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Federal Forest Policy and Its Impact on Income and Wealth in Rural Communities

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Federal forest policy in the Pacific Northwest has been a source of much debate since at least the 1980s when forest management policy began to work toward a different balance between habitat protection and harvesting timber on Federal lands. The Northwest Forest Plan, put into place in 1994, established a new forest management framework that shifted 11 million acres of federal forest land from timber production to old-growth forest protection.

Implementation of this plan speeded up a decline in timber harvests that began in 1990 (Figure 1). In 1989, almost 5 billion board feet of timber was harvested off of Federal land managed by the U.S. Forest Service and the Bureau of Land Management. The figure steadily declined to less than 200 million board feet in 2001, and has averaged less than 330 million board feet per year during the most recent decade. It should also be noted that the wood products industry was in the midst of massive structural change over the decades since the 1980s. In 1980, for example, there were 405 lumber mills in about half (113) of Oregon's communities. Two thirds of these mills (282) closed during the following three decades and by 2007 there were only 58 mill towns in Oregon.

The impact of the reduction in timber harvests on Federal land has been the subject of much research. Given that the forest management policy probably contributed both to the shutdown of some mills and to the enhancement of the natural amenities in this region, the research (reviewed below) has analyzed impacts of the timber harvest reductions and the Northwest Forest Plan on both loss of jobs and on amenity-driven migration. The studies generally supported the notion that the timber harvest reductions (and Northwest Forest Plan) reduced employment in the affected counties (and in some cases nearby counties). There was less agreement about the impact on amenity migration.

In a previous paper (Chen and Weber, 2012), we were able to distinguish econometrically the two possibly contrasting (amenity enhancement and mill closure) impacts of the Northwest Forest Plan on population growth and real property wealth in Oregon's 234 rural communities. We found evidence supporting the conclusions that (1) proximity to forest land protected by the Northwest Forest Plan may have induced amenity migration; (2) mill closures may not have significantly reduced populations in affected mill towns. We estimated a simultaneous equations model explaining population change and changes in real property values in these communities during the 1980s, 1990s and early 2000s as a function of community economic and demographic characteristics and variables that attempted to spatially distinguish amenity and mill closure impacts of these Federal policy changes.

In this paper, we extend these results by attempting to discern whether the policies that may have contributed to population growth and growth in real property also had a positive effect on the median household income in these rural Oregon communities. An alternative hypothesis, suggested by some who have studied

amenity migration, is that amenity migration leads to lower average incomes in these communities.

Literature Review

Traditionally, assessments of the potential impacts of resource conservation policies focus on the economic damages resulting from loss of jobs in the regulated sector. Hence, large job losses and other economic damages have been estimated to result from policies such as the Northwest Forest Plan (NWFP), designed to protect forest habitat for the northwest spotted owl and provide other amenities. Beuter (1990), Anderson and Olson (1991), Waters, Holland and Weber (1994) and Charnley (2006) used input-output models to estimate that employment reduction would range from 13,000 to 147,000 jobs. Charnley (2006) conducted case studies and found a negative impact of NWFP on county employment.

The impact of such an amenity-related migration on income is not clear. On one hand, many studies suggest that the income level in amenity rich communities tend to be lower because people are willing to accept lower wages in places with higher natural amenities as proposed by Rosen (1979) and Roback (1982). A set of papers (like Blomquist et al. 1988, Gyourko and Tracy 1991 and Schmidt and Courant 2006) investigated individual location decisions and find that amenities in and outside the metropolitan area generates compensating wage and land differential because workers are willing to accept lower wages and pay higher rent. There is also the long standing concern that the amenity-related development is less desirable because it increases the service employment with low paying jobs (McKean et al. 2005) and result in less equitable income distribution (Gibson 1993, Marcouiller and Green

2000).

On the other hand, other studies find that the presence of higher natural amenities can contribute to an increase in income. According to a review article by According to Waltert and Schlapfer (2010), among the 11 articles included in their analysis that reported amenity impact on income (7 on income per capita and 4 on wage and transfers), 4 reported significant positive impact. Shumway and Otterstrom (2001) find that in the 1990s, counties characterized by environmental amenities, recreation-based economies and retirement communities experienced higher population growth and gained in income as in-migrant income is on average about $10,000 higher than the out-migrant income. (Shumway and Otterstrom 2001, p.498) Reeder and Brown (2005) focus on the impact of amenity related growth on rural communities and find that recreation and tourism development attracts population growth, increases county income and pushes up housing cost. Lorah and Southwick (2003) find that population and income growth rates in nonmetropolitan counties with protected lands are much higher than those without protected land. Rasker (2006) find similar results in Western U.S.. Lewis, Hunt and Platinga (2003) find that the public conservation lands had no significant impact on wage growth in Northern Forest region. Deller et al. (2001) and English et al. (2000) found that amenity based development had a positive impact on income.

In this paper, we investigate the impact of the NWFP on the economic development of Oregon rural communities. In particular, we will investigate the impact on population growth, change in real property value and median household income.

A Model of Community Growth

We develop a model to estimate the impact of NWFP on population growth, real asset value and the median household income in rural communities in Oregon. Our model, like many models of regional growth, views community growth as the outcome of interactions between firm and household location decisions. Like Carlino and Mills (1987) and Deller et al. (2001), we assume that households and firms are free to migrate. Households migrate to seek higher levels of utility from both market goods and services and nonmarket amenities. Firms migrate to seek lower production costs and be closer to market demand.

Empirical Model

Our empirical model has three dependent variables: 1) average annual changes in population, 2) average annual changes in community real property value and 3) the annual changes in median household income. The same model is estimated for three time periods: 1980-1990, 1990-2000, and 2000-2007.

The census data on place level population gives the number of residents in the place. Therefore, community population change derived from the census data incorporate two components: natural growth and migration following utility differentials. Because we cannot separate the two components at the place data due to data availability, we incorporate explanatory variables that are believe to affect natural growth along with those that are believed to affect net migration. Natural growth is a function of the population base and demographic variables like population aged 65 and over. We include the number of Hispanic population and the percentage

population with at least bachelor degree because Mathews and Ventura (1997) find that people with Hispanic origin and lower education attainment tend to have higher birth rate. The migration component, following the migration literature as articulated in Ferguson et al. (2007), is modeled as a function of median household income, the unemployment rate, percentages of population with bachelor degrees and professional degrees, the heating degree days[1], distance to Portland. Because the educational attainment could influence both the natural growth and migration, we can only estimate the total effect rather than identify the individual effect. According to the location choice models (like Epple and Sieg 1999), people will rank the communities by income and community characteristics in their choice of location. At the locational equilibrium, given the preference characteristics, richer households will outbid poor household in more desirable communities, i.e. more highly ranked communities. The implication on the overall population size is undetermined. However, there might be short-run significance in the transition to the equilibrium, as more desirable communities are more attractive thus provide higher incentives to migrating households. Because NFP was officially implemented in 1994, the full policy impact has to gradually unfold, plus the fact that household migration is a slow process that involves substantial moving cost, we include the ranking of communities in income and community real property value in the analysis. Highly ranked communities will attract more in-migrants. Highly ranked communities in terms of income are more attractive but that in terms of real property value might be different.

[1] We exclude the July temperature because the weather in the summer in Oregon is quite temperate. We include other weather variables like precipitation, but none are significant, except for January temperature which is correlated with heating degree days.

Community real property is mainly composed of industrial/commercial and residential real property.[2] We believe that the industrial/commercial real property value changes are induced by industrial/commercial location decisions which should reflect local labor market conditions like the total number of workers, the wage rate, and the tax rate. Because population and median household income are included and because these are highly correlated with the total number of workers and wage rate, the latter variables are not included in the model. Residential real property value is expected to be affected by housing and community characteristics such as urban and natural amenities that are capitalized into property value. We include in the analysis the average number of rooms, the heating degree days, number of hospitals in the city and the distance to Portland.

Community-level median household income is expected to be correlated with the number of minorities (African, Native American, Hispanic, Asian and Pacific), educational attainment, percent of employment in farming and professional jobs, and the unemployment rate. To investigate the impact of amenities on income, we include the heating degree days and distance to Portland, as Portland is the largest urban center in Oregon.

We expected that other spatial variables like the distances to larger communities (the nearest city of 20,000 or more people), to interstate highways (to capture the accessibility into and out of the community), and to valued services such as medical care and law enforcement facilities might be important in explaining population and wealth changes. However, all these variables were insignificant in

[2] There is no statewide database that separates residential real property value from industrial/commercial real property at the city level.

preliminary analyses and are excluded from the final model.

Federal policies related to forest management may affect the population and wealth changes as well as the median household income. As in Chen and Weber (f2011), we hypothesize that the negative effect of Federal resource conservation policies on a given community is not mainly related to a community's proximity to the protected land under Northwest Forest Plan but rather to whether it affects mill operations. Because the mills are not necessarily close to the forests that supply them with logs, the negative effects of reducing harvests on federal timberland are not confined to nearby communities but spread across a broader region. We expect to capture this negative effect in a variable that indicates the number of mills that closed in a community during the period examined.

The positive effect of resource conservation policy on amenity-related growth will, in contrast, be most pronounced in communities close to the protected land. Thus we expect to be able to spatially separate the negative and positive impacts of NFP. We attempt to capture the positive amenity effects of the NFP by creating a dummy variable that indicates whether a community is within a 10 mile-buffer of the "reserved land" designated in the NFP for species protection. From now on, we will refer to the communities within 10-mile distance as "NFP-adjacent communities" or NA. We also examine whether the NFP affected NFP-adjacent communities differently if the community had a high share of workers in logging and forest management. We do this by creating three sub-categories of NA communities: 1) those with less than 5% workers in Farming, Forestry and Fishing occupations ("non-logging communities" or NA-NL); 2) those with no less than 5% but less than 10% of workers in Farming, Forestry and Fishing occupations ("logging-reliant communities"

or NA-LR), and those with no less than 10% of workers in these occupations ("logging-dependent communities" or NA- LD).

The definition and data sources for the variables are summarized in Table 1a. The summary statistics are listed in table 1b.

We use a simultaneous equations model and employ generalized method of moments (GMM). The system of equations is specified as:

$$\Delta N_{j,t} = \alpha_0 + \alpha_{1,2}\Delta W_{j,t} + \alpha_{1,3}\Delta I_{j,t} + \alpha_2 X^{N}_{j,t-1} + \alpha_3 P_j + \varepsilon_j$$
$$\Delta W_{j,t} = \beta_0 + \beta_{1,1}\Delta N_{j,t} + \beta_{1,3}\Delta I_{j,t} + \beta_2 X^{W}_{j,t-1} + \beta_3 P_j + \eta_j$$
$$\Delta I_{j,t} = \gamma_0 + \gamma_{1,1}\Delta N_{j,t} + \gamma_{1,2}\Delta W_{j,t} + \gamma_2 X^{I}_{j,t-1} + \gamma_3 P_j + \zeta_j$$

where t (=1, 2 or 3) is the time index and j is the community index. We try to identify how changes in community population, real property value and median household income over the time period are correlated with community characteristics at the beginning of the period and how they are affected by some of the major changes during the decades, particularly the NWFP. $X^{N}_{j,t-1}$ $X^{W}_{j,t-1}$ and the exogenous contextual variables of the base year that might affect changes in community population, wealth and median household income. ε_j , η_j and ζ_j are the disturbance terms. The differences in the economic and demographic conditions across rural communities can be potential sources of heteroskedasticity which are controlled implicitly using the optimal weighting matrix under GMM. The instruments pass the relevance test as the statistics for each period are above 10 (Stock and Watson, 2007). The single-equation over-identifying test statistics for each equation and each period are reported in Table 2. The Hansen's J test statistic for each period is also calculated. The J-test statistic for 1980s is 25.05 with p-value equal 0.16. That for the 1990s is 15.60 with p-value equal 0.68 and that for early 2000s is 13.23 with p-value 0.83.

Results

Table 2 reports the estimation results and Table 3 reports the total effect of mill-closure, NA-NL, NA-LR and NA-LD after considering the interactions across equations. The results for the period in 1980s provide a baseline for the assessment of policy impact. In the 1980s, *ceteris paribus*, NFP-adjacent communities (NA) are not significantly different from other communities in the change of population. The change of real property value in NA-LR communities during the 1980s was $1.2 million greater than in other communities. And mill closures in Oregon's rural communities led to$1,000 lower growth in median income.

The 1990s was a decade of income growth and significant in-migration in Oregon. It was also the decade in which the NFP was implemented, Federal timber harvests were reduced by 90 percent, and total timber harvests were reduced by half. We found that the NFP had a negative effect on mill towns and NFP-adjacent logging-dependent (NA-LD) communities, but may have attracted amenity migrants to NA-NL and NA-LR communities. Towns with mill shutdowns saw significantly lower growth in community wealth as the growth in total real property value is estimated to be $0.16 million less. NA rural communities in general, however, experienced significantly higher growth in community wealth and median income than those not close to the protected forests. The community wealth growth is higher than other communities by around $4.0 million in the 1990s. However, among the NA communities, if they were logging-dependent, the growth in population, community wealth and median household income are all estimated to be slower, not only compared with other NA communities but with non-NA communities. The

higher growth in population, real property value and median income in NFP-adjacent communities overall is likely due to the amenity-related migration that is brought about by the NFP. However, in NA-LD communities, the negative economic impact of NFP out-weighed the positive impacts of the amenity-related migration on all the indicators of community growth in this paper: growth in the population, real property value and median income.

The early 2000s were a time of reduced economic growth and slower in-migration, both nationally and in Oregon, and timber harvests remained at the levels of the 1990s. Mills were still closing, but at a smaller scale. In addition, after the economic transformation that took place in the 1990s, the rural communities may have already become less dependent on timber harvest. Changes in population, property wealth and median income were not significantly different in communities with mill closures compared to communities without mill closures. NFP-adjacent communities, however, continued to benefit from amenity related growth and saw higher growth in community wealth. The growth in community wealth is estimated to be $8.4 million higher than others. This additional growth spills over to increase the growth in population and median household income. This holds true whether or not the communities were NA-LR or NA-LD.

Applying the delta method, we estimate the total effects of mill closures, the Northwest Forest Plan on changes of population, community wealth and median household income. The estimated total effects are summarized in Table 3 with the χ^2 test statistics reported in parentheses. Mill closures had a significant negative impact on community wealth in the 1990s. The implementation of the Northwest Forest Plan is associated with significantly higher growth in community wealth in the 1990s and

2000s. In the 1990s, the NA-LR communities, however, experienced significantly slower growth in median household income. The NA-LD communities had significantly slower growth in community wealth and median household income. These effects were no longer significant in early 2000s.

Conclusion

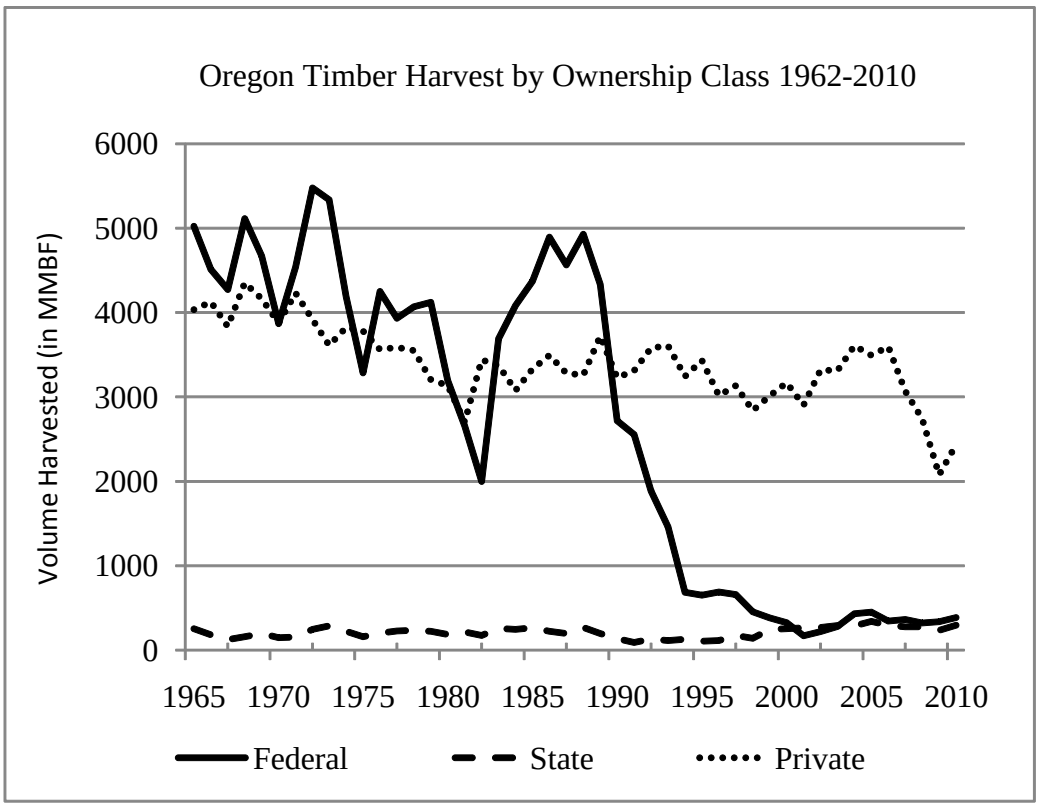
The policy of protecting forests through implementation of the NWFP appears to have increased community wealth, as measured in real property value per capita of the communities close to the NWFP land, except if they were dependent on logging. Not surprisingly perhaps, Federal forest policy appears to have affected the prosperity of logging and mill towns differently than other types of rural communities. In the 1990s, NWFP had a negative effect on the wealth and income of communities whose economic base had historically been tied to the wood products industry, including mill towns and other logging dependent communities.

After 2000, however, negative logging- and mill-related NWFP impacts appear to have subsided, and the NWFP induced amenity-migration effects continued: NWFP-adjacent communities experienced higher growth in community wealth than communities more than 10 miles from NWFP-protected land, even among those that were dependent upon logging.

The NWFP appears to have redistributed the benefits associated with the federal forestland, and the impact has evolved during the almost two decades since implementation. For timber dependent communities—the mill towns and logging towns—the implementation of the NWFP reduced growth in community wealth and median income during the initial decade of implementation due to reduced timber harvest in federal forestland. But in the longer run, NWFP appears to have had a more

positive impact on the wealth creation in rural Oregon communities, even in those timber-dependent communities that initially went through difficult economic transformations. The associated development may be more sustainable, but that is yet to be determined and is beyond the scope of existing studies. It is possible, of course, that there were also important within-community shifts in well-being between original residents and newcomers as has been found in other studies of amenity-related development, where growth in real property values has priced original residents out of local housing.

The preservation of forest capital through the NWFP ultimately has induced a redistribution of the forest-related benefits of Federal forestland across communities. Historically, the major benefits came from the timber production which went mainly to the timber-dependent communities. The implementation of the NWFP, signaling that the federal government wanted to protect old-growth forestland, appears to have promoted community wealth in communities close to the protected land, and to have redistributed the economic benefits from the timber-dependent communities to a broader set of NWFP-adjacent communities.



Source: Oregon Department of Forestry

Figure 1. Timber harvest by ownership, 1962-2010

Table 1a. Variable Definitions and Data Sources

Variable	Definition	Source
dpop	population change (person/year)	Census, ACS
dasset	wealth change ($100,000/year)	Calculated
mdincome	median household income ($1000)	Census, ACS
pop	population in base year (person)	Census, ACS
asset	wealth in base year ($100,000)	ODR
pop_65pl	population 65 + (person)	Census, ACS
hisp	hispanic population (person)	Census, ACS
minority	non-white population (person)	Census, ACS
edu_bach	bachelor degree (%)	Census, ACS
room number	median number of rooms	Census, ACS
unemploy	unemployment rate (%)	Census, ACS
farm	farm, foresty and fishing industries (person)	Census, ACS
hdd	heating degree days	WRCC
n_hospital	number of hospitals	GEO
dist_portland	distance to Portland (mile)	Calculated
city_tax	city tax rate (‰)	ODR
mill_employ	annual loss of employment due to mill closure (job/year)	NWFPREO
nwfp	dummy, equal 1 if distance to NWFP reserved land is less than 10 miles	ODF

Note: ACS: American Community Survey; CFFR: Consolidated Federal Fund Report
NWFPREO: Northwest Forest Plan Regional Ecosystem Office; GEO: Oregon Geospatial Enterprise Office
ODR: Oregon Department of Revenue; ODF: Oregon Department of Forest
WRCC: Western Regional Climate Center, http://www.wrcc.dri.edu/index.html

Table 1b. Summary Statistics

Year		1980				1990				2000			
Number of Observations		223				220				213			
Variables	Unit	MIN	MAX	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX	MEAN	STD
dpop	person/year	-66.6	1505.8	36.2	129.1	-52.6	1083.5	89.2	173.9	-65.4	1172.6	58.1	147.9
dasset	$100,000/year	-64.9	970.5	20.0	78.5	-7.7	1229.0	110.2	185.4	-45.7	2788.9	217.8	382.3
dincome	$1000/year	-1.7	1.8	-0.1	0.5	-2.8	3.6	0.6	0.7	-3.9	3.0	0.3	0.9
pop	person	39.0	17931	2882.9	3941.1	34.0	18692	3056.5	4208.7	63.0	19511.0	3233.4	4208.2
asset	$100,000	14.9	6880	829.2	1279.0	10.5	7577.5	925.6	1453.5	16.8	15660.1	1589.1	2302.7
mdincome	$1,000	16.5	74.6	35.5	8.2	18.1	86.9	34.7	8.4	19.5	105.6	40.1	10.6
pop_65pl	person	7.0	3204	395.2	561.7	6.0	3840.0	484.8	692.9	9.0	2907.0	464.1	626.4
hisp	person	0.0	2035	94.0	203.1	0.0	4226.0	171.4	396.6	0.0	3643.0	316.7	604.4
minority	person	0.0	2153	156.1	271.1	0.0	4361.0	266.2	487.3	0.0	3972.0	420.7	713.0
edu_bapl	%	0.0	53.2	15.5	8.0	0.0	59.6	16.6	9.6	2.5	50.6	15.3	9.1
med_room	room	3.4	5.6	4.9	0.4	4.1	8.2	5.2	0.5	4.2	9.1	5.3	0.5
unemploy	%	0.0	31.5	11.1	6.4	0.0	30.9	8.3	4.3	0.0	15.3	3.9	2.4
manageprof	%	1.6	37.0	19.1	6.2	0.0	46.2	19.7	7.1	9.1	55.7	25.2	8.0
techsale	%	0.0	43.9	23.2	7.0	5.0	52.7	23.9	7.0	0.0	42.4	23.0	5.7
frmfrstfsh	%	0.0	37.4	6.9	6.1	0.0	33.3	7.2	5.8	0.0	22.7	3.5	3.5
hdd	degree day	4078	9022	5326.4	915.9	4078	9022	5325.6	913.3	4078	9022	5354.6	912.5
n_police	law enforcement facilities	0.0	34.0	4.1	6.2	0.0	34.0	3.9	5.7	0.0	29.0	3.6	5.0
n_hospital	hospital	0.0	17.0	1.4	2.9	0.0	14.0	1.3	2.6	0.0	14.0	1.1	2.3
dist_portland	mile	0.0	292.2	110.3	82.4	0.0	292.2	111.3	82.3	0.0	292.2	113.0	81.9
travel	minute	5.1	43.4	17.0	5.2	4.2	35.6	17.8	5.1	6.7	44.2	21.8	6.1
mill_employ	job/year	0.0	82.4	3.4	8.7	0.0	93	4.7	11.4	0.0	44.9	2.4	7.5

Table 2a. Regression Results on Community Population Change (standard deviation in parenthesis)

	Label	t=1 (year=1980S)			t=2 (year=1990S)			t=3 (year=2000S)		
Population change	intercept	796.75	663.16		1184.10	1707.39		-189.73	463.38	
	dasset	2.28	0.69	***	1.72	0.52	***	0.57	0.18	***
	dincome	-68.34	144.01		-341.14	351.75		121.15	62.88	*
	pop	-0.013	0.017		0.000	0.029		-0.007	0.013	
	mdincome	-31.53	25.77		1.23	39.21		1.61	11.18	
	income rank	2.58	2.03		-1.25	2.95		0.42	0.81	
	asseet rank	0.04	0.17		0.00	0.39		-0.07	0.21	
	pop_65pl	0.01	0.05		-0.25	0.24		-0.02	0.07	
	pop_hisp	0.07	0.04		0.16	0.09	*	0.00	0.02	
	edu_bach	8.78	11.11		-18.56	12.81		-13.51	10.08	
	unemploy	2.88	3.70		-13.47	13.15		4.90	8.65	
	heating degree days	-0.02	0.02		-0.06	0.09		0.04	0.03	
	n-police	4.77	6.47		4.55	15.55		7.60	4.02	*
	dist_portland	-0.25	0.31		-1.01	1.11		-0.14	0.27	
	mill_employ	0.14	0.80		1.97	2.41		0.57	2.14	
	nwfp	-9.20	31.10		35.54	141.54		0.89	53.45	
	nwfp*Forest5	-66.54	56.41		-153.42	126.33		-32.11	80.14	
	nwfp*Forest10	-34.78	109.41		-420.25	368.47		-137.70	336.04	
	Instrument Irrelevance Stat	78.01			57.59			46.44		
	Overidentification (p-value)	0.73 (0.9998)			0.015 (1.0000)			0.37 (1.0000)		

Note: ***: significant at 0.01, ** significant at 0.05, * significant at 0.1

Table 2b. Regression Results on Changes in Real Property Value (standard deviation in parenthesis)

	Label	t=1 (year=1980S)			t=2 (year=1990S)			t=3 (year=2000S)		
Change in Real Property Value	intercept	71.01	39.59	*	-118.16	46.94	**	-617.25	240.63	**
	dpop	0.25	0.09	***	0.40	0.06	***	0.34	0.36	
	dincome	0.38	4.63		-5.25	8.79		22.81	44.86	
	asset	0.01	0.00		0.07	0.01	***	0.12	0.02	***
	medium room #	-19.57	7.28	***	16.91	6.80	**	81.40	30.36	***
	travel	-0.25	0.24		-0.87	0.91		0.09	1.76	
	heating degree days	0.0038	0.002	*	0.007	0.003	**	0.01	0.02	
	n-hospital	7.80	2.65	***	1.00	2.23		9.40	6.40	
	dist_portland	0.01	0.02		-0.01	0.04		0.43	0.19	**
	mill_employ	0.29	0.23		-1.57	0.52	***	-0.77	2.02	
	nwfp	-6.08	6.06		40.38	11.34	***	84.17	34.83	**
	nwfp*Forest5	13.03	6.02	**	-12.18	10.69		20.07	46.67	
	nwfp*Forest10	25.11	11.78	**	-27.89	16.15	*	-216.67	229.61	
	Instrument Irrelevance Stat	67.49			101.42			14.60		
	Overidentification (p-value)	0.146 (1.0000)			0.23(1.0000)			0.01 (1.0000)		

Note: ***: significant at 0.01, ** significant at 0.05, * significant at 0.1

Table 2c. Regression Results on Median Household Income (standard deviation in parenthesis)

	Label	t=1 (year=1980S)			t=2 (year=1990S)			t=3 (year=2000S)		
Median Household Income	intercept	2.87	0.89	***	4.12	1.10	***	3.83	2.10	*
	dpop	-0.005	0.005		0.003	0.002		0.003	0.002	
	dasset	0.012	0.008		-0.003	0.002		-0.001	0.001	
	mdincome	-0.05	0.01	***	-0.04	0.02	**	-0.01	0.02	
	non-white	-0.0001	0.0003		-0.0002	0.0002		-0.0002	0.0001	*
	edu_bach	0.092	0.038	**	0.124	0.058	**	0.043	0.073	
	mngprof	-0.100	0.063		-0.151	0.058	***	-0.061	0.068	
	techsale	-0.001	0.011		-0.020	0.017		-0.028	0.025	
	unemploy	0.017	0.012		0.007	0.025		-0.039	0.048	
	heating degree days	-0.0001	0.0001		-0.0001	0.0001		-0.0003	0.0001	**
	dist_portland	-0.002	0.001	**	-0.002	0.001	**	0.002	0.001	*
	mill_employ	-0.01	0.005	**	-0.005	0.006		-0.008	0.01	
	nwfp	0.02	0.26		0.50	0.33		-0.20	0.22	
	nwfp*Forest5	-0.40	0.26		-0.46	0.29		-0.28	0.63	
	nwfp*Forest10	-0.69	0.90		-1.25	0.62	**	-2.14	2.51	
	Instrument Irrelevance Stat	153.21			47.70			14.98		
	Overidentification (p-value)	9.95 (0.3543)			1.54 (0.9968)			2.75 (0.9733)		

Note: ***: significant at 0.01, ** significant at 0.05, * significant at 0.1

Table 3. Estimated Total Effect (χ^2 test statistics in parenthesis)

	Mill Closure	NFP	NFP & FFF5	NFP & FFF10
1980s				
Population	0	0	0.09 (0.78)	0
Wealth	0	0	0.02 (1.01)	0
Income	0	0	2.15 (0.90)	0
1990s				
Population	0	0	0	0
Wealth	-0.33(4.8)**	0.02 (10.3)***	0	-0.02(2.9)*
Income	0	0	-0.59(4.5)**	-1.63(7.7)***
2000s				
Population	0	0.017(2.33)	0	0
Wealth	0	0.042(5.94)**	0	0
Income	0	0.530(1.58)	0	0

Note: ***: significant at 0.01, ** significant at 0.05, * significant at 0.1

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