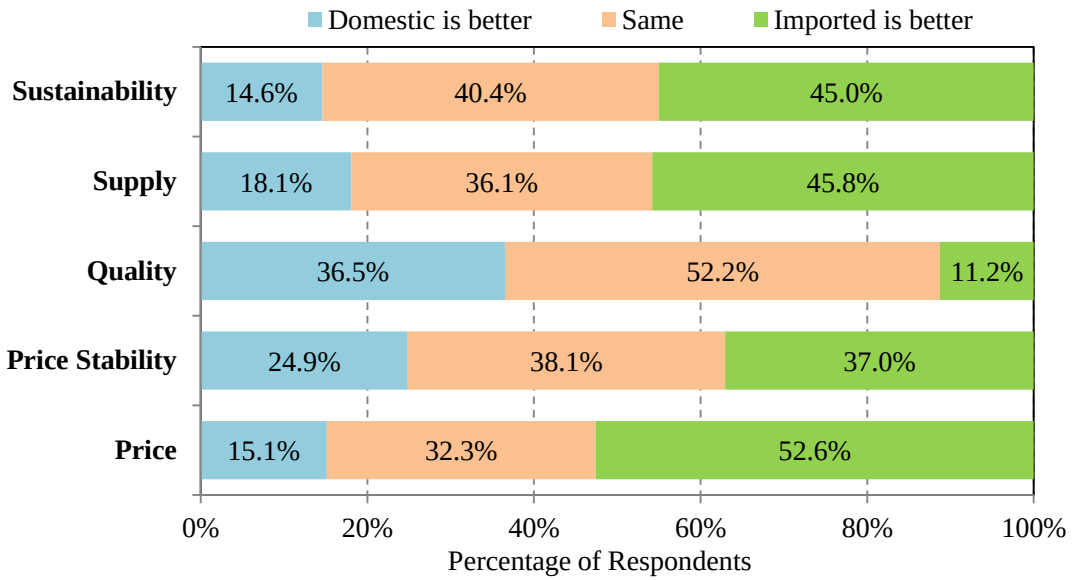

Figure 47 Respondent's perceptions of domestic and imported wood on different product attributes.

Japanese post and beam home builders reported that the major domestic wood species (*sugi* and *hinoki*) were the best species to use in most end-use applications in post and beam construction, Figure 48 and Table 20. For example, *hinoki* was by far perceived to be the best species for *dodai* (ground sills) because of its superior natural resistance to decay. In fact, with the exception of Douglas-fir, no other imported wood species was rated highly in any end-use application. Douglas-fir was highly rated for use in several end-use applications including *neda* (floor joists), *hirakaku* (beams), *sujikai* (diagonal wall bracing) and *taruki* (rafters).

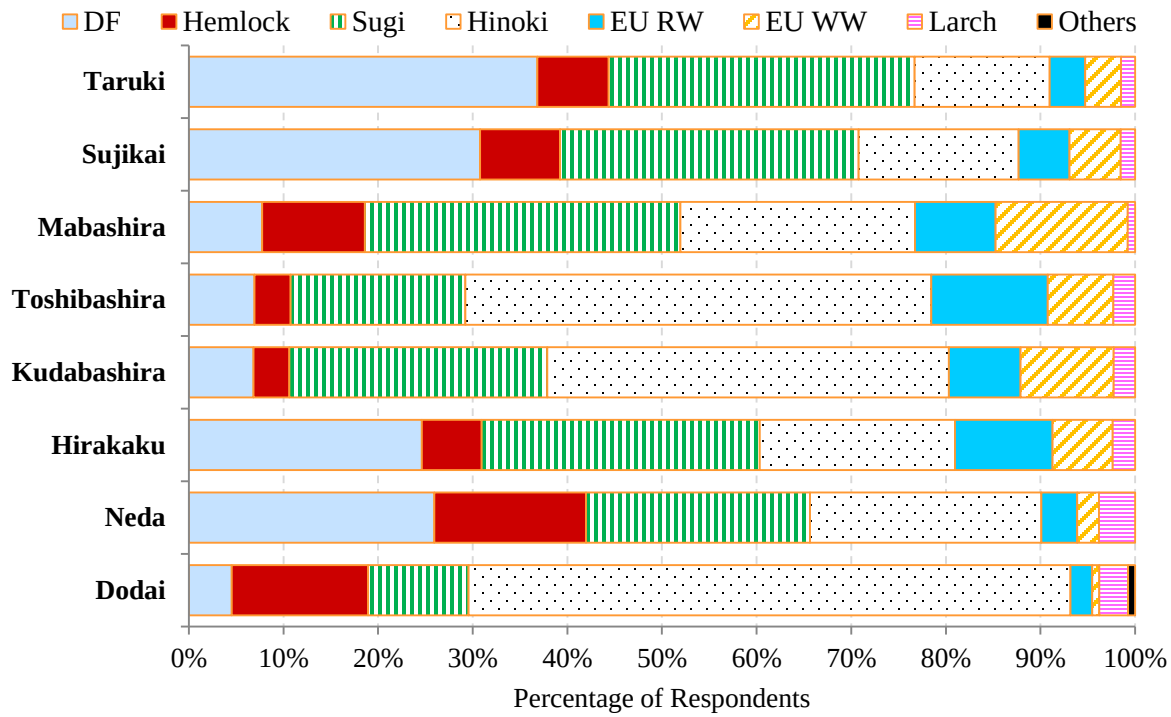

Figure 48 Respondent's perceptions of best wood species for specific P&B end-use applications.

Table 20 Respondent's perceptions of best wood species for specific P&B end-use applications.

	DF	Hemlock	EU Redwood	EU Whitewood	Larch	Sugi	Hinoki	Domestic
Dodai	4.5%	14.4%	2.3%	0.8%	3.0%	10.6%	**63.6%**	74.2%
Neda	**26.0%**	16.0%	3.8%	2.3%	3.8%	23.7%	**24.4%**	48.1%
Hirakaku	**24.6%**	6.3%	10.3%	6.3%	2.4%	**29.4%**	20.6%	50.0%
Kudabashira	6.8%	3.8%	7.6%	9.8%	2.3%	**27.3%**	**42.4%**	69.7%
Toshibashira	6.9%	3.8%	12.3%	6.9%	2.3%	**18.5%**	**49.2%**	67.7%
Mabashira	7.8%	10.9%	8.5%	14.0%	0.8%	**33.3%**	**24.8%**	58.1%
Sujikai	**30.8%**	8.5%	5.4%	5.4%	1.5%	**31.5%**	16.9%	48.5%
Taruki	**36.8%**	7.5%	3.8%	3.8%	1.5%	**32.3%**	14.3%	46.6%

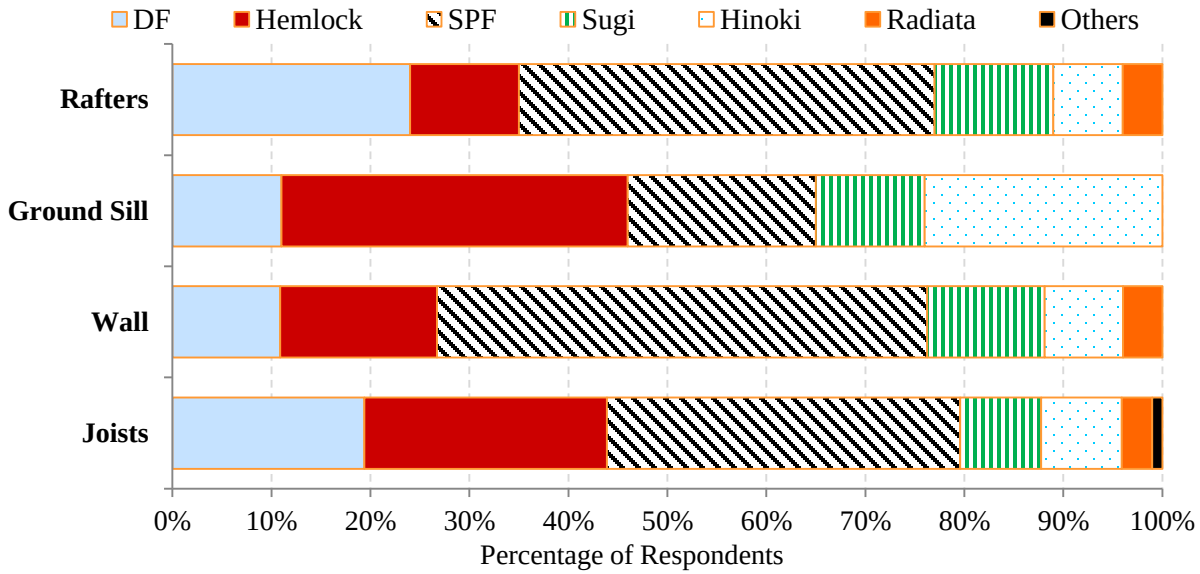

Figure 49 Respondent's perceptions of best wood species for specific 2x4 end-use applications.

Japanese 2x4 home builders were also asked to rate imported and domestic wood species, Figure 49 and Table 21. In contrast to the results reported by post and beam builders, 2x4 builders tended to view imported wood as vastly superior to domestic wood across all of the major end-use applications. The singular exception to this observation is for ground sills where approximately a quarter of 2x4 home builders perceive *sugi* as being the best species. In general, however, Japanese 2x4 builders perceive SPF and hemlock are the best wood species.

Table 21 Respondent's perceptions of best wood species for specific 2x4 end-use applications.

	DF	*Hemlock*	*SPF*	*Radiata*	*Sugi*	*Hinoki*	*Domestic*
Joists	19.4%	**24.5%**	**35.7%**	8.2%	8.2%	3.1%	11.2%
Wall	10.9%	15.8%	**49.5%**	11.9%	7.9%	4.0%	11.9%
Ground Sill	11.0%	**35.0%**	19.0%	11.0%	**24.0%**	0.0%	24.0%
Rafters	24.0%	11.0%	**42.0%**	12.0%	7.0%	4.0%	11.0%

9. Impact of Domestic Wood Programs on US Log and Lumber Exports to Japan

Estimating the Impact of the Revitalization Plan on US Exports of Logs and Lumber

The Forestry and Forest Revitalization Plan was specifically designed to increase both the supply and demand for domestic wood in Japan. As mentioned previously, the goal of the Revitalization Plan is to increase the market share of domestic wood in Japan to 50% by 2020, Figure 50.

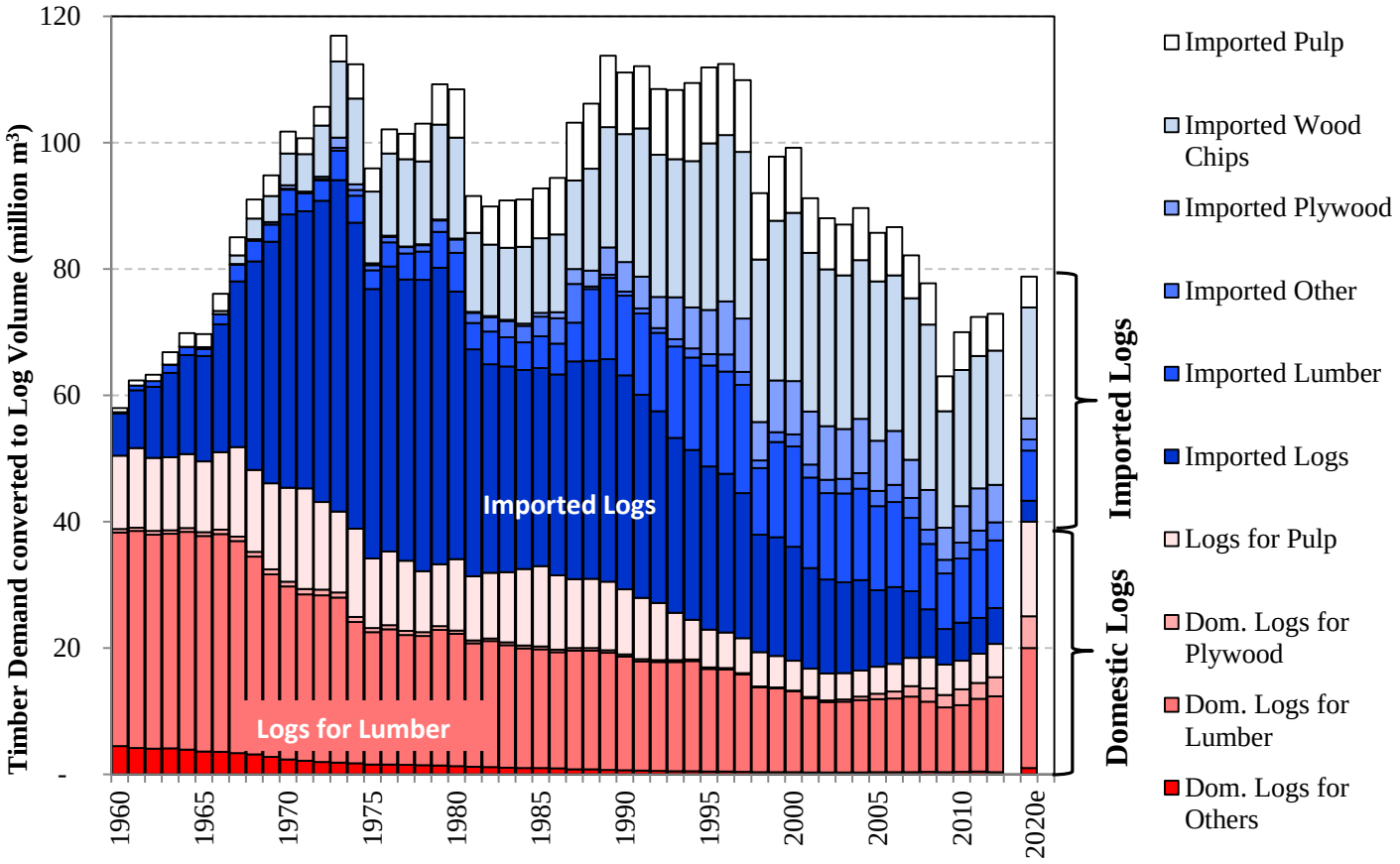

Figure 50 Total supply of wood materials in Japan (converted to log volume) through 2020 based on Revitalization Plan.

In designing the program and developing the estimates for increased demand for domestic wood, the Forestry Agency developed detailed estimates of how domestic wood was expected to be substituted for imported wood in general (Figure 51) and within specific end-use applications, Figure 52. For example, in Figure 51 it can be seen that the Forestry Agency estimates that, as a result of the Revitalization Plan, the share of domestic wood used in *hirakaku* (beam) applications in residential housing will increase from the current 5% to 33% by 2020 and that the volume of imported wood that will be substituted out by domestic species will be approximately 1.4 million cubic meters. Similar estimates were developed for the total wood market in Japan, plywood demand and the pulp/chip market as well and these estimates are provided in Appendix D.

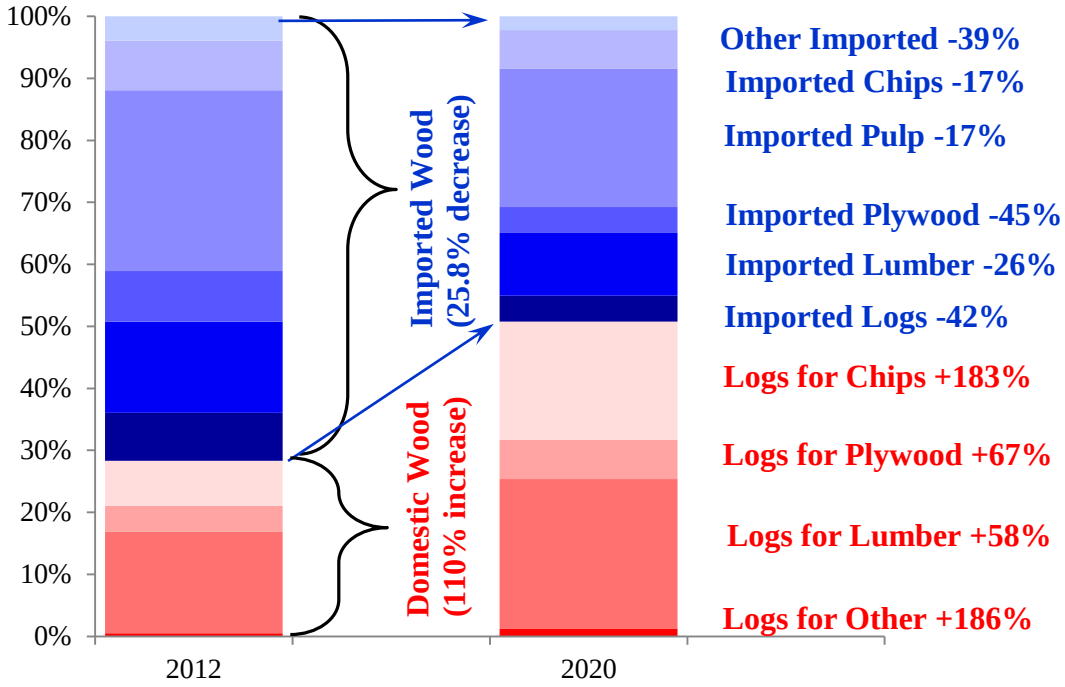

Figure 51 Market shares of domestic and imported wood in Japan between 2012 and 2020 based on Revitalization Plan, as projected by the Forestry Agency.

It would have been almost impossible to meet the goals of the Revitalization Plan simply by substituting domestic wood for imported wood within the residential housing sector. Thus, MAFF, in consultation with other government Ministries, developed a complementary strategy designed to expand the use of wood within other sectors of the economy, including non-wood housing (demand for wood was to be increased by 900,000 m^3 by 2020), public buildings (demand increased by 720,000 m^3), commercial buildings (demand increased by 3.15 million m^3), public works (demand increased by 4.9 million m^3), biomass energy (6 million m^3) and log exports (demand increased by 350,000 m^3). While most of the new demand for wood was targeted to domestic wood products through the use of subsidies and government programs, some would inevitably be captured by imported wood products, Table 22. However, the net result of the Revitalization Plan on the demand for imported wood products would be a loss in demand of approximately 8 million m^3 by 2020.

Table 22 Net change in demand for domestic and imported wood under the Revitalization Plan (m^3)

	Demand due to Substitution	Demand due to New Uses	Net Change in Demand	
			Domestic	Imported
Lumber	Domestic: 5,800,000 Imported: -5,800,000	Domestic: 5,400,000 Imported: 3,400,000	11,200,000	**-2,400,000**
Plywood	Domestic: 3,100,000 Imported: -3,100,000	Domestic: 800,000 Imported: 500,000	3,900,000	**-2,300,00**
Chips	Domestic: 3,300,000 Imported: -3,300,000	Domestic: 6,000,000 Imported:	9,300,000	**-3,300,000**
Total Change in Demand for Wood Products in Japan			24,400,000	**-8,000,000**

Impact on Lumber Demand

Wood Demand 2009	
Total Demand	25,680,000 m^3
Domestic Wood	10,580,000 m^3
Imported Wood	15,100,000 m^3
Self-Sufficiency	41%

Wood Demand 2020	
Total Demand	34,500,000 m^3
Domestic Wood	21,800,000 m^3
Imported Wood	12,700,000 m^3
Self-Sufficiency	63%

(1,000 m^3)

Wood Frame Housing	Posts	600	Dom. Share: 54% to 77%
	Beams	1,400	Dom. Share: 5% to 33%
	Foundation	500	Dom. Share: 28% to 66%
	Rafters	1,100	Dom. Share: 44% to 72%
	Glulam Lumber	1,400	Post: 600,000 m^3; Beam: 300,000 m^3; Foundation: 100,000 m^3; Rafter, 400,000 m^3
	2x4 Lumber	1,400	Domestic Share to 33%
Non-Wood Housing	Structural	600	Dom.: 400,000 m^3, Imp.: 200,000 m^3
	Interior	300	Dom.: 200,000 m^3, Imp.: 100,000 m^3
Public Buildings	Structural	700	Dom.: 400,000 m^3, Imp.: 300,000 m^3
	Interior	20	
Commercial Buildings	Structural	3,100	Dom.: 1,900,000 m^3, Imp.: 1,300,000 m^3
	Interior	50	
Other Uses	Civil Engineering	3,000	Dom.: 1,800,000 m^3, Imp.: 1,200,000 m^3
	Concrete Forming	800	Dom. Share: 60%
	Pallets	800	Dom. Share: 70% of increase
	Export	300	Inc. due to export promotion program

Demand due to the substitution of domestic wood for imported wood (5,800,000 m^3)

Demand due to increase from new uses of wood (Domestic: 5,400,000 m^3 and Imported: 3,400,000 m^3)

Figure 52 MAFF estimate of the impact of the Revitalization Plan on lumber demand in Japan in 2020.

While understanding the overall impact of the Revitalization Plan on global exports of wood products to Japan is useful, it is perhaps more important to understand the impact of the Revitalization Plan on US wood exports to Japan. To simplify the analysis, we will focus our attention on US exports of logs and lumber to Japan, since these two product categories represent 80% of US wood exports to Japan. In developing their demand estimates, MAFF made several assumptions to facilitate analysis. First, they assumed that housing starts would average approximately 800,000 units per year between 2012 and 2020. Second, they assumed that the total demand for wood products in Japan would increase from 68.1 million m^3 in 2009 to 81.1 million m^3 by 2020. The increased demand within each product category between 2009 and 2020 were estimated to be: lumber: 25.7 million m^3 to 34.5 million m^3; plywood: 8.2 million m^3 to 9.5 million m^3; and chips: 29.4 million m^3 to 37.1 million m^3. These assumptions provided a baseline against which to estimate the impact of the Revitalization Plan on US wood exports to Japan.

To provide a conservative estimate of US export losses due to the implementation of the Revitalization Plan, we have made several additional assumptions. First, we assume that the total demand for wood in Japan and the demand for US logs and lumber remains unchanged between 2012 and 2020. Second, the US share of the Japanese market for imported logs and lumber remains at the 2012 levels of 40.2% for logs and 6.4% for lumber. Finally, the unit value of US logs and lumber are set at the average price for 2012: \$252.11/ m^3 for logs and \$479.17/ m^3 for lumber.

Using these assumptions, we developed a linear model to project US export losses to Japan between 2012 and 2020 for both logs and lumber due to the Revitalization Plan, Figure 53. Based on this analysis, total cumulative export losses for the US between 2012 and 2020 due to the Revitalization Plan reach \$1.1 billion in lost log exports with an additional \$379 million in lost lumber exports. Total cumulative export losses for the US to Japan for just logs and lumber over the period 2012-2020 reach \$1.46 billion. If we were to consider all other wood products, the estimated total cumulative export losses for the US that are attributable to the Revitalization plan would reach \$1.8 billion by 2020. Keep in mind that this is a conservative estimate. Our model kept Japanese wood demand constant over the period 2012-2020 whereas MAFF has estimated that the Japanese demand for wood will increase from 68.1 million m^3 in 2012 to 81.1 million m^3 by 2020. In addition, we only estimated the impacts of the Revitalization Plan on US exports to Japan. We did not take into account the impacts of the other subsidy programs (the Public Building Law or prefectural subsidies for the 200 Year House program) that have been adopted or will be adopted in the near future (Wood Use Points Program).

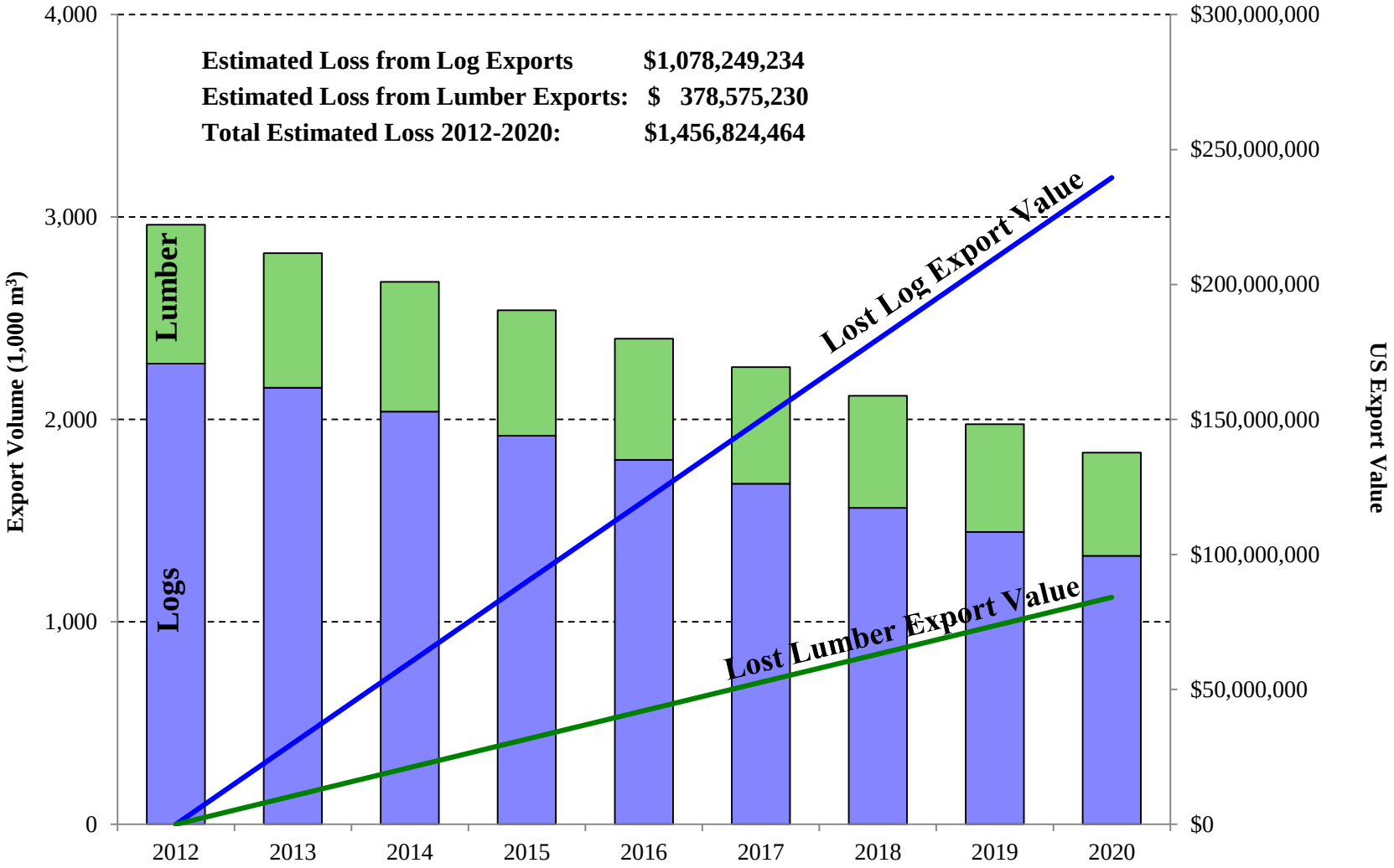

Figure 53 Projected loss of softwood log and lumber export revenue for the US through 2020 based on the Revitalization Plan.

Estimating the impact of exchange rates on Japanese imports of wood products

Imports have played an important role in Japan's timber supply mix since 1955 and have been the dominant source of supply since 1970. The driving forces behind the growth in timber imports have been the high cost of domestic wood products, growing demand and the strengthening of the yen. There is a strong inverse relationship between the yen and timber imports in Japan, Figure 54. While it seems clear that the exchange rate influences total imports into Japan, total imports are also influenced by the demand for, and the inventory of, wood products in Japan. To assess the influence of the exchange rate on Japan's wood imports, an autoregressive moving average model (ARMA) time-series regression was performed, using the following equation:

$$WI_t = 1340 - 3.62 \times [JPY/USD_t] + 0.963 \times WI_{t-1} + \varepsilon_t - 0.458 \times \varepsilon_{t-1}$$

where: WI_t is the value of wood imports for period t

JPY/USD_t is the exchange rate of yen per US dollar at time t

ε_t is the error term at time t

The adjusted R-square for the regression model was 0.795, indicating that the exchange rate model alone can explain almost 80% of the variability in the value of Japan's timber imports. The regression equation estimates that a one yen drop in the exchange rate (the yen strengthens) would result in a $3.62 million increase in wood imports into Japan. In other words, a 1% drop in the exchange rate results in approximately a .3% increase in the value of timber imports in Japan. Conversely, a one yen gain in the exchange rate (yen weakens) would lead to a $3.62 million decline in Japan's wood imports. In 2012, the US represented 7.1% of the total value of wood products imported into Japan. From the US perspective, a one yen gain in the exchange rate could be expected to result in a $257,000 drop in US wood exports to Japan.

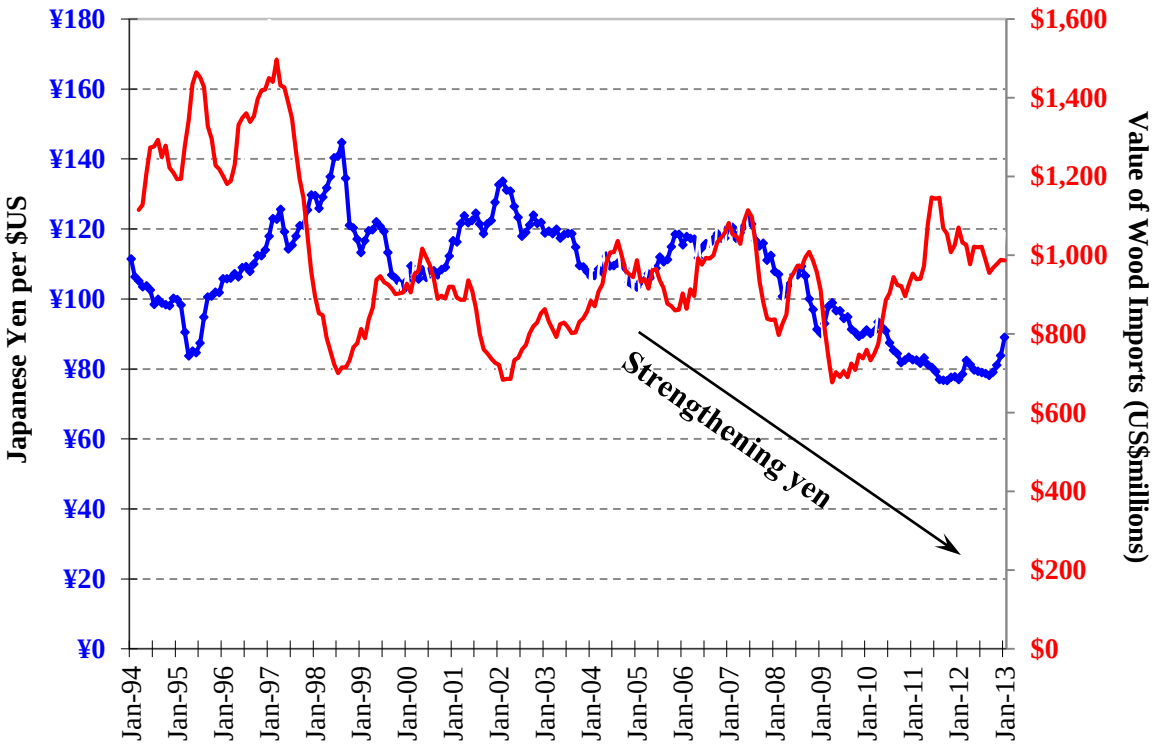

Figure 54 There is a strong inverse relationship between the value of the yen and the value of wood imports.

10. Strategic Observations

Japan is a timber deficit country that imports substantial volumes of timber to meet its domestic demand for wood. To a large degree, wood demand in Japan is tied to housing starts and approximately 55% of the new homes built in Japan in 2012 were wooden. This reliance on imported wood has always caused a certain tension in Japan where forests cover two-thirds of the country and there is an extensive sawmill industry skewed heavily to small, rural sawmills using inefficient and out-dated technology. Relatively high production costs have made both domestic logs and lumber uncompetitive within the domestic market and, as a result, lower cost imported wood products have become an important source of supply within Japan.

Japan's forestry and wood products industries face several physical and structural challenges, most of which adversely impact the competitiveness of the forestry sector in general and the small private forest owner in particular. One of the most basic obstacles is Japan's geography. Many forests are located in steep terrain, which makes forest management challenging and increases the costs of building roads, harvesting, and transporting logs from the forest. These high costs are further exacerbated by the fact that the majority of private forests are very small, which makes it difficult for the owners to raise capital and harvest their forests. The small size of private forest holding also makes it difficult to coordinate management and harvest activities to ensure a reliable supply of raw materials to local wood processing facilities, making it difficult for companies to invest in expanding the wood manufacturing capacity in local areas. At the same time, emigration from rural to urban areas reduces the number of available workers. The workers who remain are aging and few younger workers are drawn to the hard and dangerous labor involved with forestry, despite the fact that wages for forestry work are increasing.

In addition, there are a variety of factors that adversely affect the competitiveness of Japan's sawmill industry. These factors include the structure of the industry itself, including rising production costs and the small, regional structure of the sawmill industry, lack of coordination within the supply chain, lack of investment in efficient processing and kiln-drying technology, regulatory reform within the residential construction industry that has affected the demand for lumber produced from domestic species like *sugi*, the transition to pre-cut structural components in the post and beam industry, the continued strength of the yen, and imports of low cost, high quality logs and lumber.

Over the past several years, Japanese governments at both the local and national level have adopted measures aimed at increasing the use of domestic wood. These measures range from the Long-Term Superior Housing System (often called the 200 Year House program) adopted in 2009, to the Promotion of Wood Use in Public Buildings Act that was adopted in 2010, to a series of prefectural programs that provide subsidies to home builders who use local timber in their houses. The most recent legislation, referred to as the Forest and Forestry Revitalization Plan, was developed by the Ministry of Agriculture, Forestry and Fisheries (MAFF) in 2009 and was approved by the Legislature in 2011. The goal of this latest legislation is to increase the supply of domestic wood and thereby increase the self-sufficiency rate in Japan from the current 26% to 50% by 2020. The expansion of the domestic wood supply would be achieved through a combination of sectoral reforms and massive subsidies designed to expand the timber supply while simultaneously increasing the use of domestic wood in both residential and public sector construction.

Based on this analysis, total cumulative export losses for the US between 2012 and 2020 due to the Revitalization Plan could reach $1.1 billion in lost log exports with an additional $379 million in lost lumber exports. Total cumulative export losses for the US to Japan for just logs and lumber over the period 2012-2020 reach $1.46 billion. If we were to consider all other wood products, the estimated total cumulative export losses for the US that are attributable to the Revitalization Plan would reach $1.8 billion by 2020. Keep in mind that this is a conservative estimate. Our model kept Japanese wood

demand constant over the period 2012-2020, whereas MAFF has estimated that the Japanese demand for wood will increase from 68.1 million m^3 in 2012 to 81.1 million m^3 by 2020. In addition, we only estimated the impacts of the Revitalization Plan on US exports to Japan. We did not take into account the impacts of the other subsidy programs (the Public Building Law or prefectural subsidies for the 200 Year House program) that have been adopted or will be adopted in the near future (Wood Use Points Program).

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12. Appendices

Appendix A

Results of the regression analysis of exchange rate and wood imports by Japan.

	Coefficient	Std. Error	t-Statistic	Prob.
C	1340	193.9	6.91	0.0000
YEN	-3.62	1.658	-2.18	0.0300
AR(1)	0.963	0.0198	48.77	0.0000
MA(1)	-0.458	0.0662	-6.92	0.0000
R-squared	0.799	Akaike info criterion		11.91
R-squared	0.798	Akaike info criterion		11.91
Adjusted R-squared	0.795	Schwarz criterion		11.97
Log likelihood	-1353.8	Hannan-Quinn criter.		11.94
F-statistic	294.4	Durbin-Watson stat		2.168

Appendix B-1

Survey Questionnaire for Architects and Home Builders (English Version)

2011 CINTRAFOR Survey of Eco-Friendly Housing Programs in Japan

*For each question, please check only one ☑ answer.

1. Please indicate your business type: ❑ Home Builder ❑ House Architect ❑ Other (specify:_____)

2. Please indicate your familiarity with the following green building programs.

	Haven't heard about it	Heard about it but never used it	Planning to use it	Have used it
Choki Yuryo Jutaku	☐	☐	☐	☐
CASBEE-Sumai	☐	☐	☐	☐
LEED	☐	☐	☐	☐

3. In your opinion, how effective are these green building programs in reducing the environmental impact of a house?

	Don't Know	Not Effective	Somewhat Effective	Very Effective
Choki Yuryo Jutaku	☐	☐	☐	☐
CASBEE-Sumai	☐	☐	☐	☐
LEED	☐	☐	☐	☐

4. In your opinion, how do domestic and imported lumber compare on each of the following attributes?

Attributes	Domestic lumber is better	Both are same	Imported lumber is better
Competitive Price	☐	☐	☐
Price stability	☐	☐	☐
Structural strength	☐	☐	☐
Overall lumber quality	☐	☐	☐
Availability of supply	☐	☐	☐
Sustainable forest management practices	☐	☐	☐
CO_2 emission during transportation	☐	☐	☐
Overall environmental friendliness	☐	☐	☐

5. Please rate the 'overall environmental friendliness' of wood sourced from the following regions.

Regions	Good	Average	Bad
Domestic wood (Japan)	☐	☐	☐
USA	☐	☐	☐
Canada	☐	☐	☐
European Union	☐	☐	☐
Russia	☐	☐	☐

6. Please indicate the change in your use of softwood lumber. (Please circle one.)

Time Period	Domestic Wood	Import Wood
Over the <u>past two years</u> my use has	increase, same, decrease, never use	increase, same, decrease, never use
Over the <u>next two years</u> my use will	increase, same, decrease, won't use	increase, same, decrease, won't use

7. <u>Regional Subsidy Programs</u> are programs that offer a subsidy to homebuilders for using regional lumber

a. Have you heard about regional wood subsidy programs?	**☐ YES**	**☐ NO** (if **no** skip to question 8)
b. Have you built houses in prefectures that offer regional wood subsidy programs?	**☐ YES**	**☐ NO**
b. Have you ever received a subsidy for using regional wood in a house that you built?	**☐ YES**	**☐ NO**
c. Have the regional subsidy programs encouraged you to use more regional wood?	**☐ YES**	**☐ NO**
d. Are you planning to increase your usage of regional wood to qualify for a regional subsidy?	**☐ YES**	**☐ NO**

Continue to back side.↺

*For each question, please check only one ☑ answer.

8. Please indicate the best lumber species for each of the following end-uses applications in a post & beam house.

End-Use	Douglas-fir	Western Hemlock	*Sugi*	*Hinoki*	European Red Pine	European Spruce	Russian Larch
Dodai	☐	☐	☐	☐	☐	☐	☐
Neda	☐	☐	☐	☐	☐	☐	☐
Hirakaku	☐	☐	☐	☐	☐	☐	☐
Kudabashira	☐	☐	☐	☐	☐	☐	☐
Toshibashira	☐	☐	☐	☐	☐	☐	☐
Mabashira	☐	☐	☐	☐	☐	☐	☐
Sujikai	☐	☐	☐	☐	☐	☐	☐
Taruki	☐	☐	☐	☐	☐	☐	☐

9. Please indicate the best lumber species for each of the following end-uses applications in a 2x4 house

End-Use	Douglas-fir	Western Hemlock	SPF	*Sugi*	*Hinoki*	Radiata Pine
Floor Joists	☐	☐	☐	☐	☐	☐
Wall joists	☐	☐	☐	☐	☐	☐
Sill plate	☐	☐	☐	☐	☐	☐
Roof rafter	☐	☐	☐	☐	☐	☐

10. Approximately how many housing units did your company build in 2010? _____housing units

11. How many years has your company been building homes? _____years

12. What percentage of your houses were built in each of the following categories?

Post and Beam	%
2X4	%
Wooden Prefab	%
Non Wood	%
Others( )	%
Total	Total 100 %

Custom Single House	%
Tract Single House	%
Multi-Family Housing	%
Total	Total 100 %

13. Please circle <u>all</u> regions where you build houses.

Hokkaido, Tohoku, Kanto, Chubu, Kansai, Shikoku, Chugoku, Kyushu&Okinawa

Thank you for your cooperation!

Appendix B-2

Survey Questionnaire for Architects and Home Builders (Japanese Version)

平成24年度　環境考慮型住宅に関する調査　ワシントン大学・森林学部

＊それぞれの質問について、最も適当だと思われるものを一つ選び、チェック☑ を入れてください。

問1. 貴社の業務を選んでください。　❑ 住宅建築　❑ 住宅設計のみ（建築は行わない）　❑ その他（_____)

問2. それぞれのプログラムについて、貴社はどの程度関与したことがありますか？

	全く知らない	知っているが利用した事は無い	知っていて今後利用するつもり	利用した事がある
長期優良住宅	☐	☐	☐	☐
CASBEEすまい	☐	☐	☐	☐
LEED（リード認証）	☐	☐	☐	☐

問3. 個人的な意見として、次のプログラムが住宅を取り巻く環境問題解決のために有効であるとお考えですか？

	解らない	効果は薄い	多少有効である	とても有効である
長期優良住宅	☐	☐	☐	☐
CASBEEすまい	☐	☐	☐	☐
LEED（リード認証）	☐	☐	☐	☐

問4. 針葉樹の「国産材」と「輸入材」を比べた際に、次の項目ではどちらが優れていると思われますか？

	国産材が優れている	大差ない	輸入材が優れている
価格	☐	☐	☐
価格の安定性	☐	☐	☐
強度	☐	☐	☐
品質の良さ	☐	☐	☐
供給	☐	☐	☐
適切な森林管理が行われている	☐	☐	☐
輸送時の二酸化炭素排出量	☐	☐	☐
総合的な環境への優しさ	☐	☐	☐

問5. 下記産地の針葉樹木材を使う事は、総合的に判断して環境に良いと思いますか？以下から選んでください。

	環境に良い	良くも悪くもない	環境に悪い
国産材	☐	☐	☐
アメリカ産木材	☐	☐	☐
カナダ産木材	☐	☐	☐
ヨーロッパ産木材	☐	☐	☐
ロシア産木材	☐	☐	☐

問6. 国産材と輸入材について「過去二年」及び「今後二年」の使用量の変化で適当な物に丸をつけて下さい。

	国産材	輸入材
過去二年間の使用量	増加　・同じ　・減少　・未使用	増加　・同じ　・減少　・未使用
次の二年間の使用量	増加　・同じ　・減少　・使わない	増加　・同じ　・減少　・使わない

問7.　一部の都道府県では、地域材を一定の割合で使用すると、建築業者が助成金を受理できる制度があります。

a. 地域材の助成制度をご存知でしたか？	☐ はい　☐ いいえ (**いいえ**の場合は裏面の問８へ)
b. 地域材の助成制度がある都道府県内で住宅を建てた事がありますか？（貴社が助成金申請をしたかどうかは関係ありません）	☐ はい　☐ いいえ
c. 地域材を利用し、実際に助成金を受け取った事はありますか？	☐ はい　☐ いいえ
d. 地域材の助成制度の影響で、地域材を多く用いることを意識していますか？	☐ はい　☐ いいえ
e. 助成制度を申請するために、将来的に地域材使用を増やすつもりはありますか？	☐ はい　☐ いいえ

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＊それぞれの質問について、最も適当だと思われるものを**一つだけ**選び、チェック☑ を入れてください。

問8.　在来工法の住宅において、以下の部位に材として最も適していると考えられる樹種をお選びください。

部位	米マツ	米ツガ	杉	ヒノキ	レッドウッド集成材	ホワイトウッド集成材	カラマツ
土台	☐	☐	☐	☐	☐	☐	☐
根太	☐	☐	☐	☐	☐	☐	☐
平角	☐	☐	☐	☐	☐	☐	☐
管柱	☐	☐	☐	☐	☐	☐	☐
通し柱	☐	☐	☐	☐	☐	☐	☐
間柱	☐	☐	☐	☐	☐	☐	☐
筋交い	☐	☐	☐	☐	☐	☐	☐
垂木	☐	☐	☐	☐	☐	☐	☐

問9.　ツーバイフォー工法において、以下の部位に材として最も適していると考えられる樹種をお選びください。

部位	米マツ	米ツガ	SPF	杉	ヒノキ	ラジアータパイン
床根太	☐	☐	☐	☐	☐	☐
（壁）たて枠	☐	☐	☐	☐	☐	☐
土台	☐	☐	☐	☐	☐	☐
（屋根）垂木	☐	☐	☐	☐	☐	☐

問10.　昨年度（平成23年）に貴社が建築された住宅はおよそ何棟ですか？　＿＿＿＿＿＿棟

問11.　貴社は何年ほど住宅建築業務を行っていますか?　＿＿＿＿＿＿年

問12. 昨年度に施工した住宅のうち、以下の様式で建築された着工数をパーセントでお答えください。

木造在来工法	%
2X4	%
木造プレハブ	%
非木造	%
その他（　　）	%
合計	合計　100　%

注文住宅一戸建て	%
分譲住宅一戸建て	%
集合住宅	%
合計	合計　100　%

問13. 貴社が昨年度に住宅を建築・販売された地域全てに丸をつけて下さい。

北海道、　東北、　関東、　中部、　関西、　中国、　四国、　九州沖縄

ご協力、ありがとうございました！

Appendix C

Summary of Prefectural Programs to Subsidize the Use of Domestic Wood

Prefecture	max subsidy (yen)	Description
Hokkaidō	400,000	For a new wood house; a subsidize up to 400,000 yen
Aomori	210,000	Every 1 m^3 Aomori wood you use, you will get 7,000 yen eco-points up to 210,000 yen.
Iwate	300,000	Up to 300,000 yen for new house and 100,000 for remodeling, if they use regional lumber.
Miyagi	500,000	Use Miyagi wood for more than 60% of structural parts (with 40% being "Miyagi prime grade wood"); subsidy is 28,000 yen per 1 m^3 of Miyagi wood plus 8,000 yen per 1 m^3 for Miyagi Prime Grade Wood. You have to use builders within Miyagi prefecture.
Akita	200,000	If Akita KD *sugi* is used for over 70% of the structural parts.
Yamagata	150,000	If Yamagata wood is used for more than 70% of hashira
Fukushima	300,000	New house is larger than 70 m^2 and uses Fukushima wood for more than 1/2 of wood materials . Builders should operate mainly within Fukushima prefecture.
Ibaraki	200,000	Must use KD Ibaraki wood for more than 1/2 of wood materials, primarily posts.
Tochigi	600,000	If more than 10 m^3 of Tochigi wood (at least 50% Tochigi wood and 60% of structural), subsidy is 210,000. If use more than 35 m^3 Tochigi wood max subsidy is 600,000 yen. The headquarters of the builder should be in Tochigi Prefecture.
Gunma	800,000	If new house exceeds 165 m2 and uses Gunma wood for more than 90% of wooden structure; subsidy is 800,000 yen. Subsidy varies from 200,000-800,000 yen based on amount of local wood used.
Saitama	No	Some towns and cities have, though.
Chiba	400,000	60,000 yen for 5-10 m^3 up to 400,000 yen for more than 25 m^3 of Chiba wood used in new house.
Tokyo	No	
Kanagawa	400,000-6,000,000	Kanagawa wood must be used for more than 50% of the house.
Niigata	400,000	Niigata *sugi* must be used for more than 50% of their wood materials. Get 100,000 yen for using 5 m^3 up to 400,000 for 20 m^3 or more. If home buyer is 35 years old or less, get another 100,000 and if you use Niigata tiled roof, and get max 200,000.
Toyama	500,000	Subsidy of 5,000-20,000 yen per m^3 for Toyama wood up to 500,000 yen.
Ishikawa	120,000	Minimum of 5 m^3 of Ishikawa wood. If you use 10 m^3, subsidy is 120,000 yen.
Fukui	150,000	Use Fukui lumber for structural & non-structural parts: get 7,000 yen per m^3 and for boards or molding get 5,000 yen per m^3.
Yamanashi	400,000	Homes certified by Yamanashi Prefecture Wood House receive favorable mortgage rates from local banks.
Nagano	500,000	Must use Nagano lumber for at least 50% of wood material
Gifu	300,000	Must use Gifu wood more than 80% of structure parts to get 200,000 yen and if Gifu wood is used for interior decoration get additional 100,000 yen.
Shizuoka	300,000	Use more than 20 m^3 of Shizuoka Premium Grade lumber to get 60,000 yen and use more than 20 m^3 to get 300,000 yen.
Aichi	500,000	Use Aichi Certified wood and get 8,000 yen per m^3 for structural parts, 1,000 yen per m^3 for interior parts. Maximum is 500,000

Prefecture	max subsidy (yen)	Description
Mie	130,000	Use 12 m^3 of Mie wood (and more than 60% of woody parts).
Shiga	400,000	Use more than 15 m^3 Shiga Lumber to get 400,000 yen and 7.5-15 m^3 to get 300,000.
Kyoto	400,000	Use more than 5 m^3 of Kyoto lumber.
Osaka	No	
Hyōgo	400,000	Use Hyogo wood for more than 60% of wood materials to get 400,000m yen or 1.2%, 25 year, fixed rate mortgage from local bank.
Nara	300,000	Use Nara Lumber more than 7 m^3 of structural parts to get 300,000 yen or if 5-7 m^3 is used, get 200,000 yen.
Wakayama	200,000	Use more than 5 m^3 of Wakayama lumber and get 60,000 yen; up to 200,000 yen for 15 m^3 or more.
Tottori	400,000	Use Tottori Wood for more than 50% of woody parts, and more than 10 m^3, to get 130,000 yen; up to 400,000 yen for 25 m^3.
Shimane	300,000	Use Shimane Lumber for at least 50% of woody parts to get 300,000 yen.
Okayama	200,000	Use at least 8 m^3 of Okayama dried lumber, and more than 50% of woody parts, to get 200,000 yen.
Hiroshima	400,000	Use Hiroshima wood for at least 70% of structural parts to get 400,000 yen.
Yamaguchi	500,000	At least 60% of structural parts should be top graded Yamaguchi lumber, and use more than 100 m2 of Yamaguchi boards to get 500,000 yen.
Tokushima	30 m^3 free wood (~300,000 yen)	If project fixed 1 tons of CO_2, then builder gets 1 credit that can be exchanged for 10,000 yen worth of wooden products, up to 30 m^3 wood. Also, if you use Tokushima wood for more than 50% of the house, home owner can get a 1.5%, 10 year flat rate mortgage.
Kagawa	No	
Ehime	80 posts (~184,000 yen)	Use Ehime lumber for 80% of all woody part, and include a traditional *tatami* room with exposed posts, get 80 free posts.
Kōchi	1,000,000	Get 13,500 yen per 1 m^3 for lumber parts and 2,000 yen per 1 m^2 of decoration parts up to 1 million yen.
Fukuoka	602,000	Use 70% or more wood processed in Fukuoka and get 2,587 yen per m^2 of floor area (up to 470,000 yen). In addition, if use wood harvested in Fukuoka, get additional subsidy: less than 5 m^3 for 33,000 yen, 5-10 m^3 for up to 99,000 yen; 10 m^3 or more up to 132,000 yen.
Saga	500,000	Use certain amount of Saga lumber and your household income is lower than 12 million yen, prefecture will pay first 5 years of interest payments on mortgage.
Nagasaki	400,000	Use more than 5 m^3 of Nagasaki wood and get at least 60,000 yen and up to 400,000 for 25 m^3.
Kumamoto	free local wood	You can get *sugi* hashira or beam, *sugi* board or Kumamoto *tatami* mat.
Ōita	400,000	Use 1 m^3 of Oita wood and get at least 25,000 yen up to 400,000 yen for using more than 25 m^3.
Miyazaki	100,000	Use at least 15 m^3 of Miyazaki wood for structural parts and get 100,000 yen.
Kagoshima	140,000	Use at least 10 m^3 of Kagoshima lumber to get 140,000 yen but must use a local builder.
Okinawa	No	

Appendix D

Demand and Substitution Projections based on the Goals of the Forestry and Forest Revitalization Plan

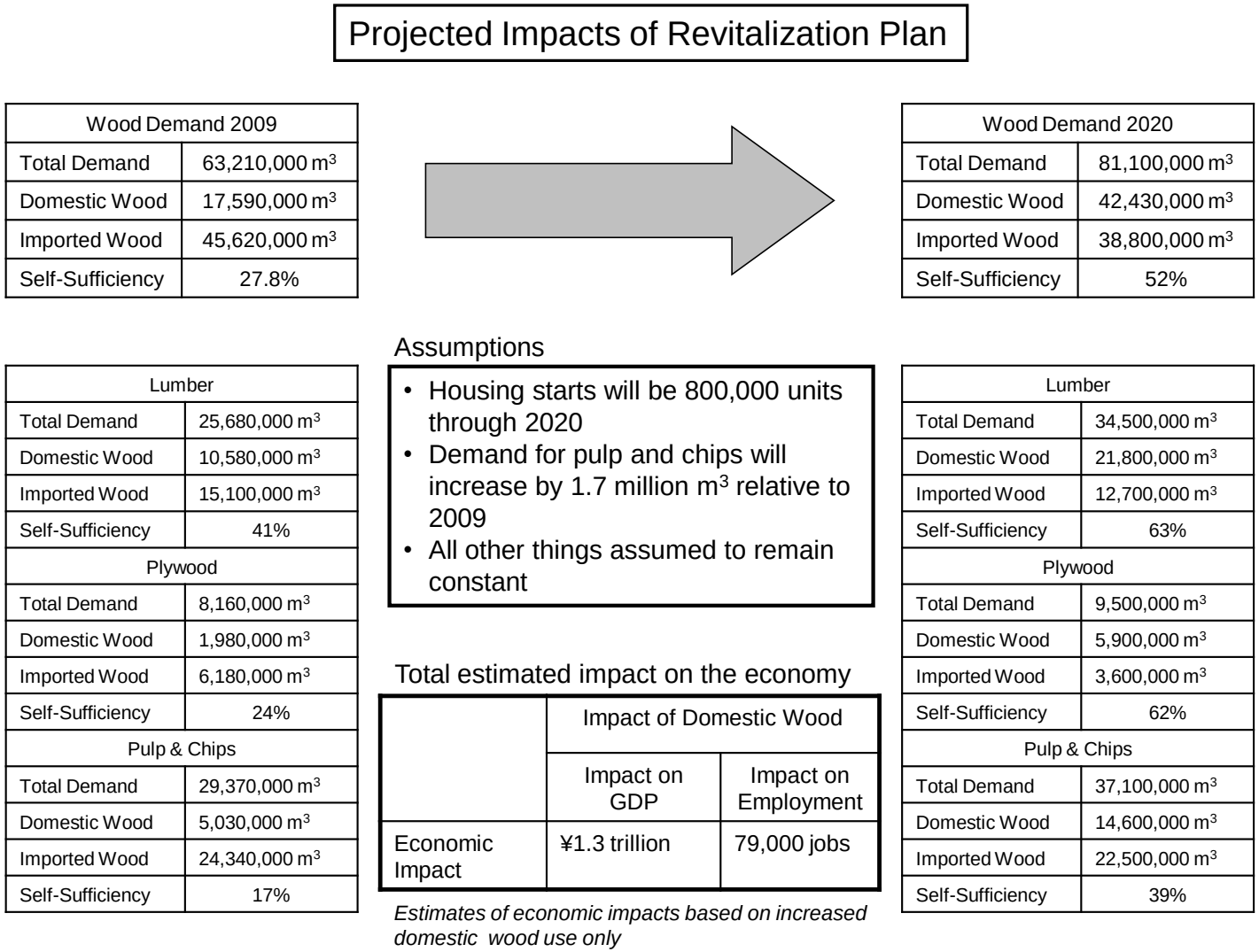

Figure D-1 MAFF estimate of the impact of the Revitalization Plan on total wood demand in Japan in 2020.

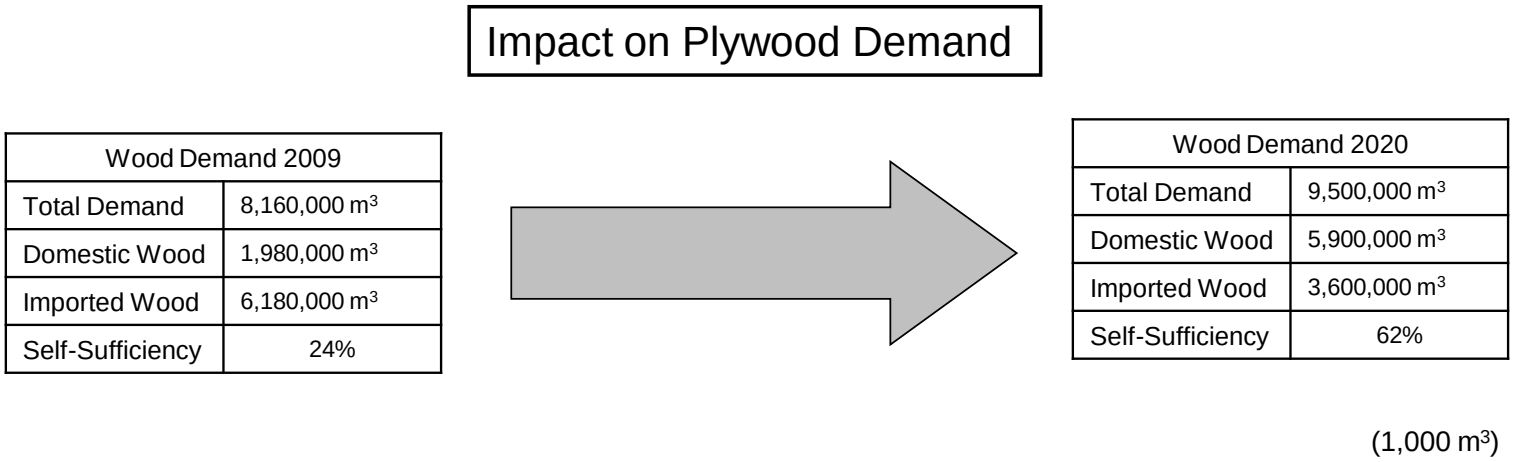

Figure D-2 MAFF estimate of the impact of the Revitalization Plan on plywood demand in Japan in 2020.

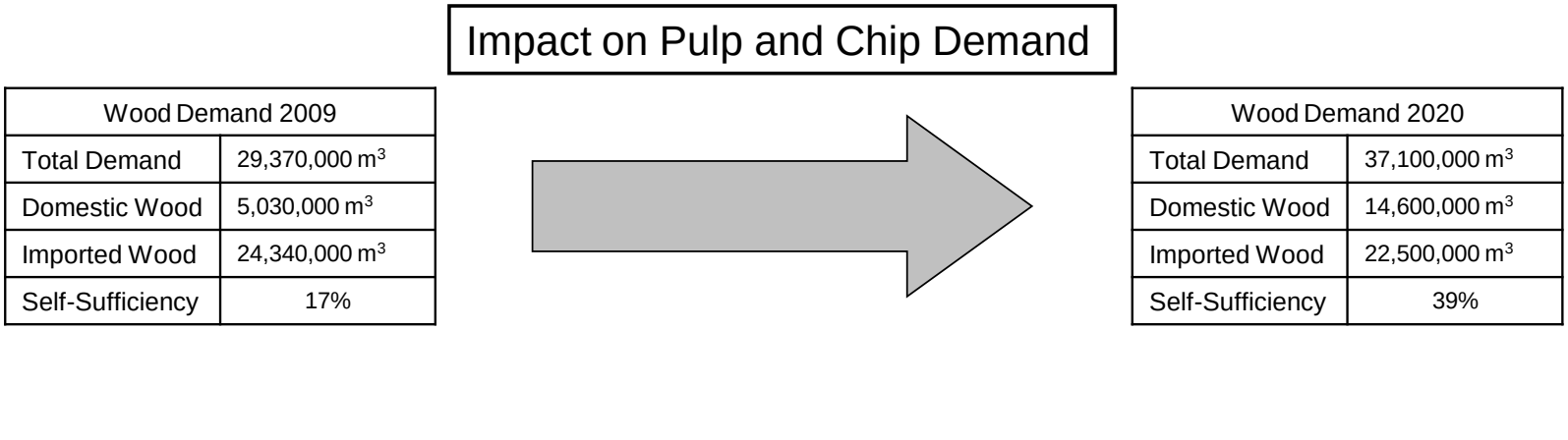

Figure D-3 MAFF estimate of the impact of the Revitalization Plan on pulp and chip demand in Japan in 2020.