AN ABSTRACT OF THE THESIS OF

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County-level net migration and employment growth rates associated with the Northwest Forest Plan (NWFP) are examined. The NWFP area encompasses federal land in 53 Oregon, Washington and California counties; 20 counties adjacent to NWFP counties are also included in the sample. The NWFP was enacted in December of 1993, however, this analysis examines the 24 year time period from 1980 through 2003. Net migration (the change in population due to in-migration and out-migration) and employment growth are represented by a simultaneous equation model (SEM) that is corrected for spatial autocorrelation. While the NWFP land allocations are expected to influence net migration and employment growth, they are potentially determined by similar processes as the endogenous economic indicators. Logistic regression analysis shows the probability that NWFP lands were allocated to biodiversity purposes or to land uses subject to timber harvest depends on natural, political and economic variables. The SEM is run on a yearly basis to explore changes in net migration and employment growth due to policy enactment, future expectations about land allocations, and market fluctuations. These results suggest the time period was characterized by many changes the endogenous variables from the effects of land management. In addition, the yearly analysis suggests that variation in yearly

employment growth and net migration may not be sufficient for precise estimation of the effects of the exogenous variables. Pooling the yearly data over policy-relevant time periods is thus appropriate and provides insight into the NWFP effects on the economic indicators. Counties with more land reserved for biodiversity purposes had higher net migration and employment growth. In contrast, counties with more land allocated to extractive uses experienced low net migration. During the period following NWFP enactment, from 1994 to 2003, the classification of land according to NWFP management yields no significant relationship, suggesting adjustment to the NWFP had occurred. The effects of land management variables for rural and metropolitan counties are distinguished in another SEM. Contrary to the popular notion that employment effects were felt in large part by rural counties, this analysis shows changes in employment growth due to policy effects were felt primarily in metropolitan counties within the NWFP region. In addition, higher net migration occurred in rural and metropolitan counties containing land reserved for biodiversity purposes. These counties also experienced a simultaneous increase in employment growth as a result of allocation of these lands. Analysis of employment growth changes in specific industry sectors indicates manufacturing jobs were lost, however, service industry growth was encouraged as a result of NWFP land allocations. In addition, land allocated solely for the purpose of biodiversity services was not associated with changes in the manufacturing employment while potentially promoting growth in service sector employment.

Northwest Forest Plan Effects on County Net Migration and Employment Growth;
Causality of Policy Variables, Timing of Response, Relevant Time Periods, Rural vs. Metro Policy Effects and Effects on Industry Employment

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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Henry N. Eichman, Author

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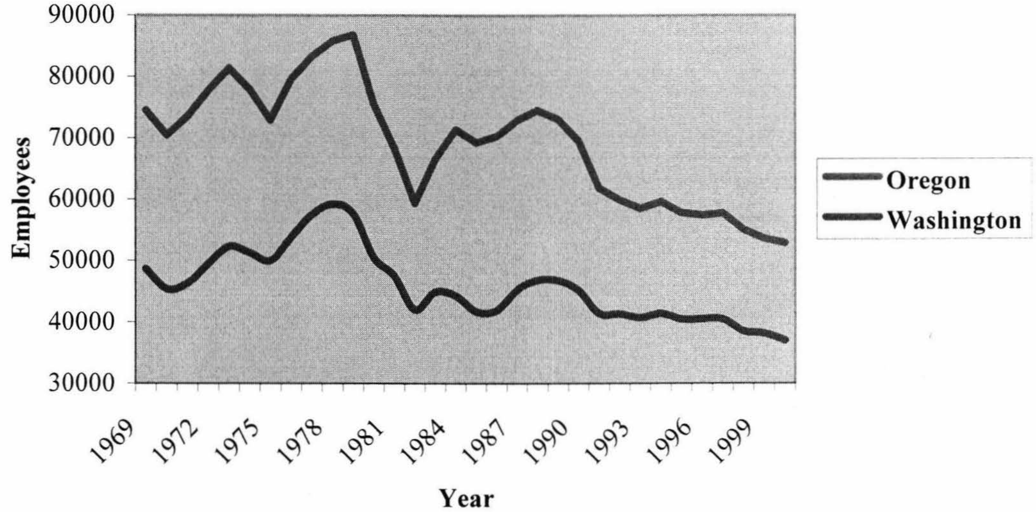
Introduction

NWFP Background

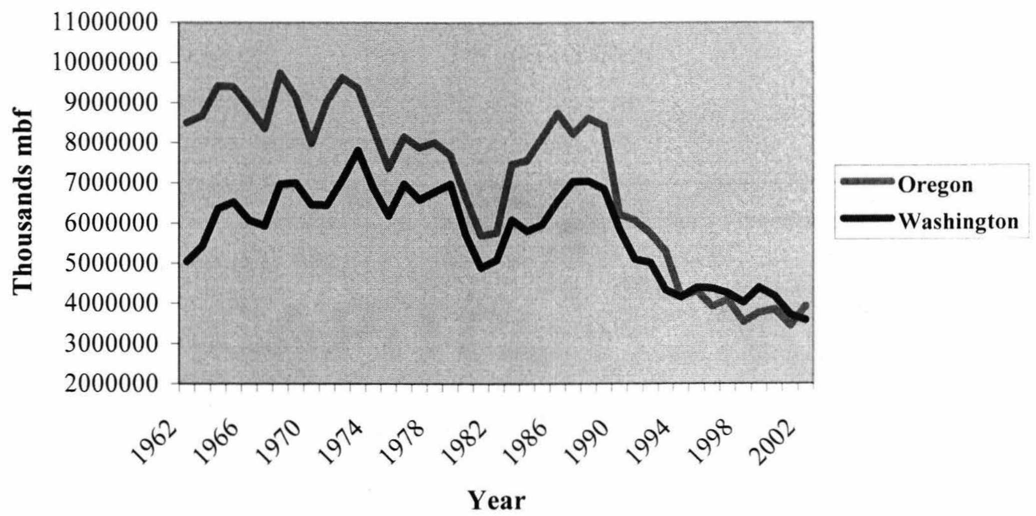
The timber industry in the Pacific Northwest underwent widespread industry changes in the 1980's leading up to enactment of the Northwest Forest Plan (NWFP). Timber harvests increased by nearly one-third over the past 50 years in the entire nation (Adams et al. 2006). However, in the Pacific Northwest, timber industry employment and harvests have decreased since the mid 70's (see figures 1 and 2). Optimism overshadowed these declines with the mantra that a rural employment base could be sustained (personal communication with Richard Haynes). Endangered Species Act legislation and litigation against public agencies in the 1980's and 90's suggested the role of public forest land in the Northwest was changing. Habitat conservation became increasingly prioritized over the iconic role of logging. Imminent but uncertain consequences to rural communities loomed on the horizon. The prevailing issue was widely perceived to be a choice between jobs and the environment.

Figure 1: Lumber and Wood Products Employment



Source: Bureau of Economic Analysis

Figure 2: Oregon and Washington Net Yearly Harvest



Source: Washington Department of Natural Resources; Oregon Department of Forestry

Legislation in the late 1960's and 70's set the stage for what would be the largest ecosystem management plan ever undertaken in the US. In 1969 the National

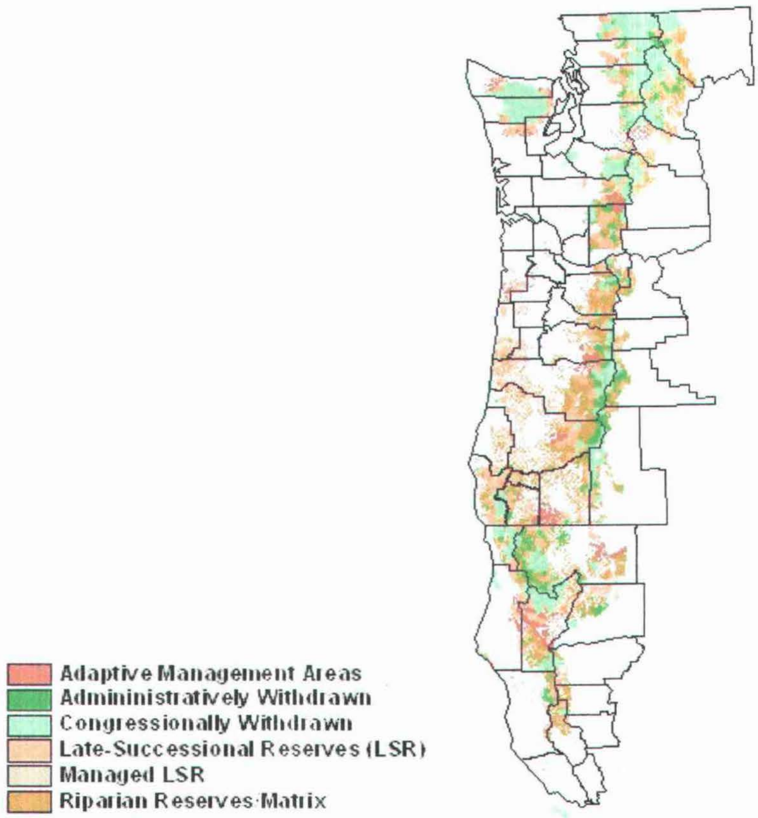
Environmental Policy Act (NEPA) greatly increased the role of public involvement in the policy process and required consideration of the environmental impacts of federal actions. In 1973 the Endangered Species Act (ESA) was created, under which the northern spotted owl (*Strix occidentalis caurina*) would be listed in 1990 (Federal Register, 1990) and the marbled murrelet (*Brachyramphus marmoratus*) in 1992. In 1976 the National Forest Management Act (NFMA) was passed which included language about maintenance of 'viable populations' of native vertebrates. This language would be most often used in many of the lawsuits that embroiled the Northwest in the 1980's and 90's.

These lawsuits challenged the adequacy of protection of old growth species and fish in federal forest plans. Consequent court decisions stopped old growth harvests until defensible conservations strategies were developed. Timber sales on federal land within the Northwest Forest plan region came to a complete halt in April 1989 with a federal court injunction made by Judge Dwyer (Caldwell et al. 1994). Projected job losses were as high as 130,000 (Beuter et al.1990). The Spotted owl had effectively pitted loggers against environmentalists in a controversy that was not about to calm. In 1993 President Clinton assigned the Forest Management Assessment Team (FEMAT) with development of the largest land management plan the nation had ever seen.

Clinton enlisted FEMAT to create a plan that would protect the long-term health of forests, wildlife, and waterways, while not discounting the human and economic dimensions of the problem. The plan was to be scientifically sound, ecologically credible, and legally responsible. In addition, Clinton wanted the plan to provide a predictable and sustainable level of timber sales and non-timber resources that would not degrade or destroy the environment (Shannon, Johnson, 1994). FEMAT developed 10 alternatives that differed in levels of management for ecological goals and timber harvesting. The final option selected by Clinton, Option 9 (the Preferred Alternative) accomplished these ecological goals while throwing out restrictions on timber harvest to protect late-successional species existing outside of the allocated reserves (Thomas, 1994). This would provide for more harvest than most of the other alternatives while accomplishing the charge set forth by Clinton. However, as a result of these new land allocations, FEMAT estimated that the plan would yield about 1 billion board feet of timber per year, which represented a 73-percent reduction from the "unsustainable" average timber sale levels of the 1980s (Marcot and Thomas, 1997).

As noted in the Record of Decision (ROD) for the NWFP (Espy and Babbit, 1994), management and consequent land allocations were devoted to preservation of Northern spotted owl and late-successional old growth associated species. Over 50% of federal land in Oregon, Washington and California was reclassified under six land allocations under the Preferred Alternative (see figure 3). Three of these land use types were dedicated to biodiversity conservation: Late Successional Reserves, Managed late Successional Reserves, and Riparian Areas. Matrix lands and Adaptive management areas were designated for timber and other ecologic, economic and social management goals.

Figure 3: NWFP Land Allocations



The three land-use allocations dedicated to biodiversity conservation accounted for more than 40% of the land allocated under the NWFP (see table 1). Late Successional Reserves (LSR) accounted for 30% of land allocated and were designated to maintain late successional old-growth forest as habitat for associated species and the Northern spotted owl. Managed Late Successional reserves were delineated areas or unspecified protection buffers designated to protect Northern spotted owl, murrelet or rare species. Riparian Areas were designated along all streams, wetlands, ponds, and lakes in order to protect the health of aquatic systems and dependent species.[1]

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[1] Initial estimates under the ROD of Riparian Areas were 11% or 2,627,500 acres of land in the range of the Northern spotted owl. However Hunt et al. estimated total Riparian Area land acres allocated at 1,242,238. This number was recognized in the ROD as a preliminary estimate subject to revision following a 'watershed analysis' (ROD, 1993). Guidance on the Riparian Area boundary adjustment following the

Table 1. Land Allocations under the Preferred Alternative

Land Allocation	Area (acres)	Percentage
RESERVED		
Late-Successional Reserves	7,430,800	30
Managed Late-Successional Areas	102,200	<1
Riparian Reserves	2,627,500	11
UNRESERVED		
Matrix	3,975,300	16
Adaptive Management Areas	1,521,800	6
Administrative Withdrawn Areas[2]	1,477,100	6
Congressionally Reserved Areas[3]	7,320,600	30

Source: Regional Ecosystem office

Concessions were made under the Preferred Alternative for 1.1 billion board feet of timber to be harvested annually on federal lands (ROD, 1994). Matrix lands represent the federal land not included in any of the other allocations where most of the timber harvesting would be done. Adaptive management areas did not preclude timber harvest as long as ecologic, economic and other social or community objectives were achieved (ROD, 1994). Despite concessions made for harvest, only one quarter of a billion board feet were sold in each of the first two years after enactment of the NWFP (Johnson et al. 1999). This was far less than expected under the NWFP and the historic levels that supported the rural timber economy in the Northwest (see figure 2 above).

Previous Research

The management of public lands for conservation purposes can influence employment in a variety of ways. Decreases in employment resulting directly from designation of land for conservation certainly occurs, however increases in tourism related jobs may

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watershed analysis is supposedly provided in attachment A to the ROD, however it is not explicitly included.

[2] Administratively withdrawn areas were identified in the existing forest plans as lands serving back country uses such as recreation and scenic value. These lands were not scheduled for timber harvests.

[3] No new lands in Congressionally RESERVED areas were allocated under the Preferred Alternative

also occur. Indirect effects on employment may occur as residents leave for employment opportunities elsewhere or migrants are attracted because of local amenities associated with the land designation. Evidence in the literature exists that natural amenities encourage migration (e.g., Knapp and Graves 1989, Clark and Hunter 1992; Treyz *et al.* 1993; Mueser and Graves 1995; McGranahan 1999, Haynes and Perez 2001).

These amenity-seeking migrants may be more willing to accept lower incomes than their skills would require somewhere else. The lower cost of labor may in turn attract firms interested in the higher quality and lower cost of labor. Lands designated for conservation purposes may also attract firms focusing on amenity based tourism; such as bird watching, fishing, and rafting. These possibilities suggest the use of public land for conservation may be an alternate strategy for fueling economic growth (Power 1996; Duffy-Deno 1998; Niemi, Whitelaw, and Johnson 1999; Power and Barrett 2001).

Several studies have applied the employment-migration models developed by Greenwood and Hunt (1984), Greenwood et. al. (1986), and Carlino and Mills (1987). Duffy-Deno (1998) examines the impact of wilderness areas on population and employment levels for 250 counties in the U.S. Rocky Mountains. He found no effects of federal wilderness area designation on population and employment density growth between 1980 and 1990. Lewis et al. (2002, 2003) assess the effects of conservation lands on net migration, employment growth and wage growth in the Northern Forest region. These studies found limited to no effects of public land designation on economic indicators[4].

These studies may examine lands which have been designated for amenity uses because they were potentially unproductive for commodity based uses (Duffy-Deno 1998). In

[4] Lewis et al. (2002) found that net migration rates were higher in counties with more conservation lands however these effects were small.

addition Lewis et al. explain their lack of significant effects with an issue of timing. The conservation lands under scrutiny may have been designated long enough ago such that all adjustments in local economies had occurred. Thus the degree to which public policy influences migration and employment growth through effects on amenities is still largely unknown.

Ashton and Pickens (1992) observed that federal policymakers have a long term concern with their impact on small rural communities and maintain that the relationship between resource policy and the resilience of local communities is poorly understood. The NWFP provides an opportunity for determination of the economic effects of reserving land for biodiversity protection. A study of lands classified by the NWFP will not suffer from the problems encountered by Duffy-Deno and Lewis et al. These lands were not designated for biodiversity preservation based on their lack of suitability for commodity production. The forests of the Pacific Northwest are among the most productive timberlands in the world and the area encompassed by the NWFP represents an area much larger than examined in previous studies. In addition, the changes in land management occurred recently allowing for measurement of any adjustments that might have occurred.

Hunt, Kerkvliet and Plantinga (2005) estimate simultaneous equation model (SEM) of net migration and employment growth in which county level land management variables are included as regressors. The effects of land managed for biodiversity conservation under the NWFP are captured by a variable that combines late successional reserves, managed late successional reserves, and riparian reserves into a single variable *RESERVED*. The effects of matrix land and adaptive management land designation are also captured by the variable *UNRESERVED*. These two classes are grouped since harvests would come from timberlands in matrix and adaptive management areas (Charnley 2006). The Hunt et al. SEM examines three periods; pre-NWFP 1980 -1990, litigation and NWFP enactment 1990-1994, and post-NWFP 1994-1999.

Northwest Forest Plan Effects on County Net Migration and Employment Growth; *Causality of Policy Variables, Timing of Response, Relevant Time Periods, Rural vs. Metro Policy Effects and Effects on Industry Employment*

While the Hunt et al. analysis gives an initial glimpse into the effects of the NWFP land management variables, the purpose of this thesis is to address a number of issues not addressed in their model. In Chapter One I layout the specification of the general model which is then explored in subsequent chapters.

In Chapter Two, I examine the assumption that the NWFP land share measures are exogenous regressors in the model specified by Hunt et al. As suggested by Soules (2002), ecological and economic factors may have been the drivers of the land use allocation decision. In this case, net migration and employment growth may be functions of the underlying local ecological and economic factors that also determined NWFP land allocations. If these factors influence net migration and employment growth in addition to the NWFP land shares then they cannot be treated as exogenous regressors. Ramsey's regression specification error test (RESET) is performed and indicates endogeneity may be a problem amongst a set of possible misspecification problems. Instrumental variables for the NWFP land allocation variables are then formed. The formation of these instrumental variables from economic, political and ecological variables is of interest given the lack of information about what drove the FEMAT decision making process.

In Chapter Three, the Hunt et al. model is then estimated on a yearly basis over a twelve year period before and after NWFP enactment. The instrumental variables for the NWFP land allocation variables are used to test for exogeneity in these yearly regressions. The total effects of NWFP land allocations in consecutive years are then compared using pairwise t-tests in order to reexamine the periods designated by Hunt et al. The NWFP was enacted in 1993, however, expectations about future land allocations and lags in policy implementation may have influenced migration and employment growth.

In addition, other policy actions and market fluctuations may have influenced the land management parameters of interest. As discussed above the time period before NWFP enactment was tumultuous. After NWFP enactment, the region endured impacts to the timber industry unrelated to the NWFP. Daniels (2005) explains Northwest timber export market declines as a result of changes in Asia's demand, and globalization of wood markets. By running the general model specified in Chapter One on a yearly basis the periods specified by Hunt et al. are reexamined. The general model is then reconstructed using information gleaned from the yearly regressions and according to policy relevant time periods. The estimation of this model and the subsequent results are the subject of Chapter Four.

In Chapter Five, the general model is used to describe changes in industry employment in sectors of interest of the regional economy; agriculture, service, and manufacturing. Duffy-Deno (1998) examines the effects of wilderness designation on employment in the resource sector but finds no significant effects. In addition Lewis et al. (2002, 2003) does not address changes in the composition of employment as a result of changes in land classification. A popular notion is that conservation causes employment sector shifts from high-paying manufacturing jobs to low-wage service sector jobs. The analysis in Chapter Five will examine changes in the composition of employment at the county level as it relates to the NWFP land designations. This will show whether NWFP land designations caused positive growth in one sector at the expense of another.

In addition to the breakdown of employment growth into industry sectors, Chapter Five examines the general model when the NWFP policy variables are differentiated for rural and metropolitan counties. By distinguishing between NWFP effects, analysis may show how rural and metropolitan counties experienced different economic effects from NWFP enactment. Prevailing wisdom predicted the majority of economic losses would be felt by rural communities within the NWFP planning area. This idea rested on the assumption that lumber and wood products industries were located in rural areas, however most of the region's lumber and wood products industry was located in or near metropolitan areas (Neimi et al. 1999). Therefore job losses due to anticipated policy actions affecting future harvests may have likely occurred to a greater extent in these metropolitan areas. The distinction of NWFP effects for rural and metropolitan counties will allow me to examine these assumptions.

Chapter 1: General Model Specification

The effects of the NWFP land classifications on employment growth (EG) and net migration (NM) are modeled with a two equation simultaneous system of equations similar to the model used by Lewis et al. (2002, 2003) and Hunt et al. (2005). This simultaneous system characterizes migration and employment impacts from the NWFP. The NWFP may have had direct effects on local employment through the land allocations which restricted timber harvest or through enhancement of recreational opportunities. The NWFP may have also directly affected migration causing an outflow of workers and an inflow of amenity-seeking migrants. Additionally migration and employment are intertwined, as people move to new areas jobs are created to support this migration. This relationship suggests land use allocations may have indirect effects on employment and migration, which can be captured in a simultaneous system of equations.

The general model uses a cross-section of county-level data for the 53 Oregon, Washington, and northern California counties with lands reclassified under the NWFP and the 20 counties adjacent to these counties.

$$(1)\quad \begin{aligned} EG_{j,s-t} &= f_1(NM_{j,s-t}, \text{PUBLICLAND}_{j,t}, \mathbf{X}_{jt} \mid \boldsymbol{\alpha}_t) + \varepsilon_{j,s-t} \\ NM_{j,s-t} &= f_2(EG_{j,s-t}, \text{PUBLICLAND}_{j,t}, \mathbf{Y}_{jt} \mid \boldsymbol{\beta}_t) + \lambda_{j,s-t} \end{aligned}$$

where the endogenous variables, $EG_{j,s-t}$ and $NM_{j,s-t}$ are the employment growth and net migration rate, in the j^{th} county where j=1,2,..., 73. The time periods over which the endogenous variables are defined vary in the chapters that follow. In Chapter Three the periods vary annually from s to t such that over the period $s-t$, s = 1987, 1989, 1991........1999 and t =1988, 1990, 1992.......1998. This is done in order to explore the timing of the response in the economic indicators to the NWFP variables. In Chapter Four the endogenous variables cover the subsequent periods defined in order to explore four policy relevant periods where s=1980, 1990, 1992, 1994 and t=1990, 1992, 1994, 2004. Chapter Five truncates the final period where t=1990, 1992, 1994 and then 2000.

$PUBLICLAND_{j,t}$ is a vector of variables describing public land management in the j^{th} county and the t^{th} time period. $X_{j,t}$ and Y_{jt} are vectors of exogenous variables, α_t and β_t are vectors of time-period specific parameters, and $\varepsilon_{j,s-t}$ and $\lambda_{j,s-t}$ are disturbance terms. A linear relationship between employment growth and net migration and the exogenous variables is assumed and the system of equations is estimated with three-stage least squares.

Since many of the variables are location specific, cross-county effects of the exogenous variables on the endogenous variables is of concern. Spatial autocorrelation of the residuals is examined and then modeled using a weight matrix approach. To test for spatial autocorrelation the Moran I statistic is used with the second-stage residuals. Since within-county effects of the exogenous variables are modeled, a potential source of spatial autocorrelation is cross-county effects on employment growth and net migration. The Moran I statistic is given by:

(2) $$\hat{I} = \frac{N(\hat{\mathbf{e}}'\mathbf{W}\hat{\mathbf{e}})}{S(\hat{\mathbf{e}}'\hat{\mathbf{e}})}$$

where N is the number of observations, $\hat{\mathbf{e}}$ is a vector of residuals, $\mathbf{W}$ is the spatial weights matrix, and S is a standardization factor equal to the sum of the elements of $\mathbf{W}$.

Specification of **W** defines the nature of the spatial relationship between the error terms. The non-diagonal elements of **W** are equal 1 for adjacent counties and 0 otherwise.[5] The Moran I statistic has an approximate standard normal distribution. Rejection of the null of no spatial autocorrelation is then corrected using the weight matrix procedure presented in Dubin (1998).

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[5] Queen contiguity and a row-standardized version of **W** are used in which the elements of each row are weighted so they sum to one.

Variable Definitions and Measurement[6]

Employment growth measures the percentage change in total county employment and net migration is the percentage change in county population. Net migration is net of natural changes due to births and deaths so that only population changes due to in-migration and out-migration are considered.

The exogenous variables in (1) include a set of variables measuring public land management, $PUBLICLAND_{j,t}$. In the net migration equation these variables represent amenities or disamenities to potential migrants. In the employment growth equation, these variables represent production opportunities in the form of available forest for harvest. They also represent production restrictions in the case of logging restrictions.

$STFOR_{jt}$, $NATFOR_{jt}$, BLM_{jt}, and $NATPARK_{jt}$ are the proportions of county *j* land managed by state forestry departments, the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and the National Park Service (NPS). The public land variables also include the percentage of the county's land in wilderness areas ($WILD_{jt}$).

The NWFP primarily affected lands managed by the Forest Service and the BLM. Thus, the $NATFOR_{jt}$ and BLM_{jt} variables are replaced by the county proportions of Forest Service and BLM land designated under the NWFP.[7] The lands reclassified under the NWFP are combined into two categories; lands allocated for biodiversity services ($RESERVED_j$) and as lands dedicated to other ecological, social or economic goals ($UNRESERVED_j$). $RESERVED_j$ includes lands designated as late successional reserves, managed late successional reserves, and riparian reserves. The area of land dedicated to $UNRESERVED_j$ is calculated by subtracting the riparian reserve area estimated by Hunt et al. from the area in the combined matrix/riparian reserve category and adding the

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[6] Definitions and notation for the variables used in equation (1) are also provided in Appendix A.
[7] Even though NWFP enactment did not occur until December of 1993 the land allocations were effectively established before this point due to litigation, policy discussion and timber harvest injunctions during this time period

adaptive management area category. In addition an indicator variable *ADJNWFP* is used which captures potential spillover effects from the NWFP. $ADJNWFP_j$, is equal to 1 if a county does not contain NWFP land but is adjacent to one that does.

In order to control for historical effects of conservation lands[8] on employment levels lagged employment density ($EMPDEN_{jt}$) is included in the employment growth equation. This variable is defined as total county employment divided by county land area. Additionally lagged population density, $POPDEN_{jt}$, is included in the net migration equation to control for historical effects of conservation lands on migration.

To obtain consistent estimates of the effects of the land management variables on the endogenous economic indicators, relevant exogenous variables are included in the general model to minimize bias in the land management parameter estimates of interest.

Variables to control for production costs are included in the employment growth equation. A dummy variable, $INTER5_j$, is included which takes the value of 1 if Interstate 5 passes through a county. Other transportation costs are controlled for with a variable measuring the ratio of interstate and other arterial road miles to county land area, $ROADDEN_j$. Cost reductions as a result of the proximity of firms are controlled for with another dummy variable $METRO_{j,t}$. This indicator variable takes the value of 1 if the county is part of a metropolitan statistical area (MSA) over the period defined. For counties which are part of the Seattle and Portland MSA's, another dummy variable ($BIGMETRO_j$) is included in order to capture cost reductions which may be greater when firms are located closer together in larger metropolitan areas.

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[8] Since some conservation lands in the study region were designated before the periods analyzed; Mount Rainer and Crater Lake National Parks were established in 1899 and 1902, respectively. Redwood National Park, in northern California, was created in 1968, and most of the region's wilderness areas were initially designated in 1964.

Additional variables measuring factors which affect local labor market conditions are included in the employment growth equation. Lagged high school ($HSGRAD_{jt}$) and college graduation ($COGRAD_{jt}$) rates are used to measure effects of educational attainment. These variables are the percentages of a counties' population over 25 years of age who have completed high school and college. The share of local government expenditures on education, $EDUCEXP_{jt}$, is included in order to measure the educational quality of the local labor force. The lagged rate of unemployment is also included, $UNEMPLOY_{jt}$, which indicates the availability of potential workers. The share of total county payroll from Standard Industrial Classification (SIC) code 24 for lumber and wood products earnings ($WOODEARN_{jt}$) is included. This controls for disproportionate effects of land management changes felt by counties more dependent on wood products employment. In order to account for the effect of non-labor sources of income on local labor markets, the share of total personal income derived from dividends, $DIVIDEND_{jt}$ and per capita federal expenditures, $FEDEXP_{jt}$, are included.

Given the extent to which natural amenities influence migration, variables are included to capture effects on net migration and employment growth stemming from climatic variation across the NWFP planning area. Mean values between the years from 1941 to 1970 were included for January and July temperatures ($JANTEMP_j$ and $JULYTEMP_j$), hours of sunshine in January ($JANSUN_j$), July humidity ($JULYHUMID_j$) and rainfall in January ($JANRAIN_j$). These variables capture climatic differences in the NWFP area that vary predominantly from the east to west.

In addition, other exogenous variables are included in the net migration equation in order to capture changes due to other amenities unassociated with climate. The variables noted previously in the employment growth equation controlling for transportation cost ($INTER5_j$ and $ROADDEN_j$) are used to control for accessibility in the net migration equation. Variables that enter the employment growth equation controlling for reductions in costs associated with firm proximity in metro areas ($METRO_j$ and $BIGMETRO_j$), are included in order to control for better employment opportunities and subsequent migration in these areas. These variables also control for effects of urban amenities on migration decisions. Finally, the land management variables are included in the net migration equation to capture effects from associated natural amenities, or disamenities on migration.

Community characteristics feasibly influence migration decisions and are accounted for with several variables. The share of federal expenditures dedicated to health care and education ($HEALTHEXP_{jt}$, and $EDUCEXP_{jt}$) are included. The ratio of federal expenditures to local taxes ($EXPTAX_{jt}$) gives a measure of local public goods provided relative to the tax burden imposed on residents. The share of owner-occupied homes ($OWNHOME_{jt}$) and the number of serious crimes 100,000 residents ($CRIME$) is also included. Median household income ($INCOME_{jt}$) is included in the net migration equation in order to account for variation in cultural opportunities and variation in local housing markets.

Finally dummy variables for counties in Oregon, and Washington, are included in both the net migration and employment growth equations (with California included as the reference group). These variables control for differences between states, such as tax rates, land-use regulations, and regional market fluctuations not accounted for by the previous variables.

Chapter 2: NWFP Land Share Determination

Introduction

It is feasible that net migration and employment growth in the general model described in the previous chapter, may be functions of the underlying local ecological and economic factors that also determined the NWFP *RESERVED* and *UNRESERVED* land allocations. If these factors influence net migration and employment growth in addition to the NWFP land shares, then they cannot be treated as exogenous regressors in the general model and the model explored by Hunt et. al. (2005). Ramsey's RESET test is performed on the periods of analysis established in the Hunt et al. model; 1980 to 1990, 1990 to 1994, and 1994 to 1999. This indicates endogeneity of the *RESERVED* and *UNRESERVED* land designations may be an issue amongst a set of possible misspecification problems. Since exogeneity is strongly suspect the land share measures are reconstructed using economic, ecologic and political variables established as determinants of the NWFP land allocation decision.

The determination of the NWFP land allocations has been explored in the paper by Soules (2002). His analysis the land designations were based on ecological and economic variables at county and tract levels of analysis. Given this established relationship our exogenously treated measures of *RESERVED* and *UNRESERVED* land shares may be correlated with the error term. If this is the case then these land shares cannot be considered to be determinants of employment growth and net migration that are desired. Ecological and economic variables (such as northern spotted owl locations, location of Key Watersheds[9] or county timber harvests) may have been the actual drivers of net migration and employment growth rather than the amount of land in NWFP land allocations.

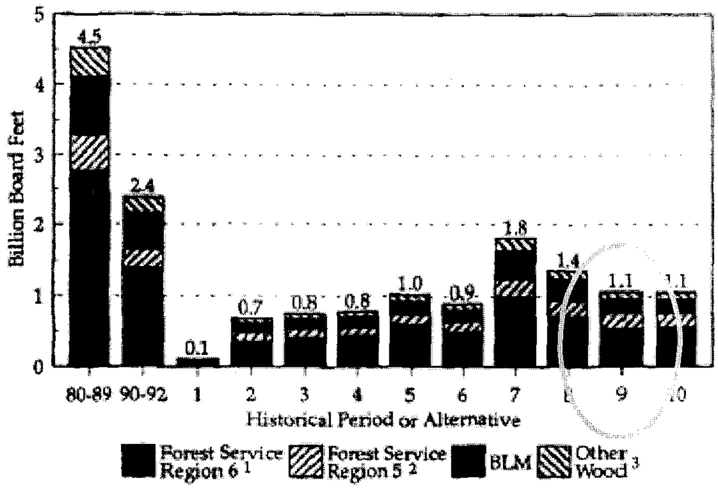
[9] As defined by the ROD: Tier 1 key watersheds - those to be managed for at-risk anadromous salmonids, bull trout, and resident fish (141 watersheds, 8,119,400 acres); Tier 2 key watersheds - those where high water quality is important (23 watersheds, 1,001,700 acres); and non-key watersheds - all other watersheds (15,334,200 acres).

The Record of Decision for the NWFP does not include explicit explanation of the land allocation designations. The decision was made through cooperative effort of FEMAT which was composed of more than 600 scientists, technicians and support personnel (Thomas, 1994). An overarching emphasis was placed on the maintenance of habitat for native species while assuring a sustainable supply of timber and other forest products over the long term (Standards and Guidelines attachment to the ROD, 1994).

In addition FEMAT was certainly aware of section 4(b)(2) of the ESA. This section outlines the requirement for consideration of economic impacts in the designation of critical habitat[10]. This section thus allows an area to be rejected as critical habitat based upon economic analysis unless the threat of species extinction exists (Darin, 2000). Also, the range of federal harvest levels associated with the ten options presented by FEMAT demonstrates the concern with economic impacts. From the ten options presented to President Clinton the alternatives ranged from the "Big Green" option to an intensive timber harvest option. Selection of the Preferred Alternative by President Clinton called for significant harvest levels relative to other options (see circled alternative 9 in figure 4).

[10] Section 4(b)(2) was a 1978 amendment to the ESA. It states that 'the Secretary shall consider the economic impact, and any other relevant impacts, of specifying any particular area as critical habitat and he may exclude any such area from the critical habitat if he determines that the benefits of such an exclusion outweigh the benefits of specifying the area as part of critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species'.

Figure 4: First decade probable average annual timber sale levels by historical period and NWFP alternative



1 Region 6 = Pacific Northwest Region
2 Region 5 = Pacific Southwest Region
3 Includes cull, submerchantable material, firewood and other products.

Source: ROD, 1994

During the FEMAT process federal legislation also required ecological considerations in the land allocation decision. Section 7 of the ESA states that only habitat which is deemed critical to species survival will be protected. FEMAT made an effort to maintain contiguous stretches of habitat and designate land in order to improve habitat (Standards and Guidelines attachment to the ROD, 1994). This was done based on the fact that habitat encompasses more than just that deemed critical. Land between the reserve systems was also designated in order to facilitate owl population dispersal between reserves (personal communication with Eric Forsman).

In the end the land designations were based on the expert opinion of specialists in FEMAT. Some specialists made decisions to avoid undue economic impact to communities dependent on the logging industry. Other FEMAT specialists made choices based on retention of large diameter trees and other forest structure characteristics that contributed to biological objectives (Franklin, 1994). Using economic, ecologic and political variables a deterministic relationship is established with the NWFP land share measures. These variables will then be used as the instruments in the formation of instrumental variable projections for the *UNRESERVED* and *RESERVED* land share measures.

Methods

A RESET test was performed in order to examine the exogeneity of the regressors in the model specified by Hunt et al. In this form RESET can be viewed as a method to search for correlation between regressors and the error term in the structural equations. If correlation can be established, then one or more of the regressors may be endogenous. If correlation between regressors and the error is not established, then the regressors can be considered exogenous. For example;

(3) $$Y_{j,s-t} = \beta_o + \beta_1 \mathbf{X}_{jt} + \beta_2 \text{PUBLICLAND}_{jt} + \varepsilon$$

and can be rewritten as;

$$\Rightarrow \varepsilon = Y_{j,s-t} - \beta_o - \beta_1 \mathbf{X}_{jt} - \beta_2 \text{PUBLICLAND}_{jt}$$

Where the endogenous variable *Y* represents net migration (NM) and employment growth and the test is performed on each of the structural equations. Net migration and employment growth over the first two time period of the Hunt et al. model are examined, X is a vector of the exogenous variables that enter each structural equation in the general model as before, and PUBLICLAND is the public land management vector of variables. The projection of each of the dependent variables can then be described as;

(4) $$\hat{Y}_{j,s-t} = \hat{\beta}_o + \hat{\beta}_1 \mathbf{X}_{jt} + \hat{\beta}_2 \text{PUBLICLAND}_{jt}$$

where the hats indicate estimated values. Since $\hat{NM}$ is a linear combination of the original regressors, X and $\text{PUBLICLAND}_{j,t}$, it carries the information on these regressors. By taking the second, third and fourth powers[11] of the estimated dependent variable the RESET test can be constructed as the following equation (Hill et al. 2001, Kmenta 1986);

(5) $Y_{j,s-t} = \beta_o + \beta_1 \mathbf{X}_{jt} + \beta_2 \text{PUBLICLAND}_{jt} + \alpha_1 (\hat{Y}_{j,s-t})^2 + \alpha_2 (\hat{Y}_{j,s-t})^3 + \alpha_3 (\hat{Y}_{j,s-t})^4 + \varepsilon$

For expository purposes equation (5) can be viewed as

(6) $Y_{j,s-t} - \beta_o - \beta_1 \mathbf{X}_{jt} - \beta_2 \text{PUBLICLAND}_{jt} = \alpha_1 (\hat{Y}_{j,s-t})^2 + \alpha_2 (\hat{Y}_{j,s-t})^3 + \alpha_3 (\hat{Y}_{j,s-t})^4 + \varepsilon$

Since the LHS of (6) is the original error term in equation (3), an F-test of the joint significance of α_1, α_2 and α_3, is a test for correlation of the original regressors and the original error term of the structural equations. The null hypothesis supposes all of the parameters are jointly zero which implies exogeneity of all regressors. The alternative hypothesis posits some coefficients are not zero, which implies some of the regressors are not exogenous. Rejection of the null would indicate correlation of the original error term and any of our regressors X or $\text{PUBLICLAND}_{j,t}$.

The first two periods of analysis in the Hunt et al. study are of interest given this is the time period over which data was collected and consequently used in the FEMAT land allocation decision. Acceptance of the alternate hypotheses in the RESET implies possible endogenously determined land share measures. This possibility is then tested using an instrumental variable technique (Geroski, 1982).

Determination of land share measures

Each acre within a county is classified as either *RESERVED* or *UNRESERVED* and can be considered a probability event. Let A_{ij} be a binary variable equal to 1 if the ith acre in the jth county is classified as *RESERVED* or *UNRESERVED*, and zero otherwise.

[11] RESET includes as many polynomials of $\hat{y}$ as practical; as the included powers increase the cross-product matrix is incalculable due to multicolinearity and the estimation of (4) is unfeasible.

(7) $$E(A_{ij}) = \frac{1}{n_j} \frac{e^{\beta_1 \mathbf{X}_{jt} + \beta_2 \text{PUBLICLAND}_{jt}}}{1 + e^{\beta_1 \mathbf{X}_{jt} + \beta_2 \text{PUBLICLAND}_{jt}}},$$

The experiment is repeated for each acre in the county and from this we get the proportion of acres in the county classified under each NWFP land designation (p_{ij}). Therefore;

(8) $$p_{ij} = \sum_{i=1}^{n_j} Y_{ij}$$

is the proportion of land in the jth county classified under each NWFP land allocation. The relationship between the regressors and regressand is not a linear function in logistic regression, instead the log- odds transformation is used;

(9) $$\log(\frac{p_j}{1 - p_j}) = X_j \beta + \varepsilon$$

This is the equation estimated for both the *RESERVED* and *UNRESERVED* lands. Thus, a linear transformation (9) of a non-linear function (7) is used to explore the probability an acre is allocated as opposed to not allocated. The log transformation introduces heteroscedasticity and is corrected via weighted least squares where the weights are a function of the total number of acres in a county (Greene, 2003).

NWFP Land Share Instrumental Variable Definition and Measurement

The instrumental variable technique requires that variables are found which accurately portray the variable of interest without being correlated with the structural disturbances. In this way, specification sometimes incorporates high degrees of multicolinearity. Perfect multicolinearity is avoided for practical purposes however many of the instruments (variables used to form the instrumental variables for the NWFP land shares) are somewhat repetitive. This does not preclude their use given the nature of the task is to provide the best fit of the *RESERVED* and *UNRESERVED* land shares.

Ecological determination of land shares

Many FEMAT scientists made land allocation choices based on forest structure and ecologic characteristics that contributed to biological objectives (Franklin, 1994). Ecological and forest characteristic variables were included as instruments which were used directly by FEMAT[12].

Late-successional old growth (LSOG) was a forest type classified by the Regional Ecosystem Office (REO) and consequently used in the NWFP planning process. By using this measure of LSOG instead of particular forest characteristics the old growth ecosystem, as characterized by FEMAT, is more accurately depicted[13]. Often singular focus on one or two stand characteristics skews management from considering the dynamics of a complex old-growth ecosystem (North et al. 1999). Old growth can also be accurately defined as an ecosystem state rather than attributes of individual trees (Franklin et al. 1981). In addition, the old growth forests of the PNW have variation in biological diversity within specific regions. Therefore it is hard to justify using the same criterion for old growth in the temperate rainforests of the Olympic Peninsula as the arid Ponderosa Pine stands of the Eastside. The REO classification of LSOG forest describes the habitat of many of the species considered in the NWFP. Therefore, this measure partially accounts for consideration of these other species in the land allocation decision.[14] The county share of LSOG is anticipated to be positively associated with Reserved NWFP land since Reserve land is composed largely of LSOG.[15]

In addition, the presence of known spotted owl and marbled murrelet centers was a consideration in the land allocation decision. A dummy variable indicating the

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[12] The assistance of Michael Soules was greatly appreciated in the acquisition of this data. Some of the data was collected prior to 1993; they represent the actual data used in the planning process.

[13] The US Forest Services Forest Inventor and Analysis (FIA) gives volume per unit area measures and species composition data at the plot level with 'fuzzed' (or modified) location coordinates because FIA is mandated by law not to disclose any information that can be tied back to an individual landowner. Because this fuzzed resolution severely impaired the ability to identify the specific forest characteristics of the land use allocations, forest characteristic variables were included that were used directly by FEMAT.

[14] 1098 terrestrial species were identified as being closely associated with late-successional forests on federal lands (Espy and Babbitt, 1994).

[15] 41% of federal land was allocated in the RESERVE category and LSOG reserves accounted for 73% of this land.

presence of Northern spotted owl and marbled murrelet centers within each county is included. Since these two species were LSOG associated species of concern, these variables are expected to be positively related with the probability that an acre will be allocated as RESERVE and negatively related with the probability that an acre will be an *UNRESERVED* acre.

Inventoried roadless areas were present throughout the planning area as well as NWFP key watersheds. Dummy variables indicating whether the geographic center of the key watersheds occurred within a county serve as a proxy for those counties containing large portions of key watersheds and inventoried roadless areas. Since the management of the inventoried roadless areas were intimately tied to the key watersheds (ROD, 1994) these variables are anticipated to have similar relationships to the probability of NWFP land allocations. These variables are expected to be positively associated with *RESERVED* NWFP land and negatively associated with *UNRESERVED* land because of their importance in maintaining habitat for potentially threatened species or stocks of threatened fish (ROD, 1994).

The county share of USFS and BLM land was included as a single variable ($USFS/BLM_j$) since the probability an acre was designated is dependent on the predominance of federal land available for designation.

Economic determination of land shares

Economic variables are included as instruments for the NWFP land allocations in order to account for the economic factors that entered FEMAT's decision making process. FEMAT sought to minimize the decline in timber related employment noting that "Alternatives 1 through 6 would provide a reduced timber supply when compared to Alternative 9" (ROD, 1994). In addition, FEMAT placed Adaptive Management Areas in communities more likely to suffer from reduced timber harvests (Espy and Babbitt, 1994).

In order to capture FEMAT's efforts to accommodate counties more heavily dependent on the timber industry, several variables were incorporated. The proportion of total county payroll to SIC 24 payroll (lumber and wood products earnings) captures the county dependence on timber as a proportion of all industries reporting payroll in that county. Counties with a higher share of SIC 24 payroll are expected to be associated with *UNRESERVED* land since FEMAT sought to minimize declines in timber related employment (Espy and Babbitt, 1994). Similarly, SIC 24 payroll is expected to be negatively associated with *RESERVED* NWFP land. In addition, payments to counties in 1992 from federal timber receipts reflect county dependence on federal timber[16]. Counties receiving more timber payments are anticipated to be positively associated with *UNRESERVED* land and negatively associated with *RESERVED* land.

Median household income was included since counties with lower incomes may have been perceived as more susceptible to adverse effects from timber related job losses. If this was the case then counties with lower median household income should be associated with *UNRESERVED* land since FEMAT sought to minimize declines in timber related employment (Espy and Babbitt, 1994). Counties with higher median household incomes may be positively associated with *RESERVED* lands since higher amenity levels are potentially associated with these areas. If this is the case then hedonic theory would suggest higher household incomes reflects higher cost of living in these areas.

It has been shown that in addition to forestry employment, harvest levels determine federal policy (Burton et al. 1996). Therefore, instrumental variables for the land allocation shares also include county public harvests as a share of total harvests measured in thousands of board feet (mbf). Harvest levels in the Northwest forest plan region and nationwide were at all time highs leading up to NWFP enactment (Adams et

[16] The assistance of Michael Soules was greatly appreciated in the acquisition of this data.

al. 2006). These increased harvest levels had definite impacts on habitat and the land that would later become the *RESERVED* and *UNRESERVED* land allocations. Variation in harvest volume across counties could explain the probability that the land was allocated for *RESERVED* or *UNRESERVED* purposes. This relationship might also explain whether the amount of land available for harvest in the matrix was determined by past harvest levels.

County harvest on public lands for the year 1993 is used as an instrument for the land allocation shares. Public harvests include harvests on BLM, USFS, State, County, and Municipal lands. This data was available from Oregon Department of Forestry, Washington State Department of Natural Resources and the California Board of Equalization. Data was used from the year 1993 in order to represent harvest patterns that would have been considered in the FEMAT land allocation decision. As harvest levels increase, the probability of a county acre being allocated as *RESERVED* land is expected to increase and the probability of *UNRESERVED* is expected to decrease.

Political determination of land shares

Following the methodology established by Soules (2002), political variables were included as they related to the land use allocation decision. The NWFP was developed by a team of more than 600 scientists, technicians and support personnel (Thomas, 1994). FEMAT may have tried to accommodate the views of local residents and their political representatives during the land allocation decision. Thus, more matrix and adaptive management lands and less biodiversity lands may have been allocated to those areas perceived to have greater support for timber-related interests (Soules 2002).

In order to measure the effect of these political affiliations a dummy variable measuring counties in congressional districts with Republican representatives and the portion of major party voters[17] who voted for George Bush Sr. were included. It can be expected that counties with Republican representatives and a high proportion of Bush votes would have anti-environmentalist views and therefore less land allocated to *RESERVED* land and more to *UNRESERVED* land. In addition, the county voting score for the House member representing that county was included from the League of Conservation Voters (LCV) for 1993. Counties with a higher LCV score might be expected to be positively associated with *RESERVED* land allocations and negatively associated with *UNRESERVED* land allocations.

Results

The results of Ramsey's RESET test indicate endogenous NWFP land shares may be prevalent in the first period of analysis defined by Hunt et al (see table 2). The second period results indicate the employment growth equation may suffer from an endogenously specified regressor.

Given this result, the instrumental variables are formed for the land allocation measures using the variables described above. The relationship of these variables to the *RESERVED* and *UNRESERVED* land allocations is of interest. These weighted logistic regression results are displayed in table 3.

Table 2. Results from Ramsey's RESET test

Period	Dependent Variable	F-statistic of joint significance on α coefficients	P-value
1980 to 1990			
	Net Migration	4.322***	0.0402
	Employment Growth	4.835***	0.030
1990 to 1994			
	Net Migration	0.652	0.421
	Employment Growth	3.220**	0.076

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level

[17] This variable provides a refined measure of local political preference by excluding votes for third party candidates (i.e. Ross Perot).

Table 3. Land Share Regression results

	RESERVED Equation		UNRESERVED Equation	
Variable Name	Estimate	t-statistic	Estimate	t-statistic
Constant	-3.542*	-1.556	-5.587***	-2.606
USFS/BLM	2.136**	1.703	1.725	1.460
'93 Household Income	-0.000*	-1.536	-0.000***	-2.414
'93 Public Harvest	-0.113	-0.088	1.489	1.224
'93 Wood Earnings	-1.036	-0.596	-0.765	-0.467
'92 Timber Payments	-0.001	-0.563	-0.001	-0.995
Percent of Bush votes	0.007	0.411	0.022	1.262
Average Senator LCV	-0.002	-0.325	0.003	0.390
'93 LCV House score	-0.004	-0.256	0.023*	1.523
GOP Representative	-0.411	-0.396	1.561*	1.595
Key Watershed	0.757*	1.483	0.200	0.416
Roadless Area	0.537	0.702	0.295	0.409
LSOG Share	39.552***	2.309	48.458***	3.003
Marbled Murrelet	0.323	0.968	-0.485*	-1.543
Spotted owl	0.586	1.022	0.454	0.840

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level, and * indicates significance at the 15% level

In the *RESERVED* land allocation equation the LSOG and the BLM/USFS county share variables are statistically significant and positively related to the probability an acre is allocated to a *RESERVED* use. In addition, household income is statistically different from zero and unexpectedly negative at the 15% level of confidence. The adjusted R-squared is reasonably high at 0.652.

In the *UNRESERVED* equation household income, Marbled Murrelet and GOP representative are statistically different from zero and have expected signs. The LCV House score variable and the LSOG share variable are both statistically different from zero and are unexpectedly positive. The regressors explain 65.6% of the variation in the regressand (adjusted R^2).

Discussion

The RESET test performed indicates endogeneity of the land share measures may be a problem amongst a host of specification problems. Significant F-test of the joint significance of the alpha coefficients reflects correlation of the exogenous variables and the error term, though this is not necessarily due to endogenous regressors. RESET is a general test for misspecification which could be due to omitted variables, functional form misspecification or endogenous regressors.

Using instruments that explain variation in the land share measures accommodates examination of exogeneity directly. Additionally this exploration allows for examination of the land allocation decision. From the results above it can be concluded that economic, political and ecological factors were determinants of FEMAT's decision to allocate land to reserved uses.

The significant and positive effect of the proportion BLM/USFS county land on *RESERVED* land use allocation fits expectations. The positive sign on LSOG and the marginally significant and positive sign on Key Watersheds also fit expectations about the role of ecological variables in FEMAT's decision.

While unexpected and marginally significant, the negative impact of household income on the probability of land allocation to *RESERVED* use might be a function of less available forest in areas of higher median household income; such as metropolitan counties.

The logistic regressions results for the *UNRESERVED* equation show that economic, political and ecological factors contributed to the allocation of land for unreserved uses.

The negative impact of household income on *RESERVED* land allocation certainly fits expectations. This result suggests FEMAT intended to minimize the impact of the NWFP on poor counties with lower incomes.

The LSOG share was not anticipated to be positively associated with the *UNRESERVED* land allocation. However, it is conceivable that counties with a higher proportion of land with containing LSOG had more forest available for harvest and thus higher probability of being allocated to an *UNRESERVED* use. The marginal significance of the marbled murrelet variable conforms to expectations about the role of *UNRESERVED* land allocations.

The LCV House score was marginally significant and unexpectedly positively associated with *UNRESERVED* suggesting counties with House members with good conservation voting records had a higher probability of being allocated to unreserved uses. This variable may proxy for location characteristics of county party affiliation. Urban counties represented by House members with good conservation voting scores may have more forest with ecological characteristics typical of unreserved land uses The significance of the GOP variable implies partisan politics played a role in FEMAT's determination of the forest available for harvest in unreserved NWFP land uses.

Conclusion

Contrary to the previous study by Soules (2002), this analysis suggests that in addition to ecological factors, economic and potentially political rationale were important in FEMAT's decision making process at the county level. Clinton's charge reminded FEMAT to 'never forget the human and economic dimensions of the problem' (Shannon, Johnson, 1994), which suggests the role of economic determinants in the land allocation process is plausible. These results suggest that past levels of household income were utilized when FEMAT sought to minimize the effect of the NWFP on timber dependent communities. In addition, partisan politics potentially played a role in determining the forest available for harvest. Finally, the county share of LSOG, location of key watersheds and marbled murrelet habitat reinforce the importance of ecological determinants of the NWFP land allocations.

This analysis has allowed for determination of the land use shares and, consequently, enables testing of the *RESERVED* and *UNRESERVED* variables for endogeneity in the general model discussed in Chapter One. Using an instrumental variable technique, these variables will be used for testing in the next two chapters.

Chapter 3: Yearly regression for the period from 1987 to 1999

Introduction

NWFP enactment was preceded by several years of legislation and two regional timber harvest injunctions. During this period expectations about the future of rural counties was bleak. Job-losses were predicted to be as high as 130,000 (Beuter, 1990). The anticipation of these impacts may have influenced net migration and employment growth prior to the enactment of the NWFP.

The controversy and timber injunctions that embroiled the region in the years before the NWFP feasibly shaped expectations about the future of the timber industry in the Northwest. Economic agents likely saw the writing on the wall and reacted accordingly. In addition expectations about future land use allocations and lags in policy implementation could have affected net migration and employment growth. Estimating the general model presented in Chapter One on an annual basis, allows for identification of the initial response and adjustments to the NWFP.

In addition, characterizing the general model facilitates the examination of the NWFP land share measures for endogeneity on a yearly basis. Given a lack of exogenous NWFP land share variables, the *RESERVED* and *UNRESERVED* measures will be instrumented and the yearly models will be examined for changes in the policy parameters of interest.

Methods

The general model is characterized on an annual basis where net migration and employment growth are measured annually from 1987 to 1999. The exogenous time period specific parameters enter specification similarly on an annual basis. The annual models over this period describe the period of legislation before enactment of the NWFP, and the period of adjustment after enactment.

The NWFP land share measures in the yearly regression are first tested for exogeneity using the following technique. Suppose exogeneity of the NWFP land allocation measures in $\text{PUBLICLAND}_{j,t}$ are in question where;

(10) $$Y_{j,s-t} = \beta_o + \beta_1 \mathbf{X}_{jt} + \beta_2 \text{PUBLICLAND}_{jt}$$

The instrumental variables *RESERVED*hat and *UNRESERVED*hat are formed from the instruments described in Chapter Two. A vector of errors RSVerror is formed from *RESERVED* – *RESERVED*hat, and UNRSVerror is formed from *UNRESERVED* – *UNRESERVED*hat. Y is then regressed on *X, Z,* RSVerror, and UNRSVerror. The coefficient estimates on RSVerror and UNRSVerror are tested against zero using t-tests (Geroski, 1982). This method is applied to the simultaneous equation model constructed on a yearly basis from 1992 to 1999[18]. Yearly exogeneity test results are presented with and without the spatial autocorrelation correction in tables 4 and 5.

The yearly regressions are then examined for breaks between the years from 1987 to 1999. Tests for differences in model stability over time associated with a policy change are often performed with a Chow test. This method hypothesizes that the break points are directly associated with the policy change and leaves no room for exploration of expectations or policy implementation lags. Since the policy change of interest implies

[18] Only the years from 1992 on are tested for endogenous land share measures. In October 1991 the "Gang of Four" report was released which marked the first time land allocation terms were considered in a federal land use planning context. Their report presented 14 management alternatives that specified levels of old-forest habitat patches to be provided on "matrix" lands in between LSOG reserves, owl addition areas and key watersheds (Marcot and Thomas, 1997).

a different structural form[19] CUSUM is infeasible and the Chow test is further complicated. Using pairwise t-tests individual coefficients between yearly models are compared using the following method.

Endogenous net migration and employment growth were all defined in terms of a common base year in order to allow for comparison of coefficient values between models. For example, suppose X represents a matrix of time period specific variables and W a vector of variables which are constant over yearly regressions.

If these equations are added the endogenous variable and the coefficient on W represents a change over the period of years aggregated;

$$\frac{Y_t - Y_o}{Y_o} = \alpha_o \cdot T + \beta_1(\mathrm{X}_0 + \mathrm{X}_1 + \mathrm{L} + \mathrm{X}_\mathrm{T}) + \beta_2 \cdot \mathrm{W} + \lambda_o \tag{11}$$

Since each endogenous variable has been normalized to the same base year their aggregation represents a total change over the period of years pooled. In the yearly regressions in (10) it is assumed that the annual growth is driven by the same process every year. The parameters α_o and β_2 in (11) are therefore the aggregation of the individual yearly changes. However β_1 reflects the aggregation of several time period specific parameters, which has no meaning in terms of the pooled time period of interest. Therefore the β_1's between regressions cannot be compared. However the comparison of these time period specific coefficients is not of interest.

This method allows for testing of coefficients between models on those variables which can be aggregated to represent a percent change over the period of interest (i.e. $\beta_{2,o}$ can be compared to $\beta_{2,1}$ or the effect of $RESERVED_0$ can be compared to $RESERVED_1$). The identity which is relied upon is therefore;

[19] Yearly regressions prior to 1992 contain BLM and USFS land shares in a county in place of the NWFP land share measures RESERVED and UNRESERVED.

(12) $$\beta_2 = \sum_{i=1}^{T} \beta_{2,t}$$

Each equation is estimated separately and the total effects[20] on the *RESERVED* and *UNRESERVED* land allocations are compared in successive years. The changes in the coefficients on the endogenous variables and the land allocation variables imply the NWFP is having different effects on the endogenous variable. By measuring the degree of change in the total effects of *RESERVED* and *UNRESERVED* land allocations in the yearly regressions, break points are identified. Then the general model is characterized between break points, which increases variation in the endogenous variables accommodating efficient estimation.

A comparison is not made for the total effects between the 1991 and 1992 annual models because of structural differences in the PUBLICLAND vector[21]. Due to the assumption that the NWFP variables were not feasibly known prior to 1992 the general model takes a different structural form; the BLM and national forest land share measures are replaced with the NWFP variables in the 1992 general model and beyond. Hence, the total effects of the NWFP variables in 1992 cannot be compared to those in 1991 since they do not exist.

However by modifying specification of the 1991 and 1992 general model changes in the total effects of the public land management variables is explored. By replacing the NWFP variables with BLM and USFS land share variables in the 1992 general model, a comparison was facilitated. This was done again by replacing the USFS and BLM land

[20] Total effects are analyzed given the limited value of the structural equation parameters. The structural equation parameter values represent the direct effects of the exogenous variables on each of the endogenous variables. However a change in one endogenous variable affects the other endogenous variable in a simultaneous system of equations. By solving the structural equations the total effect of an exogenous variable on each endogenous variable can be determined. These total effects then represent an equilibrium condition at which all adjustments in the endogenous variables have occurred.
[21] the RESERVED and UNRESERVED variables enter specification in 1992 prior to NWFP enactment but after the initial time period of analysis as explained above.

shares with NWFP land share variables in the 1991 general model. This allows for determination of structural changes in consistently specified equations.

Data for yearly regressions

Exogenous variables were compiled for the annual models when missing from the original data set developed by Hunt et al. In addition data was updated so the last period of analysis reflects trends through 2003. Some data was unavailable from the sources initially used by Hunt et al. In this case, data was either replaced or no supplemental data was provided. The best effort was made to find lagged regressors that were nearest to the year preceding the regressand.

Educational attainment of persons 25 years or older was obtained for the year 2000 from the US Census Bureau. Data for years between 1990 and 2000 appeared to be unavailable from the US Census Bureau (this is noted in the TSP program line by Joe as well).

Federal expenditure data to 1997 was obtained from the US Census Bureau's USA Counties website[22]. Data for years after 1997 were obtained from the US Census Bureau's Consolidated Federal Funds Report[23]. Total direct expenditures and obligations were divided by county population in order to obtain the variable FEDEXP for per capita federal expenditures.

Data from the Bureau of Labor Statistics (BLS) website was used for unemployment data per county. BLS data prior to 1990 was available from the US census bureau's USA Counties website while yearly data was obtained for the remaining years from the BLS website.

[22] http://censtats.census.gov/usa/usa.shtml
[23] http://www.census.gov/govs/www/cffr.html

Median household income data for 1993, 1995 and 1999 was found from the Commerce Department's Census Bureau. Household income data for these years other than decennial census years has been developed in response to the need for more current statistics on household income. These estimates encompass an effort by the Census Bureau to produce county-level poverty and income estimates more frequently than those released every 10 years based on the decennial census. The decennial census was used for 1969, 1979, 1989, and 1999 estimates.

The percentage of owner occupied homes from the 2000 census was added to the specification. This was measured by the percentage of occupied housing units in a county that were owner occupied.

The number of serious crimes per 100,000 county residents was updated through 2002. This data was originally obtained from USA counties and is available up to 1995. Data for subsequent years was obtained by aggregating reports of serious crimes per county and dividing by county population the same measure was obtained.[24]

Data for the wood earnings variable (WOODEARN) was obtained from the BLS. Total payroll for SIC 24 (lumber and wood products) is divided by the total payroll for all industries within the county. Many payroll estimates are not available for counties with less than three total businesses in order to maintain business anonymity. A range of values is provided in place of the non-disclosed value. These missing values were estimated using the method described in the following section.

[24] This data was available on a yearly basis from United States Department of Justice - Federal Bureau of Investigation, and does not include arson in order to maintain consistency with the variable used by Hunt et al. http://fisher.lib.virginia.edu/collections/stats/crime/

Imputation of missing SIC 24 observations

Following the method used by Hunt et al. this missing observation problem was solved using a regression imputation method (Greenlees et al 1982, Skinner et al. 2002). For all counties with fully disclosed SIC 24 data in Oregon, Washington and California a model was constructed that explained the average salary of SIC 24 workers. Since regression imputation had been performed for the years 1989 and 1993 in Hunt et al., this effort concentrated on modeling wage determination in the remaining ten years from 1986 to 1997. The dependent variable for each year was calculated as the total SIC 24 payroll divided by the number of employees.

Explanatory variables included were measures of wage adjustment made for natural amenities such as local temperature, humidity and sun. In addition an index of natural amenities which uses six measures of climate, typography, and water area was included (McGranahan 1999). In this way the variables on weather and amenities enter specification much like a hedonic wage function. These variables measure possible lower wages attributed to areas with higher natural amenities.

Regional economic effects on SIC 24 wages were controlled for with dummy variables indicating the location within Oregon, Washington or California and whether county observations contained portions of Interstate 5 and metropolitan statistical areas. Regional economic characteristics were also accounted for, with measures of the county population density and mean wage across all industries. The mean wage was included to reflect patterns in local wage markets. By inclusion of an overall wage measure we assume that local wage markets are in equilibrium and will determine variations SIC 24 wages. For example, when overall wages are higher SIC 24 wages should also be higher. The effect of human capital on local wages was accounted for by including the share of the population over 25 years of age that have completed high school.

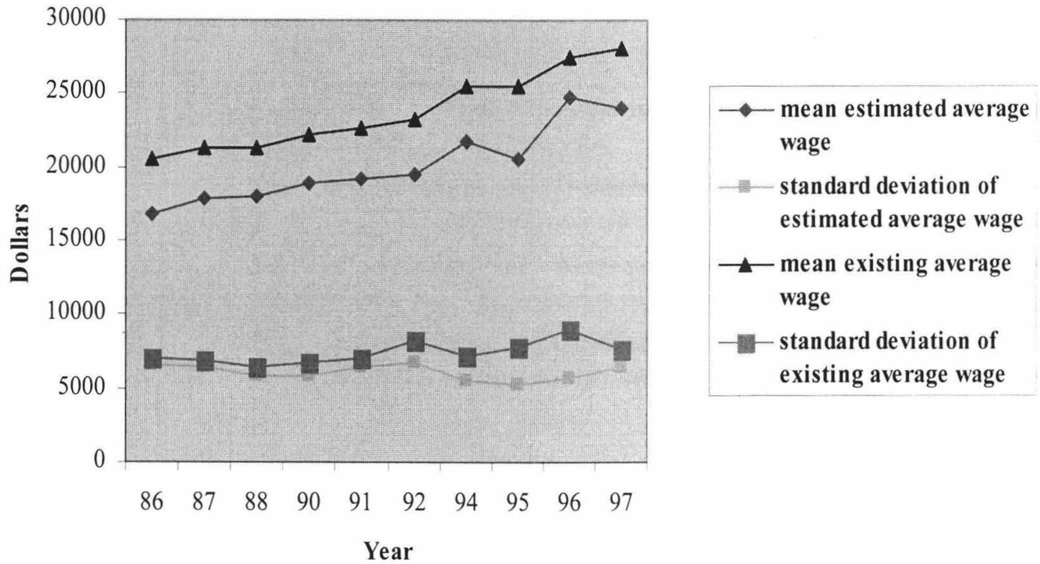
Characteristics of the landscape such as ownership and land quality were included in the SIC 24 average wage regression as well. Forest ownership variables included were the shares of county forest under federal, non-federal public (i.e. municipal or state) and private ownership. As the share of privately held forest and federal forest increase, SIC 24 wages should also increase for all years of estimation. The positive effects on wages are anticipated due to the preponderance of timber industry employment in those counties.

In order to capture the effects of SIC 24 employment due to land quality the Land Capability Class (LCC) shares and county mean elevation were included as explanatory variables. The LCC index is a rating that determines the suitability of land for agriculture. The areas of land in each of the eight LCC class were extracted from 1997 NRI database and then normalized by the acres of county non-federal land. Only the shares in classes II through VIII are included to avoid collinearity between class I and the intercept term. A variable measuring the range in elevation is also included. Counties with a lower mean elevation should have more timber related employment due to the predominance of higher quality timber in those counties. The elevation data was extracted from a global scale Digital Elevation Model in ArcGIS[25].

Once explanatory variables were obtained for the model describing average SIC 24 wage, separate OLS equations were run for each year of the ten year missing samples. R^2 values for these regressions ranged from 0.476 to 0.312. These coefficient values were then used to predict the average SIC 24 wage for the counties with missing observations. This methodology follows established methods of wage imputation using linear regression (Greenlees et al 1982, Skinner et al 2002). The mean and standard deviation of these estimates is compared to the known sample estimates in figure 5.

[25] The assistance of Scott Walker was greatly appreciated in the acquisition of this data

Figure 5: Comparison of estimated and existing data; average annual SIC 24 wage



Wh

ile the standard deviation of the estimated annual wage coincides with the true known sample, the estimated average wage is statistically different from the sample average wage for all years (at the 90% level of confidence). This can be attributed to characteristics of this sample which differ from the true sample. The missing values estimated were for counties with less than three wood products firms present. It can then be surmised that these counties exercise undue control over the local wage market and function as monopsony buyers of labor (Bhaskar 2002). In this fashion the local wage market for these counties might be consistently depressed. Both average SIC 24 wage trends reflect a decreasing demand for labor in 1995 characteristic of the decreasing overall wood product employment depicted in the figure 1 above.

The estimated wage values were then multiplied by the midpoint for the range of SIC 24 workers employed in that county. While specific payroll or employment data was not provided by the BLS, this range was reported. In addition, counties with no reported SIC 24 but without a range were distinguished as counties containing no wood products earnings. By incorporating this midpoint value, information about the number of employees enters into the desired total SIC 24 payroll estimate. Regression imputation was used to estimate 226 missing observations over the ten years estimated.

The yearly wood earnings variable *WOODEARN* was combined with the additional exogenous variables described above and the Hunt et al. model was run on a yearly basis from 1987 to 1999.

Results

The results of the exogeneity tests for the yearly regressions are provided in tables 4 and 5. Testing the NWFP policy variables for endogeneity without a correction for spatial autocorrelation yields significant results in two years. The null hypothesis of exogenously determined land share variables is rejected in the employment growth equation of 1992 and the net migration equation of 1998.

Table 4. Exogeneity test results without autocorrelation correction

Year	Variable Name	Net Migration Equation		Employment Growth Equation	
		Estimate	**t-statistic**	**Estimate**	**t-statistic**
1992					
	Error *RESERVED*	0.506	1.129	2.252**	1.663
	Error *UNRESERVED*	-0.383	-0.774	-2.217	-1.453
1993					
	Error *RESERVED*	0.331	1.471	4.530	0.363
	Error *UNRESERVED*	-0.011	-0.048	-12.499	-0.723
1994					
	Error *RESERVED*	0.367	1.590	1.527	0.393
	Error *UNRESERVED*	-0.154	-0.478	-4.152	-1.032
1995					
	Error *RESERVED*	-0.100	-0.331	-1.102	-0.376
	Error *UNRESERVED*	0.482	1.131	0.981	0.343
1996					
	Error *RESERVED*	-0.141	-0.508	-0.039	-0.022
	Error *UNRESERVED*	0.077	0.264	0.144	0.090

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level

Table 4. Exogeneity test results without autocorrelation correction (Continued)

1997					
	Error *RESERVED*	0.273	1.311	-2.634	-0.918
	Error *UNRESERVED*	-0.179	-0.623	1.192	0.437
1998					
	Error *RESERVED*	0.053***	2.310	2.529	0.720
	Error *UNRESERVED*	-0.607***	-2.083	-2.397	-0.734

The exogeneity test with corrections for spatial autocorrelation suggest both of the land share measures cannot be considered exogenous in the net migration equation in the years for 1994, 1997, and 1998. The *UNRESERVED* land share is not exogenous in the 1992 employment growth equation and both the *UNRESERVED* and *RESERVED* land shares in 1997 lack exogeneity.

Table 5. Exogeneity test results with spatial autocorrelation correction

Year	Variable Name	Net Migration Equation		Employment Growth Equation	
		Estimate	**t-statistic**	**Estimate**	**t-statistic**
1992					
	Error *RESERVED*	-0.006	-0.136	0.153	0.990
	Error *UNRESERVED*	-0.029	-0.526	-0.420***	-1.988
1993					
	Error *RESERVED*	0.026	0.742	-0.056	-0.162
	Error *UNRESERVED*	-0.020	-0.400	-0.296	-0.608
1994					
	Error *RESERVED*	0.065**	1.757	-0.058	-0.261
	Error *UNRESERVED*	-0.105***	-2.144	-0.261	-0.900
1995					
	Error *RESERVED*	-0.061	-1.116	0.148	0.637
	Error *UNRESERVED*	0.036	0.497	-0.201	-0.671
1996					
	Error *RESERVED*	0.020	0.478	0.242	1.215
	Error *UNRESERVED*	-0.075	-1.434	-0.119	-0.476
1997					
	Error *RESERVED*	0.120***	3.713	0.340**	1.674
	Error *UNRESERVED*	-0.145***	-3.329	-0.517***	-1.978
1998					
	Error *RESERVED*	0.076***	2.201	-0.060	-0.297
	Error *UNRESERVED*	-0.130***	-2.945	-0.070	-0.267

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level

The land share measures were consequently instrumented and total effects of consecutive years are compared in tables 6 and 7. Results are presented with and without corrections for spatial autocorrelation.

Table 6. Yearly regression results without correction for spatial autocorrelation

	Total Effect Variable	Net Migration Equation		Employment Growth Equation	
Year		Estimate	t-statistic	Estimate	t-statistic
88 - 87					
	USFS	-0.007	-0.598	-0.109**	-2.760
	BLM	-0.075**	-2.118	-0.236**	-1.993
89 - 88					
	USFS	-0.005	-0.283	0.235***	3.936
	BLM	0.031	0.557	-0.253	-1.417
90 - 89					
	USFS	0.028	1.013	-0.123	-1.785
	BLM	1.202***	3.206	0.527	0.627
91 - 90					
	USFS	-0.069**	-2.244	0.297	1.701
	BLM	0.061	1.691	-0.710**	-3.437
93 - 92					
	RESERVED	-0.078	-0.605	-0.485	-0.415
	UNRESERVED	0.076	0.523	-0.140	-0.105
94 - 93					
	RESERVED	-0.046	-1.539	-0.308**	-2.215
	UNRESERVED	0.071**	2.021	0.498**	3.020
95 - 94					
	RESERVED	0.110**	2.355	-0.081	-0.381
	UNRESERVED	-0.123**	-2.238	-0.044	-0.177
96 - 95					
	RESERVED	-0.017	-0.452	-0.372	-1.931
	UNRESERVED	0.037	0.831	0.438	1.914
97 - 96					
	RESERVED	-0.158***	-5.342	0.008	0.053
	UNRESERVED	0.156***	4.474	-0.022	-0.116
98 - 97					
	RESERVED	0.002	0.061	0.449**	2.028
	UNRESERVED	-0.007	-0.182	-0.492	-1.897
92 - 91					
	USFS	-0.463	-0.417	1.033	0.044
	BLM	-0.135	-0.107	1.560	0.064
92 - 91					
	RESERVED	0.110	1.080	-0.559**	-2.335
	UNRESERVED	-0.114	-0.936	1.337***	4.653

Note: *** indicates significance at the 1% level, ** indicates significance at the 5% level.

Table 7. Yearly regression results with correction for spatial autocorrelation

	Total Effect Variable Name	**Net Migration Equation**		**Employment Growth Equation**	
Year		Estimate	t-statistic	Estimate	t-statistic
88 - 87					
	USFS	0.004	0.415	-0.061	-1.528
	BLM	-0.056	-1.732	-0.196	-1.627
89 - 88					
	USFS	0.008	0.375	0.298***	4.269
	BLM	0.043	0.636	-0.210	-1.026
90 - 89					
	USFS	-0.038	-0.431	-0.223	-1.411
	BLM	-0.045	-0.154	0.121	0.237
91 - 90					
	USFS	0.029***	3.740	-0.117**	-2.581
	BLM	0.093***	3.654	0.212	1.473
93 - 92					
	RESERVED	-0.078	-0.605	-0.485	-0.415
	UNRESERVED	0.076	0.523	-0.140	-0.105
94 - 93					
	RESERVED	0.009	0.111	0.240	0.433
	UNRESERVED	0.043	0.471	0.112	0.173
95 - 94					
	RESERVED	0.150**	2.915	0.218	1.130
	UNRESERVED	-0.167**	-3.031	-0.536**	-2.424
96 - 95					
	RESERVED	0.056	0.308	0.083	0.114
	UNRESERVED	0.032	0.187	0.318	0.461
97 - 96					
	RESERVED	-0.238***	-7.864	-0.365**	-2.773
	UNRESERVED	0.169***	4.730	0.143	0.909
98 - 97					
	RESERVED	11.590	0.007	73.521	0.007
	UNRESERVED	-12.115	-0.007	-76.785	-0.007
92 - 91					
	USFS	-0.710	-0.032	2.033	0.038
	BLM	-1.301	-0.032	3.220	0.032
92 - 91					
	RESERVED	0.058	1.043	-0.445**	-2.747
	UNRESERVED	-0.096	-1.538	1.378***	7.786

Note: *** indicates significance at the 1% level, ** indicates significance at the 5% level.

The comparisons of the land share total effects presented above indicate a multitude of potential breaks. The yearly results which are not corrected for spatial autocorrelation depict a system wrought with variation in the effects of NWFP variables on the endogenous variables. Breaks are detected in almost every yearly comparison over the time periods analyzed. The cross county effects of changes in net migration and employment growth may portray greater changes in these results than can be actually attributed to changes from the policy variables of interest.

Correcting the yearly regressions for spatial autocorrelation yields more succinct breaks. The first break is evident in the comparison of 1989 and 1988 total effects. The difference between the 1989 USFS total effect on employment growth was significantly different from the 1988 value at the 99% level of confidence. This suggests the first period of analysis should be from 1980 to 1989.

The next break is apparent in the comparison of total effects between the 1991 total effect coefficients and the 1990 total effects. Both of the 1991 USFS and BLM total effects on net migration are significantly different from the 1990 values at the 99% level of confidence. The 1991 USFS total effect on employment growth is significantly different from the 1990 value at the 95% level of confidence. These breaks in total effects coefficient values suggest the second period of analysis will be from 1989 to 1991.

The next break was apparent after evaluating the yearly regressions between 1992 and 1991 (table 7). The 1992 total effects of the NWFP variables on employment growth were significantly different than the total effects of these coefficients in 1991. This suggests a possible break in 1992 making the third period of analysis 1991 to 1992.

A fourth break in successive NWFP total effects values is apparent in the 1995 to 1994 comparison suggesting a sustained period of coefficient values between 1992 and 1995.

Both of the NWFP variables had significantly different net migration total effects than in 1994. The 1995 value of the *UNRESERVED* NWFP total effect on employment growth was significantly different than the 1994 value at the 95% level of confidence.

A fifth period of analysis emerges in the comparison of total effects in the yearly regressions for 1997 and 1996. *RESERVED* and *UNRESERVED* total effects on net migration are significantly different from the prior period values at the 95% level of confidence. The 1997 Reserve land total effect on employment growth is significantly different from the value in 1996. These combined results suggest a period of sustained total effects over the period from 1995 to 1997.

Yearly regressions were performed for one more subsequent pair of years between 1997 and 1998. The results corrected for spatial autocorrelation yield no apparent change in total effects. This implies the sixth period of analysis is from 1997 to 2003, the final year of available data.

Analyzing pairwise t-tests of total effects over successive years ignores a priori assumptions about policy relevant time periods. These results suggest six periods over which federal land use determined employment growth and net migration in consistent manner. These periods are; 1980 to 1989, 1989 to 1991, 1991 to 1992, 1992 to 1995, 1995 to 1997, and 1997 to 2003.

Discussion

Results indicate exogeneity of the land share measures cannot be assumed for the employment growth equation in 1992 and 1997 and in the net migration equation for 1994, 1997 and 1998.

As might be expected the land allocation decision was determined by factors that contributed to both employment growth and the NWFP land share determination in

1992 and 1994. Section 4(b)(2) of the ESA mandates that critical habitat designation requires consideration of economic impacts. FEMAT may have used similar county level economic information as the instruments used here in their land allocation decision.

While endogenous land share measures in 1992 and 1994 might be expected given the time period over which the land allocation decision was made, it may appear somewhat peculiar to find such a result in 1997 and 1998.

Unobservable factors could exist that influence both the NWFP land shares and employment growth or net migration (the endogenous variables). These factors could be one of the instruments used in the formation of the instrumental variables or other characteristics of forests within a county. In this case correlation between the endogenous variables and the NWFP land shares might occur. This correlation might then be attributed entirely as an underlying effect of NWFP on the endogenous variables. However the correlation is partially due to the mutual dependence of NWFP and the endogenous variables on the forest characteristic. Since county forest characteristics and many of the instruments used change slowly relative to the time period of this analysis, it is plausible that the unobservable factors are correlated with the error in the later years of 1997 and 1998.

Instrumentalizing the land share measures and running the yearly regressions yields 5 breaks which imply six periods of analysis; 1980 to 1989, 1989 to 1991, 1991 to 1992, 1992 to 1995, 1995 to 1997, and 1997 to 2003. These breaks in total effects can be attributed to events in a larger market and policy context.

The first break can be explained by the timber harvest injunction issued in 1989, by Federal District Court Judge Dwyer on timber sales on BLM land near owl sites. He cited the lack of owl protection as violations of the National Forest Management Act

(NFMA) and the National Environmental Policy Act (NEPA) (Marcot and Thomas, 1997).

In May of 1991 Judge Dwyer ruled that the Forest Service had violated the EIS requirement of NEPA (Caldwell et al. 1994). A second timber harvest injunction was enacted which had more of a regional impact halting timber sales on 17 National Forests in Oregon, Washington, and Northern California (Marcot and Thomas, 1997). This second injunction marks the period from 1989 to 1991.

In May of 1992 Dwyer ruled that the Forest Service EIS violated NEPA by "failing to consider new information on the environmental effects of logging on Spotted owl habitat and … not prescribing measures to protect critical habitat or assess the viability of other species associated with old-growth forests and Northern spotted owl habitat" (Marcot and Thomas, 1997). The Forest Service formed the Scientific Analysis Team (SAT) in response to Judge Dwyer's ruling. SAT's 1993 report recommended management changes to accommodate 667 species associated with old-growth forests and "was a significant step toward a broader ecological basis for evaluating ecosystems" (Marcot and Thomas, 1997). This paradigm shift in approach to management defines the third period of analysis from 1991 to 1992.

In 1994 a ROD was issued identifying a slightly modified Option 9 as the Northwest Forest Plan. On December 21st 1994 Judge Dwyer ruled that the NWFP was consistent with the viability regulation of the NFMA. By 1995 the outcome of the policy situation in the Pacific Northwest was known. This consequently characterizes the period from 1992 to 1995.

The final period of analysis is defined by a break in 1997. This break can be explained by changes in the Pacific Northwest log export market. In May of 1996, the Canadian Softwood Lumber Agreement (SLA) was enacted whereby a limited number of producers from Canada could export only a limited amount of lumber into the US without export fees. While this act provided protection for some US lumber producers it had unintended consequences for the US market share abroad. The SLA forced Canadian producers to sell their excess lumber and wood products supply at lower prices to the Pacific Rim. Higher US prices shifted foreign markets to other supply regions and forced Pacific Northwest lumber producers in US markets traditionally served by the lower cost Southern US. Thus the SLA may have contributed to the loss of exports in the Northwest to the Southern US (Daniels, 2005). In addition the Asian economic crisis began in 1997. This translated into a direct impact on Japan's imports of Pacific Northwest logs. Mill and timber owners in the Pacific Northwest were severely impacted by the collapse as they were forced to adjust to the oversupply of wood rerouted to the US market (Daniels, 2005). These events together may have contributed to the break seen in 1997.

Conclusion

While the events described above may have affected the relationship between land use variables and employment growth or net migration it is uncertain whether this methodology accurately captures these breaks. A single change in the land use variables as a result of a single policy or market event could be attributed to several breaks. For example a break might depict an initial reaction to a market event and then a prolonged or sudden adjustment could translate into a second break. Therefore it is difficult to categorize which breaks correspond to events or their subsequent adjustments. Thereby the total effect of a policy response may not be measured.

In addition, the duration of the yearly general models and the subsequent time periods that emerge, are possibly too short to be characterized by the simultaneous system of equations defined here. The endogenous variables in the yearly models may lack sufficient variation for characterization with regression techniques.

In light of these observations the yearly break analysis might seem inapplicable. However it has enabled a thorough examination of the policy events which led to the NWFP and establishes the era as a tumultuous period where differences in the relevant policy variables were numerous.

Chapter 4: Examination of Policy Relevant Time Periods

Introduction

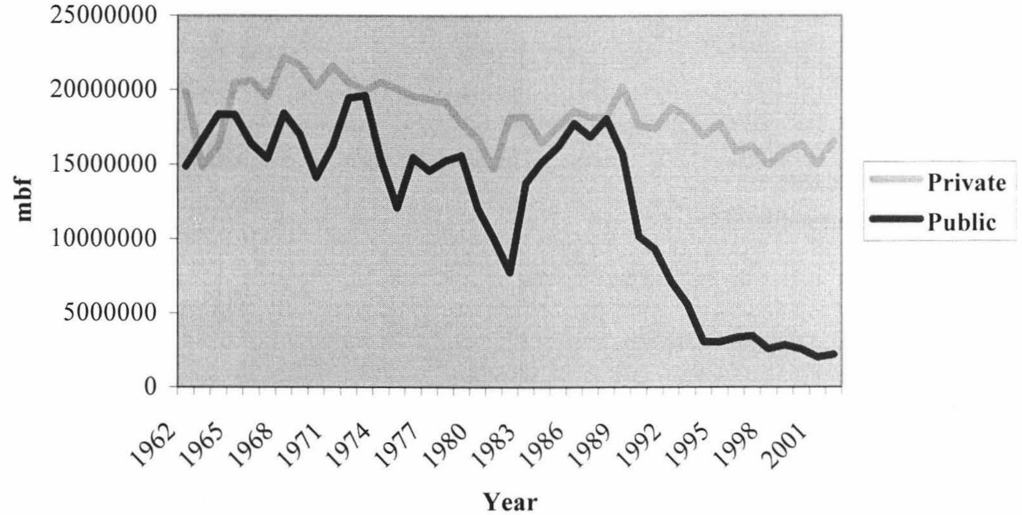
Given the policy relevance of this NWFP analysis, many of the events discussed in the previous chapter can be grouped into related time periods that categorize the nature of the policy environment. The a priori designation of time periods, over which to estimate the general model, is thus appropriate if explanation of variation over a policy relevant time period is desired. Given a comprehensive assessment of the events that preceded enactment of the NWFP, four time periods can be identified: 1980 to 1990, 1990 to 1992, 1992 to 1994 and 1994 to 2003. This Chapter focuses on these four time periods and an alternative specification for the period from 1990 to 1992. This alternate specification may characterize the rational expectations of decision makers about future amenity levels and harvests on public lands.

Background

1980-1990

1980 to1990 was a period of increasing timber harvest (see figure 6 and figure 2 above) and litigation. The northern spotted owl was considered for ESA status by the Fish and Wildlife Service in 1981 but concluded that listing was not necessary (Noon and McKelvey 1996). In 1985 concern began to mount after a team of scientist designated by the National Audubon Society concluded that the owl was headed toward ESA listing. Meanwhile timber harvests on federal lands continued to rise (see figure 6). In 1987 the ESA status was reviewed again but the FWS concluded that listing of the owl was again not warranted. This decision was appealed and in 1988 the Federal District Court ruled that the FWS decision to not list the owl was "arbitrary and capricious" (Noon and McKelvey, 1996). Then in 1989 Judge Dwyer issued an injunction against timber sales on BLM land near owl sites. He cited the lack of owl protection as violations of NFMA and NEPA (Marcot and Thomas, 1997).

Figure 6: Private and Public Harvests in Oregon and Washington



Source: Washington Department of Natural Resources; Oregon Department of Forestry

1990-1992

1990 to 1992 characterizes a period of uncertainty about the future of timber harvest in the Pacific Northwest. In June of 1990 the Northern spotted owl was officially listed under the ESA and timber harvests on federal lands had started to decrease. In response to Dwyer's injunction Congress established the Interagency Scientific Committee (ISC) which was charged with the development of a long term conservation strategy for the Northern spotted owl on public lands (Noon et al. 1996). The ISC reported to Congress in 1990 and recommended a network of Habitat Conservation Areas (HCA) managed to protect owl habitat amongst a forest matrix managed for a broad array of resources (Wood 1991). The HCA's covered approximately 7.7 million acres, but over half of this area was already reserved in wilderness, national parks, and other administratively withdrawn areas (Thomas et al., 1990).

The USFS then declared that it would operate in a manner "not inconsistent with" the ISC conservation strategy and was consequently sued by the Audubon Society charging that their decision did not comply with NEPA, ESA, or NFMA. In May of 1991 Judge Dwyer ruled that the Forest Service had violated the EIS requirement of NEPA (Caldwell et al. 1994). A second timber harvest injunction was instated which had more of a regional impact barring timber sales on 17 National Forests in Oregon, Washington, and northern California (Marcot and Thomas, 1997). Dwyer's decision required USDA to adopt a conservation plan in compliance with ESA and NFMA to ensure owl survival before selling additional timber (Daniels, 2005).

1992-1994

In response to Dwyer's 1991 decision the House of Representatives chartered a group of four experts called the "scientific Panel on Late-Successional Forest Ecosystems" to report on conditions and management of LSOG forests on Federal land of the Northwest within the range of spotted owl. The charter directed the "Gang of Four" to assess the viability of all vertebrate species associated with late-successional forests, at risk fish stocks, and the integrity of late successional forest ecosystems within the owl's range.

In October of 1991 the Gang of Four report was issued showing that while the ISC strategy might protect the owl it would not protect other species related to late-successional forests. The "Gang of Four's" report concluded that the best way to ensure long-term persistence of viable old growth ecosystems, and their component species, was to establish LSOG reserves. They also concluded that no alternative existed for abundant timber harvests and high levels of habitat protections for associated species (Caldwell et al. 1994).

Their report presented 14 management alternatives that ranged from the existing national forest and BLM plans to extensive protection of all remaining LSOG forests, owl habitat, and key watersheds. Most alternatives also had three variations that specified levels of retention of old-forest habitat patches and components to be provided on general-management "matrix" lands in between the LSOG reserves, owl addition areas and key watersheds (Marcot and Thomas, 1997). This effort required information from several hundred experts to map LSOG reserves, owl addition areas, matrix lands, and key watersheds. Therefore it can be considered the first time land classifications for the purpose of biodiversity conservation were considered.

While none of these alternatives made it to congressional vote or legislation, this marked a major turning point for planning efforts within the region by expanding the officially recognized scope of the issue beyond spotted owls to include viability of associated species and the integrity of the LSOG forest ecosystem. In May of 1992 Dwyer ruled that the Forest Service EIS (based in the ISC recommendations) violated NEPA by "failing to consider new information on the environmental effects of logging on Spotted owl habitat and ... not prescribing measures to protect critical habitat or assess the viability of other species associated with old-growth forests and Northern spotted owl habitat" (Marcot and Thomas, 1997). By the time the forest service formed the Scientific Analysis Team (SAT) in response to Judge Dwyer's ruling. SAT's 1993 report recommended management changes to accommodate some 667 species associated with old-growth forests and "was a significant step toward a broader ecological basis for evaluating ecosystems" (Marcot and Thomas, 1997).

In April 1993 President Clinton convened the Forest Conference in Portland, Oregon where he charged FEMAT to develop options for the PNW forests within the range of the owl (Marcot and Thomas, 1997). In 90 days the team produced a thousand page report that covered ten options and soon after the Forest Service produced a new EIS which identified Option 9 as the President's preferred alternative. By 1994 the outcome of the policy situation in the Pacific Northwest was known which characterizes the period from 1992 to 1994.

1994-2003

In 1994 a ROD was issued identifying a modified Option 9 as the Northwest Forest Plan. Seattle Audubon Society then challenged the NWFP's adequacy for conservation of spotted owl and other late-successional forest species. On December 21st, 1994 Judge Dwyer ruled that the NWFP was consistent with the viability regulation of the NFMA. This decision "marked the first time for several years that owl habitats were to be managed by FS and BLM under a common ecosystem management plan found lawful by the courts" (Marcot and Thomas, 1997). The final time period from 1994 to 2003 then characterizes the post NWFP enactment period within which full adjustment of the region's economy to the NWFP may have occurred (Niemi, et al. 1999).

Methods

Using the data described in chapter one (see Appendix A for variable names and definition) the simultaneous equation model (SEM) was constructed for the four periods of analysis.

For the first period of analysis from 1980 to 1990, changes in employment growth and net migration are characterized by the general model:

$$(1) \quad \begin{aligned} EG_{j,s-t} &= f_1(NM_{j,s-t}, \text{PUBLICLAND}_{j,t}, \mathbf{X}_{jt} \mid \boldsymbol{\alpha}_t) + \varepsilon_{j,s-t} \\ NM_{j,s-t} &= f_2(EG_{j,s-t}, \text{PUBLICLAND}_{j,t}, \mathbf{Y}_{jt} \mid \boldsymbol{\beta}_t) + \lambda_{j,s-t} \end{aligned}$$

where the endogenous variables, $EG_{j,\,s-t}$ and $NM_{j,\,s-t}$ are the employment growth and net migration rate, in the j^{th} county where j=1,2,..., 73. The time periods over which the endogenous variables are defined are s=1980 and t=1990. $\text{PUBLICLAND}_{j,t}$ is a vector of variables describing public land management in the j^{th} county and the t^{th} time period which include the county share of land in BLM_j and $USFS_j$. $X_{j,t}$ and Y_{jt} are vectors of exogenous variables, α_t and β_t are vectors of time-period specific parameters, and $\varepsilon_{j,s-t}$ and $\lambda_{j,s-t}$ are disturbance terms.

As noted above, the time from 1990 to 1992 characterizes a period of uncertainty about future harvest levels and natural amenity levels in the NWFP region. While the land allocation variables function as a good proxy for harvests and amenities they cannot be justifiably used during this period. The nature of future policy management was largely unknown and the traditional single species paradigm of forest management was being challenged. While endogenous land share measures may exist over this period any use of instrumental variables still reflect variation in the NWFP land shares. Therefore variables established in Chapter 1 as determinants of the NWFP land shares enter specification directly along with the share of county land in BLM and USFS. These variables would have accurately portrayed levels of future harvests and natural amenities assuming economic agents were rational and had perfect information.

The period from 1990 to 1992 is thus described by:

$$\begin{aligned} EG_{j,s-t} &= f_1(NM_{j,s-t}, \text{PUBLICLAND}_{j,t}, \mathbf{X}_{jt} \mid \boldsymbol{\alpha}_t, A_{jt}) + \varepsilon_{j,s-t} \\ NM_{j,s-t} &= f_2(EG_{j,s-t}, \text{PUBLICLAND}_{j,t}, \mathbf{Y}_{jt} \mid \boldsymbol{\beta}_t, B_{jt}) + \lambda_{j,s-t} \end{aligned} \tag{13}$$

Where A_{jt} and B_{jt} are vectors of variables that describe potential future harvests and natural amenity levels on federal lands in the j^{th} county and the t^{th} time period.

In the employment growth equation, variables in A_{jt} are included that account for future economic conditions which would be used by rational economic agents to anticipate policy efforts focused on minimizing adverse effects from timber related job losses. Median household income in 1993 is included to account for the degree to which county affluence could influence anticipated future employment under a future policy regime. In addition, timber payments per capita for 1992 are included to demonstrate how current county assistance from federal payments could be a determining factor in determining future harvest allocations across federal land. Public harvest in 1993 as a share of total harvest represents the degree to which anticipated future federal and state harvests determined current employment growth.

Political variables measure the degree to which current political affiliations might affect employment growth because of anticipated future policy decisions on harvests or amenity levels. A dummy variable indicating counties in congressional districts with republican representatives and the portion of major party voters[26] who voted for Bush in the 1992 election were included. In addition, the county voting score for the House member representing each county was included from the LCV for 1993 in order to account for anticipated conservation legislation on federal land.

Ecological variables were included in the employment growth equation to measure anticipated future employment from amenity levels and future harvests. A dummy variable indicating whether the center of a designated roadless area fell within that county indicated whether large tracts of land were excluded from harvests. In addition the county share of land in LSOG measures the degree to which anticipated future reservation of ecologically important forests could effect current employment growth.

Over the 1990 to 1992 period economic variables were included in the net migration equation in order to account for anticipated future policy actions and economic conditions that would determine migration via potential employment prospects. In addition to the economic variables, public harvest in 1993 and timber payments in 1992, wood earnings in 1993 were also included. This measure of county employment concentration in the wood products industry accounts for additional employment opportunities that might be anticipated by migrants.

Political variables were also included in the 1990 to 1992 net migration equation to explain the potential future harvests and amenity levels determined by county political affiliations. The variables percent voting for Bush senior, LCV score in 1993, and the House representation, would feasible enter migrants decision making framework regarding future harvests and amenity levels within a county. Similarly ecological variables such as designated roadless areas and the county share of LSOG are included

[26] This variable provides a refined measure of local political preference by excluding votes for third party candidates (i.e. Ross Perot) identical to that used in the analysis of Chapter 1.

to measure the degree to which migration is affected by associated amenities and/or future employment opportunities stemming from available timber for harvest.

For the 1992 to 1994 time period the NWFP land shares first enter specification. As discussed above, the policy environment underwent a transformation between 1990 and 1994 which can be attributed to legislation during that time period and reports issued in 1992. The "Gang of Four" and the ISC both released reports expounding the importance of an ecosystem based approach to managing late successional ecosystems. The "Gang of Four" report used landscape level measures of land allocations such as 'matrix and 'LSOG reserves' in order to support these goals (Marcot and Thomas, 1997). Therefore specification of the general model (1) justifiably includes the NWFP $RESERVED_{jt}$ and $UNRESERVED_{jt}$ land share measures in place of the BLM_{jt} and $USFS_{jt}$ variables. Where $RESERVED_{jt}$ is the proportion of land in the j^{th} county allocated to biodiversity services and $UNRESERVED_{jt}$ is the proportion of land allocated to matrix and adaptive management in the j^{th} county. The final time period from 1994 to 2003 is similarly specified and characterizes post NWFP enactment, during which economic agents may have made complete adjustments to policy enactment.

The NWFP land shares are tested for exogeneity in the periods in which they enter specification; 1992-1994 and 1994 to 2004. Instrumental variables are created from three combinations of instruments and are then used to test for endogeneity using the Geroski method described in Chapter Three.

Good instrumental variables are not exclusively generated by groups of variables that provide good fit in *RESERVED* and UNRSERVED regressions presented in Chapter Two (Table 3). Variables that are not determined by the same process as employment growth and net migration are necessary. It can be assumed that the economic instruments are generated by similar underlying processes as the endogenous variables in the simultaneous equation model. Political variables are also potentially driven by the same underlying process as net migration and employment growth. However it can be reasonably assumed that the ecological variables are not generated by the same underlying process that determine net migration and employment growth. These variables are therefore the most justifiable variables to be used when forming the projection of the NWFP land allocations to be used as instrumental variables in any test for exogeneity. However tests performed with these alternate instruments indicate exogeneity of the NWFP land share measures regardless of the form of the instrumental variables used. Results here are reported using the instrumental variables formed from the full set of economic, political and ecological instruments.

A linear relationship between employment growth and net migration and the exogenous variables are assumed in all time periods. The four systems of linear equations are then estimated with three-stage least squares. As discussed in the introduction modeling within-county effects of the exogenous variables are subject to spatial autocorrelation through cross-county effects on employment growth and net migration. To test for spatial autocorrelation the Moran *I* statistic is used with the second-stage residuals. Rejection of the null of no spatial autocorrelation in the final period from 1994 to 2003 is then corrected using the procedure presented in Dubin (1998) and Kelejian and Prucha (2004). For comparison results are presented with and without the correction.

Results

The exogeneity test results indicate that the land share measures in the last two periods of analysis are exogenously determined based on economic, ecological and political variables. Therefore the land share measures *RESERVED* and *UNRESERVED* were not instrumented.

Table 8. Exogeneity test results without spatial autocorrelation correction

Period	Variable Name	Net Migration Equation		Employment Growth Equation	
		Estimate	t-statistic	Estimate	t-statistic
1992 to 1994					
	Error *RESERVED*	1.244	1.021	1.615	0.578
	Error *UNRESERVED*	-0.975	-0.822	0.295	0.081
1994 to 2003					
	Error *RESERVED*	-1.046	-0.835	-0.526	-0.192
	Error *UNRESERVED*	1.257	0.871	-0.069	-0.023

Note: *** indicates significance at the 5% level and ** indicates significance at the 15% level

Table 9. Exogeneity test results with spatial autocorrelation correction

Period	Variable Name	Net Migration Equation		Employment Growth Equation	
		Estimate	t-statistic	Estimate	t-statistic
1992 to 1994					
	Error *RESERVED*	-18.559	-0.029	-0.109	-0.393
	Error *UNRESERVED*	0.027	0.317	0.141	0.371
1994 to 2003					
	Error *RESERVED*	-0.017	-0.086	-0.044	-0.087
	Error *UNRESERVED*	-0.158	-0.709	-0.765	-1.176

Note: *** indicates significance at the 5% level and ** indicates significance at the 15% level

1980-1990

The 3SLS results for the 1980-1990 period are found in table 10. The explanatory variables explain 82.8% of the variation in net migration indicating the explanatory power of the equation is high. Employment growth is a significant and positive determinant of net migration as expected. Net migration is significantly and positively associated with per capita federal expenditures (FEDEXP), homeownership (OWNHOME), crime rate (CRIME), and January temperature (JANTEMP). The results also indicate that net migration is negatively and significantly related to Washington, household income (INCOME), and humidity in July (JULYHUMID). These results suggest that government spending, community stability through home ownership and higher winter temperatures attract migrants. In contrast, factors that deter migration were location within Washington State, higher income counties possibly put upward pressure on housing prices and humidity during the summer. The significant and positive coefficient on crime was not anticipated and may be driven factors similar to net migration and outside this model.

The employment growth equation also has high explanatory power over this period with an R-squared value of 0.751. Net migration is a positive and significant determinant of employment growth along with counties containing metropolitan statistical areas (*METRO*), educational expenditures (*EDUCEXP*), road density (*ROADDEN*), and college graduation (*COGRAD*). Employment growth is negatively associated with per capita federal expenditures at the 5% level of confidence. These results suggest that counties with agglomeration economies, ease of access and education encourage employment growth. The sign of federal expenditures is not expected since an increase in expenditures increases income and should increase employment.

The results for the 1980 to 1990 period indicate that classification of land in wilderness (*WILD*), state forest (*STFOR*), Forest Service (*NATFOR*), and BLM (*BLM*) do not have significant effects on either employment growth or net migration. However, the parameter estimate for *NATPARK* is negative and significant in the employment growth equation and positive and significant in the net migration equation. The measure of NATPARK used here is the amount of non-wilderness national park in that county. This amounts to land in only one Oregon county (Klamath County) and three in northern California over the entire NWFP area and therefore does not necessarily measure effects from non-wilderness national park and could instead measure other factors related to these four counties.

Table 10. Three Stage Least Squares parameter estimates for employment growth and net migration, 1980-1990

	Net Migration		**Employment Growth**	
	Parameter	**T-statistic**	**Parameter**	**T-statistic**
Constant	-0.353**	-1.706	-0.998**	-1.723
NM			1.402***	3.444
EG	0.392***	10.819		
OREGON	-0.065	-1.566	-0.064	-0.431
WASHINGTON	-0.080**	-1.751	0.070	0.528
INTER5	0.002	0.151	0.023	0.508
METRO	-0.020	-1.056	0.104***	2.112
INCOME	-0.000001***	-2.965		
HEALTHEXP	0.133	1.518		2.157
EDUCEXP	-0.176	-1.599	0.632***	2.157
FEDEXP	0.012***	2.734	-0.036***	-2.967
POPDEN	0.026	0.477		
EXPTAX	-0.007	-0.970		
OWNHOME	0.008***	5.032		
ROADDEN	-36.492	-0.300	724.122***	2.082
CRIME	0.0001***	1.961		
HSGRAD			0.007	1.307
COGRAD			0.016***	4.258
WOODEARN			0.037	0.336
DIVIDEND			0.235	0.384
EMPDEN			-0.433	-1.510
UNEMPLOY			0.005	0.546
JANTEMP	0.0031**	1.791	-0.002	-0.442
JANSUN	-0.0004	-1.156	0.001	0.834
JULYTEMP	-0.001	-0.528	0.002	0.433
JULYHUMID	-0.001**	-1.779	0.000	-0.171
JANRAIN	0.0008	0.320	-0.003	-0.504

Note: *** indicates significance at the 5% level, ** indicates significance at the 10% level

Table 10. Three Stage Least Squares parameter estimates for employment growth and net migration, 1980-1990 (Continued)

	Net Migration		Employment Growth	
	Parameter	T-statistic	Parameter	T-statistic
BIGMETRO	0.044	1.547	-0.084	-1.055
COAST	-0.0001	-0.005	0.040	0.675
WILD	0.020	0.322	0.154	0.805
STFOR	0.062	0.851	0.033	0.158
NATFOR	-0.060	-1.295	0.080	0.612
BLM	-0.139	-0.991	0.157	0.394
NATPARK	3.050***	3.330	-6.926***	-2.751
Mean (S.D) of Dependent Variable	0.078 (0.117)		0.289 (0.272)	
R-Squared	0.828		0.751	

Note: *** indicates significance at the 5% level, ** indicates significance at the 10% level

1990-1992

The results for the 3SLS results are found in table 11. The explanatory power of the net migration equation is high with an R-squared value of 0.732. As expected employment growth is a significant and positive determinant of net migration. METRO, federal expenditures on health (HEALTHEXP), EDUCEXP, OWNHOME, and JANTEMP are significant and positive determinants of net migration. FEDEXP is a negative determinant of net migration and statistically different from zero. This suggests metropolitan counties and warmer winters attract migrants in addition to more stable communities from federal expenditures on social services and home ownership. The negative sign on FEDEXP might seem contrary to expectations however counties with more displaced mill workers, and thus higher per capita federal expenditures, may have had significant out-migration.

The R-squared value for the employment growth equation over this period indicates the regressors explain 80% of the variation in employment growth. The coefficient value

on net migration is positive and significant as expected indicating EG and NM are simultaneously determined. Employment growth is positively associated with FEDEXP while METRO, EDUCEXP, employment density (EMPDEN), JANTEMP, and coastal counties (COAST) are negative.
This suggests per capita federal expenditures may have been an effective way to retain displaced workers while the variables having negative effects on employment growth may be indicative of regional trends associated with changes in employment growth. The METRO variable does not indicate larger metropolitan areas such as Seattle or Portland therefore the negative signs on the coastal dummy variable and the metropolitan area dummy are conceivable measuring losses in employment in areas more dependent on the timber industry.

Over the 1990 to 1992 period several of the land management variables are statistically different from zero. In the net migration equation the share of county land in wilderness (WILD) is negative while NATPARK and the share of land in National Forest (NATFOR) were positive and statistically significant. In the employment growth equation WILD is positive and NATFOR is negative and statistically different from zero.

Inclusion of variables measuring the rational expectation of future harvest and amenity levels yield several statistically significant variables. Per capita timber payments (TIMBERPAY) are positive and significant from zero in the net migration equation and negative and significant in the employment growth equation indicating county payments in 1992 encouraged migration and discouraged employment growth. Rational agents may have anticipated higher amenity levels in areas with more timber payments since payments are tax reimbursements for timber that would otherwise have been harvested. Those counties with higher payments may have also been more susceptible to harvest injunctions during this period making TIMBERPAY negative in the employment growth equation. The percent of major party voters who voted for

Bush senior (BUSHVOTE) and the county share in LSOG (LSOGSHARE) are negatively associated with net migration and positively associated with employment growth. The BUSHVOTE variable may indicate a socio-demographic group more supportive of the timber industry which in this time would have discouraging amenity-seeking migrants and encouraged timber related employment; in effect opting for more harvest at the expense of forest related amenities.

Table 11. Three Stage Least Squares parameter estimates for employment growth and net migration, 1990-1992

	Net Migration		**Employment Growth**	
	Parameter	**T-statistic**	**Parameter**	**T-statistic**
Constant	-0.196***	-2.139	-0.044	-0.155
NM			0.837**	1.848
EG	0.315***	4.404		
OREGON	-0.007	-0.422	0.037	0.773
WASHINGTON	0.016	0.909	-0.002	-0.033
INTER5	0.007	1.131	-0.021	-1.391
METRO	0.024***	3.387	-0.038***	-2.133
INCOME	0.000	-0.730		
HEALTHEXP	0.060***	1.991		
EDUCEXP	0.093***	2.501	-0.205***	-2.500
FEDEXP	-0.004***	-1.897	0.010***	2.062
POPDEN	0.017	0.874		
EXPTAX	-0.001	-0.551		
OWNHOME	0.003***	4.314		
ROADDEN	14.312	0.310	57.891	0.520
CRIME	0.000	0.533		
HSGRAD			0.001	0.693

Note: *** indicates significance at the 5% level, ** indicates significance at the 10% level

Table 11. Three Stage Least Squares parameter estimates for employment growth and net migration, 1990-1992 (Continued)

	Net Migration		**Employment Growth**	
	Parameter	**T-statistic**	**Parameter**	**T-statistic**
COGRAD			0.002	1.265
WOODEARN			-0.036	-0.698
DIVIDEND			0.206	1.100
EMPDEN			-0.187***	-2.047
UNEMPLOY			0.002	0.570
JANTEMP	0.002***	3.248	-0.004***	-2.295
JANSUN	0.000	-0.326	0.000	0.610
JULYTEMP	-0.001	-0.741	0.001	0.231
JULYHUMID	0.000	-0.272	0.000	-0.385
JANRAIN	-0.001	-1.386	0.003	1.212
BIGMETRO	-0.015	-1.533	0.049	1.961
COAST	-0.005	-0.585	-0.014***	-0.631
WILD	-0.044**	-1.730	0.142***	2.283
STFOR	0.028	1.092	-0.028	-0.410
NATPARK	1.411***	4.117	-1.175	-1.059
NATFOR	0.097***	3.712	-0.260***	-4.047
BLM	-0.003	-0.048	0.115	0.757
1993 INCOME			0.000	0.237
PUBLICHARV	0.021	0.977	-0.032	-0.032
1993 WOODEARN	0.000	0.026		
TIMBERPAY	0.000***	2.097	0.000***	-4.266
BUSHVOTE	-0.001***	-3.331	0.001**	1.795
LCV	0.000	-0.667	0.000	0.117
GOPREP	-0.025	-1.442	0.031	0.629
ROADLESS	0.008	0.798	-0.032	-1.336
LSOGSHARE	-0.736**	-1.880	2.477***	2.535
Mean (S.D) of Dependent Variable	0.029 (0.025)		0.042 (0.079)	
R-Squared	0.732		0.797	

Note: *** indicates significance at the 5% level, ** indicates significance at the 10% level

1992–1994

The 3SLS results for the 1992-1994 period are depicted in Table 12. The explanatory power of the net migration equation is still relatively high, with an R^2 of 0.736. As in the earlier period, net migration is positive and dependent on employment growth. The Oregon and Washington dummy variables are positive while COAST is negatively associated with net migration indicating the importance of regional patterns in migration over this time period.

The explanatory variables explain 59% of the variation in the employment growth over the 1992 to 1994. Net migration is positive and significant indicating the simultaneous equation model is appropriate over this period. In addition the share of adults over age 25 (COGRAD) is positive and significantly different from zero along with the county unemployment rate (UNEMPLOY). Counties containing interstate 5 (INTER5), the share of county employment in wood products employment (WOODEARN), and JANRAIN are negatively related to employment growth.

Over this time period the land management variables include the county share of land reserved for *RESERVED* and *UNRESERVED* uses. These coefficient values in the structural equations are not statistically different from zero at the 10% level of confidence however *RESERVED* land is marginally significant and positive at the 13% level of confidence in the employment growth equation. The share of county land in state land (STATE) is positively associated with employment growth indicating a possible substitution from federal timber to state owned timber.

Table 12. Three Stage Least Squares parameter estimates for employment growth and net migration, 1992-1994

	Net Migration		**Employment Growth**	
	Parameter	**T-statistic**	**Parameter**	**T-statistic**
Constant	-0.235***	-3.407	-0.307	-0.733
NM			1.671***	2.143
EG	0.162***	3.987		
OREGON	0.038***	3.459	0.100	1.295
WASHINGTON	0.049***	4.003	0.047	0.561
INTER5	0.001	0.209	-0.054***	-2.173
METRO	0.006	0.952	0.039	1.519
INCOME	0.000	-0.171		
HEALTHEXP	0.009	0.305		
EDUCEXP	0.005	0.187	-0.077	-0.679
FEDEXP	-0.001	-1.465	-0.001	-0.203
POPDEN	-0.007	-0.397		
EXPTAX	0.001	0.395		
OWNHOME	0.002	4.420		
ROADDEN	-28.372	-0.650	123.403	0.732
CRIME	0.000	1.171		
HSGRAD			0.003	0.916
COGRAD			0.005**	1.696
WOODEARN			-0.187***	-2.242
DIVIDEND			0.150	0.619
EMPDEN			-0.045	-0.394
UNEMPLOY			0.021***	3.165
JANTEMP	0.001	1.484	0.000	0.148
JANSUN	0.000	1.534	0.001	0.914
JULYTEMP	0.000	0.311	-0.003	-1.145
JULYHUMID	0.000	0.809	0.000	-0.106
JANRAIN	0.001	0.804	-0.006**	-1.815
BIGMETRO	-0.004	-0.467	-0.002	-0.064
COAST	-0.012**	-1.700	-0.037	-1.004

Note: *** indicates significance at the 5% level, ** indicates significance at the 10% level

Table 12. Three Stage Least Squares parameter estimates for employment growth and net migration, 1992-1994 (Continued)

	Net Migration		**Employment Growth**	
	Parameter	**T-statistic**	**Parameter**	**T-statistic**
WILD	-0.005	-0.257	-0.059	-0.673
STFOR	-0.005	-0.178	0.227***	2.176
NATPARK	-0.032	-0.117	0.151	0.135
RESERVED	0.029	0.771	0.282	1.549
UNRESERVED	-0.041	-1.015	-0.159	-0.827
ADJNWFP	-0.003	-0.508	0.039	1.362
Mean (S.D) of Dependent Variable	0.025 (0.026)		0.063 (0.091)	
R-Squared	0.736		0.589	

Note: *** indicates significance at the 5% level, ** indicates significance at the 10% level

1994 –2003

Results unadjusted and adjusted for spatial autocorrelation are presented in tables 13 and 14 respectively. The R^2 for the unadjusted net migration and employment growth equations (0.48 and 0.54) fall well below the adjusted model (0.76 and 0.62). Employment growth is a positive and significant determinant of net migration in both the adjusted and the unadjusted models however the net migration coefficient is not a statistically significant determinant of employment growth in either model.

While the number of statistically significant coefficients values vary between the unadjusted and adjusted models it is apparent that adjusted model provides a more precise relationship between the exogenous variables and employment growth and net migration. Variables that are not significant in the adjusted model but are in the unadjusted model do not conform to expectations. This could indicate the correction for spatial autocorrelation more accurately characterizes the simultaneous equation model.

For the net migration equation Oregon, Washington, INCOME, OWNHOME, and JANSUN are positive and significant in both the adjusted and unadjusted net migration equations. In addition METRO, POPDEN, and JANTEMP are positive and significant in the adjusted equation. These results are consistent with expectations. Coefficient values negatively associated with net migration in both equations are FEDEXP, the ratio of federal expenditures to taxes (EXPTAX), ROADDEN, JULYTEMP and COAST. In the adjusted net migration equation EXPTAX is not statistically different from zero. As in the previous period, out-migration of mill workers associated with decreased employment in timber dependent counties may have been accompanied by higher per capita federal expenditures given the negative sign on FEDEXP.

The county share of residents with a high school education (HSGRAD), COGRAD, JULYTEMP, and JANRAIN encouraged employment growth in the unadjusted model however the weather variables were not significant determinants in the adjusted equation. The importance of education and as a determinant of employment growth conforms to expectations. While the share of county earnings from wood products (WOODEARN) is a negative and significant determinant of employment growth in both the adjusted and unadjusted equations, employment density (EMPDEN) is only significant in the unadjusted equation.

Results indicate that differences in county land management were not significant determinants of net migration in the unadjusted equation however land managed by the state (STATE) and counties adjacent to NWFP counties were positively associated with the adjusted net migration equation. The share of county land in wilderness (WILD) was a significant determinant of employment growth in only the adjusted equation.

Table 13. Three Stage Least Squares parameter estimates for employment growth and net migration, 1994-2003

	Net Migration		**Employment Growth**	
	Parameter	**T-statistic**	**Parameter**	**T-statistic**
Constant	0.058	0.179	-2.009***	-3.049
NM			0.574	1.381
EG	0.436***	4.439		
OREGON	0.120***	2.451	0.019	0.174
WASHINGTON	0.148***	2.591	0.014	0.118
INTER5	-0.030	-1.282	0.013	0.300
METRO	0.038	1.453	-0.048	-1.050
INCOME	0.000***	-2.271		
HEALTHEXP	-0.072	-0.722		
EDUCEXP	-0.170	-1.160	-0.191	-0.754
FEDEXP	-0.011**	-1.701	-0.002	-0.184
POPDEN	0.117	1.490		
EXPTAX	-0.004***	-2.089		
OWNHOME	0.006***	2.776		
ROADDEN	-374.270**	-1.866	375.399	1.238
CRIME	0.000	-0.029		
HSGRAD			0.018***	2.911
COGRAD			0.016***	3.535
WOODEARN			-0.248***	-2.328
DIVIDEND			0.059	0.190
EMPDEN			-0.358**	-1.796
UNEMPLOY			0.002	0.264
JANTEMP	0.002	1.034	0.001	0.171
JANSUN	0.001***	1.980	0.000	0.367
JULYTEMP	-0.006***	-2.033	0.011***	2.161
JULYHUMID	0.000	-0.272	-0.001	-0.634
JANRAIN	-0.005	-1.315	0.013***	2.075
BIGMETRO	0.009	0.228	0.001	0.009
COAST	-0.040	-1.214	-0.007	-0.120

Note: *** indicates significance at the 5% level, ** indicates significance at the 10% level

Table 13. Three Stage Least Squares parameter estimates for employment growth and net migration, 1994-2003 (Continued)

	Net Migration		Employment Growth	
	Parameter	**T-statistic**	**Parameter**	**T-statistic**
WILD	-0.097	-0.977	0.182	1.076
STFOR	0.086	0.795	-0.018	-0.092
NATPARK	0.089	0.072	-2.326	-1.070
RESERVED	0.004	0.020	0.069	0.220
UNRESERVED	0.064	0.334	-0.199	-0.568
ADJNWFP	0.024	0.848	-0.033	-0.639
Mean (S.D) of Dependent Variable	0.051 (0.083)		0.172 (0.167)	
R-Squared	0.482		0.537	

Table 14. Three Stage Least Squares parameter estimates for employment growth and net migration, residuals adjusted for spatial autocorrelation 1994-2003

	Net Migration		Employment Growth	
	Parameter	**T-statistic**	**Parameter**	**T-statistic**
Constant	0.347	1.199	-1.821***	-2.442
NM			0.412	0.888
EG	0.359***	4.850	0.028	0.225
OREGON	0.105***	3.037	0.036	0.293
WASHINGTON	0.121***	3.206	-0.044	-0.999
INTER5	-0.013	-0.736	-0.005	-0.102
METRO	0.047***	2.109	0.028	0.225
INCOME	0.000***	-3.055		
HEALTHEXP	0.011	0.097		
EDUCEXP	-0.082	-0.702	-0.218	-0.816
FEDEXP	-0.015***	-3.305	-0.014	-1.151
POPDEN	0.212***	3.253		
EXPTAX	-0.002	-0.906		
OWNHOME	0.006***	2.469		
ROADDEN	-593.148***	-3.584	336.595	0.930
CRIME	0.000	0.213		
HSGRAD			0.021***	2.781
COGRAD			0.014***	2.811
WOODEARN			-0.321***	-2.167

Note: *** indicates significance at the 5% level, **indicates significance at the 10% level

Table 14. Three Stage Least Squares parameter estimates for employment growth and net migration, residuals adjusted for spatial autocorrelation 1994-2003 (Continued)

	Net Migration		**Employment Growth**	
	Parameter	**T-statistic**	**Parameter**	**T-statistic**
DIVIDEND			0.200	0.489
EMPDEN			0.006	0.638
UNEMPLOY			-0.272	-1.141
JANTEMP	0.005***	2.857	0.007	1.639
JANSUN	0.001**	1.926	0.000	-0.002
JULYTEMP	-0.010***	-4.171	0.005	0.832
JULYHUMID	-0.001	-1.426	-0.003	-1.546
JANRAIN	-0.002	-0.898	0.009	1.359
BIGMETRO	-0.025	-0.855	-0.021	-0.344
COAST	-0.069***	-2.880	-0.070	-1.200
WILD	-0.038	-0.526	0.261**	1.678
STFOR	0.127**	1.725	0.085	0.450
NATPARK	0.038	0.037	-2.407	-1.077
RESERVED	-0.042	-0.355	0.017	0.062
UNRESERVED	0.104	0.658	0.127	0.344
ADJNWFP	0.054***	2.566	0.000	-0.001
Mean (S.D) of Dependent Variable	0.097 (0.091)		0.299 (0.184)	
R-Squared	0.762		0.672	

Note: *** indicates significance at the 5% level, **indicates significance at the 10% level

Total Effects

The above results depict the coefficient estimates in the structural equations only. They represent the direct effects of the exogenous variables on each of the endogenous variables; however a change in one endogenous variable affects the other endogenous variable in a simultaneous system of equations. By solving the structural equations for each period the total effect of an exogenous variable on each endogenous variable can be determined. These total effects then represent an equilibrium condition at which all adjustments in the endogenous variables have occurred.

As shown in table 15 only the wilderness variable total effect is marginally statistically different from zero and positive in the 1980 to 1990 period.[27] For the 1990 to 1992 period the total effect on employment growth of wilderness (WILD) and the county share of land in LSOG are positive while the share of land in national forest (NATFOR) is negative and statistically different from zero. In addition the total effect of non-wilderness National Park land (*NATPARK*) on net migration is positive and significantly different from zero for this period. The NWFP land classifications enter specification in the 1992 to 1994 period and are significant; the *RESERVED* total effects are both positive determinants of net migration and employment growth while the *UNRESERVED* total effect on net migration is negative and marginally significant at the 12% confidence level[28]. Additionally the total effects of state forest management (STATE) on employment growth and net migration are positive and statistically significant. For the 1994 to 2003 period, total effects for the adjusted and unadjusted model are presented however none of the NWFP land allocation effects are significantly different from zero. With correction for spatial autocorrelation the positive total effect of state land on net migration and wilderness land on employment growth become marginally significant.

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[27] For expository purposes it is worth mentioning that this result holds even though the direct effects of NATPARK are significantly different from zero in the employment growth and net migration equations (Table 10). The coefficient estimates in these equations are opposite in signs which suggests their combined effects may cancel each other out.

[28] While the total effects are significant the structural equation parameter values were only marginally significant. This suggests incorporating adjustments in the endogenous variables when considering the variables of interest is important.

Table 15: Total effects by land classification

	Net Migration		Employment Growth	
	Parameter Estimate	**t-statistic**	**Parameter Estimate**	**t-statistic**
1980 to 1990				
NATFOR	-0.062	-0.653	-0.008	-0.032
BLM	-0.172	-0.594	-0.084	-0.113
WILD	0.178*	1.610	0.404	1.414
NATPARK	0.746	0.459	-5.881	-1.426
STFOR	0.165	1.227	0.265	0.756
1990 to 1992				
NATFOR	0.021	0.754	-0.243***	-3.313
BLM	0.046	0.736	0.154	0.899
WILD	0.001	0.038	0.143***	1.965
NATPARK	1.414***	3.360	0.010	0.008
STFOR	0.026	0.874	-0.006	-0.075
LSOG	0.059	0.132	2.527***	2.186
1992 to 1994				
RESERVED	0.103***	1.964	0.454***	2.137
UNRESERVED	-0.092*	-1.589	-0.313	-1.324
WILD	-0.020	-0.706	-0.093	-0.818
NATPARK	-0.010	-0.027	0.135	0.094
STFOR	0.044*	1.449	0.301***	2.393
1994 to 2003				
RESERVED	0.045	0.280	0.095	0.285
UNRESERVED	-0.030	-0.169	-0.217	-0.574
WILD	-0.023	-0.254	0.169	0.934
NATPARK	-1.233	-1.141	-3.034	-1.379
STFOR	0.104	1.076	0.042	0.206
Corrected for spatial autocorrelation				
1994 to 2003				
RESERVED	-0.042	-0.218	0.000	-0.001
UNRESERVED	0.175	0.678	0.199	0.438
WILD	0.065	0.570	0.288*	1.509
NATPARK	-0.969	-0.602	-2.805	-1.046
STFOR	0.185*	1.514	0.162	0.745

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level and * indicates significance at the 15% level

Conclusion

The examination of economic indicators over policy relevant time periods yields variation in the effects of land classification variables. Prior to consideration of the NWFP land use allocations the NWFP region was characterized by a period of management uncertainty. During this period from 1990 to 1992, economic agents made rational decisions regarding the future of timber harvests and amenity levels within the range of the Northern spotted owl. Counties with larger proportions of national forest land experienced less employment growth while counties containing more land in late successional old growth (LSOG) experienced higher rates of employment growth.

Over the period from 1992 to 1994 counties with more land reserved for biodiversity purposes had more immigration and employment growth. In contrast counties with more land allocated to uses permitting extractive uses experienced less migration. In the period following, from 1994 to 2003, the classification of land according to NWFP management yields no significant relationship with the economic indicators indicating adjustment to the NWFP had occurred.

These results suggest the NWFP had short-lived county level effects on employment growth and net migration as local economies switched from commodity production to amenity uses of their public lands.

The decreases in federal harvests following the industry highs in the late 1980's were largely felt in terms of decreased employment growth occurring in counties with high proportions of national forest land. Despite the decrease in federal harvests, the presence of LSOG in NWFP counties offset some of these losses as economic agents anticipated future harvests or amenities in those areas.

Once it became apparent that federal lands and much of the remaining LSOG would be devoted to biodiversity services under the NWFP in 1992, the uncertainty about federal harvests was over. Employment growth and net migration were higher in counties that would contain more land allocated to biodiversity services under *RESERVED* land. Counties with higher shares of lands allocated to *UNRESERVED* uses faced a future in which federal harvests might continue but at the expense of amenity uses of the land. These counties deterred migrants and encouraged out-migration while counties with more biodiversity lands benefited from the associated amenities and increased employment growth and net migration.

Judging from the lack of significant total effects in the final period following NWFP enactment all adjustments may have occurred. Economic agents with knowledge of the local forest resource would have determined the implications of the NWFP land allocations on the local economy and made the adjustments seen in the previous period. This may have occurred due to a lack of importance on a broader regional scale. For example the NWFP may have shifted timber production to the southern US (Adams et al., 2006) however the tumultuous indecision that had plagued the Northwest was over.

Chapter 5: Effects of land management variables in metropolitan vs. rural counties and on industry sector employment

Introduction

In retrospect it can be stated that the NWFP had little effect at the regional level. Lumber and wood products employment, as a percentage of total employment, had been steadily declining so that by 1990, the timber industry provided only 3.1 % of total regional employment (Niemi, Whitelaw, Johnston 1999). Effectiveness monitoring as required under the ROD for the NWFP (Sommers, 2001) has shown net migration and employment growth increases in metropolitan counties typical of the overall regional trends of the period. In 1991 the national recession did little to harm the overall regional growth of Northwest in the mid to late 1990's.

However this regionally robust economy hides very different patterns of change for counties within the region due to the timber harvest injunctions and the NWFP. From the above analysis it is apparent that county level employment growth was affected by the decrease in harvests associated with spotted owl litigation and the designation of land under the NWFP. Employment growth increases were seen in counties containing more land designated for biodiversity services, potentially due to an influx of amenity-seeking migrants to these areas. It is perceived that while amenity-seeking migrants may be drawn to such areas, it comes at the expense of higher paying manufacturing jobs. The degree to which this transition is due to the designation of land under the NWFP is unknown.

Analysis of timber employment in northern California counties found that the state economic conditions rather than local employment conditions were the drivers of local poverty (Berck et al. 2000). In order to examine the effects of the NWFP directly the changes in net migration and employment growth must be separated from the existing regional economic environment. The analysis of Hunt et al. and in Chapter 4 treats the relationship of the public land management variables and the economic indicators the same for all counties, regardless of their location in metropolitan or rural areas. This justification is based on the assumption that the effects of NWFP designation were the same for rural and urban counties. The analysis in this chapter will show if characteristically different counties experienced different effects from the NWFP land classifications on employment growth and net migration. In addition the measure of total employment used previously will be disaggregated by industry. This will examine whether the NWFP discouraged employment in some industry sectors while encouraging others.

Methods

Distinguishing the effects of land management in Metropolitan and Rural counties

Using the classification of metropolitan statistical areas (MSA) developed by the US Office of Management and Budget, each county within the NWFP planning area is classified as metropolitan (METRO; containing an MSA) or rural (RURAL; absence of an MSA). These METRO and RURAL dummy variables are then interacted with each of the variables in the PUBLICLAND vector of the general model. In the two periods prior to 1992 these variables are thus the share of metropolitan counties under BLM ownership (BLMmetro) and forest service ownership (NATFORmetro). Likewise the shares of rural counties under BLM and Forest Service are included (BLMrural and NATFORrural respectively). WILDmetro, WILDrural, STFORmetro, STFORrural, NATPARKmetro, NATPARKrural, are also included. LSOGmetro and LSOGrural enter specification in the 1990 to 1992 period in order to assess the total effects of the LSOG in rural and metropolitan counties. In the two periods that follow 1992 the *UNRESERVED* and *RESERVED* land share designations are distinguished for rural and metropolitan counties (*UNRESERVED*rural, *UNRESERVED*metro, *RESERVED*rural and *RESERVED*metro) and replace the NATFORmetro, NATFORrural, BLMmetro and BLMrural variables. Adjacent counties which are rural and metropolitan are also distinguished in the final two periods of analysis (ADJNWFPrural and ADJNWFPmetro).

The underlying drivers of the NWFP land classification variables are presumably unique in rural versus metropolitan counties. Given this distinct possibility the instruments outlined in Chapter Two are used to construct projections for the rural and metropolitan and *RESERVED* land shares. These are then used to test for exogeneity of the new NWFP land shares using the Geroski technique outlined in Chapter Three. The null hypothesis of exogenously determined NWFP land shares cannot be rejected in either the 1992 to 1994 or the 1994 to 2003 period. The NWFP land share measures are consequently not instrumented in the model that distinguishes metropolitan and rural counties.

However rejection of the null of no spatial autocorrelation in the final period from 1994 to 2003 is detected and corrected using the procedure presented in Dubin (1998) and Kelejian and Prucha (2004). Total effects for the four periods of analysis are presented in table 16 (the structural equation results are presented in Appendix C). Given significant correspondence between the 1994 to 2003 results when corrected and uncorrected for spatial autocorrelation, both are presented while discussion focuses on the corrected results.

Distinguishing NWFP effects on employment in distinct industry sectors

The total employment growth measure used by Hunt et al. and in Chapter Four, is disaggregated into three different industry sectors; agriculture, manufacturing and services.

The agriculture industry disaggregation is composed of SIC codes 01 to 09. Industries which produce agricultural crops, raise livestock and perform agriculture related services such as veterinarian and custom slaughtering. SIC industry code 08 is includes all forestry related industries which included timber tract operations (0811) and support activities for forestry such as firefighting and timber valuation (0851). Fishing and hunting related industries are also included in the agriculture industry disaggregation. While many of the agriculture related industries included in this disaggregation were not affected by the NWFP, many counties were heavily dependent upon industries which were affected.

The manufacturing industry disaggregation includes industries which were also affected by NWFP enactment. This disaggregation is composed of SIC codes 20 through 39 which includes industries such as lumber and wood products, paper products, furniture, and electronic equipment. While many of the NWFP counties may have been dependent on product manufacturing unassociated with the lumber and wood products industries, they were feasibly indirectly associated given the importance of this sector. Lumber and wood products manufacturing made up 39% of total earnings in NWFP and adjacent counties in 1997 (BLS, 1997). The change in land management under the NWFP may have certainly been a large part of variation within the manufacturing industry disaggregation. Much of the employment in the technology industry is captured in this disaggregation. The region experienced fluctuations in the technology market over this time period which may be captured in many of the structural equation parameters.

Service related industries include SIC codes 70 to 89 which aggregates many high and low wage paying jobs. High paying service industries included are legal, engineering, business and management related services. Other industries included range from social, health, lodging services and other tourism related industries. Changes in migration associated with NWFP enactment feasibly drove changes in the service sector.

These three categories exist as broad classifications within the Bureau of Labor Statistics framework which aids estimation of undisclosed employment data. The

North American Industrial Classification System (NAICS) replaced the Standard Industrial Classification system in 1997 in order to integrate with Canadian and Mexican industry classification conventions. NAICS industries are identified by a six-digit code, in contrast to the four-digit SIC code. In order to maintain consistency with the SIC system a conversion is necessary. This would require an aggregation of NAICS subsectors that correspond to the SIC code aggregations in the three sectors of interest. However county level data is only available at the four-digit NAICS and two-digit SIC code level. In addition some of the NAICS subsectors correspond to SIC four-digit codes but many are made up of parts of the old SIC codes. Aggregating the four digit NAICS codes provided at the county level would result in misclassification of employment in a manner inconsistent with the SIC grouping. Creating a bridge for compatibly coded county level industry classifications would thus introduce unavoidable error at the county level.

Despite the 1997 change in the US industry classification from SIC to NAICS, consistent analysis can be performed up to the last year the BLS provides SIC data in 2000. Therefore industry employment growth and net migration over the four periods discussed in the preceding chapter; however the final period is shortened to encompass the years from 1994 to 2000.

Given the unique determinants of employment within each of the industry sectors of interest, the imputation of undisclosed observations using linear regression would be very intensive. While in Chapter three regression imputation of the wood products industry was feasible it makes up only one of the 20 industry codes within manufacturing. For the purpose of this analysis causation of each industry disaggregation is not used to impute missing values. By subtracting employment over all counties in each of the three industry disaggregations, from the reported state employment total, the remaining employment is accounted for. This remaining industry employment is then distributed equally amongst the remaining counties with undisclosed values.

Employment growth in each industry sector is then characterized alongside net migration in the general model described in Chapter One. In this manner three separate models are estimated via three stage least squares. Exogeneity of the *RESERVED* and *UNRESERVED* land share measures are examined using the method established by Geroski (1982) and are presented in tables 17, 18 and 19. Instrumental variables (IV) are consequently used for the 1992 to 1994 period in both the structural equations of the service industry model. The IV is used in just the net migration equation of the agricultural industry disaggregation model.

Potential cross-county effects on employment growth and net migration are examined in each of the three models using the methods outlined by Dubin (1998) and Kelejian and Prucha (2004). Based on rejection of the null of no spatial autocorrelation, these results are presented alongside the uncorrected three-stage least squares results. The total effects for the three models are only presented in order to portray the results in a parsimonious manner (The structural equation results are presented in Appendix C).

Results

Distinguishing the effects of land management in metropolitan and rural counties

For the 1980 to 1990 period, total effects are displayed in table 16. The effect on net migration of national park land and wilderness in rural counties was positive and statistically different from zero at a marginal level of confidence of 15%. The national park land in rural counties applies to only two counties and may indicate characteristics specific to those counties unassociated with national park management. However these results suggest the management of wilderness for recreation and biodiversity purposes had a positive effect on net migration in rural counties. In addition the lack of significant total effects for the employment growth equation indicates Forest Service and BLM land ownership had no effect on total employment over this period of increasing harvest on public lands (see figure 6).

The period from 1990 to 1992 shows positive total effects on net migration associated with national park land in metropolitan and rural counties. In addition state land management in metropolitan counties also positively determines net migration. Total effects on employment growth were negative for land managed by forest service and BLM in metropolitan counties. National forest land in rural counties was also negative determinant of employment growth during this period. In contrast BLM land was a positive determinant of employment growth in rural counties.

Total effects for the 1990 to 1992 period also include the total effect of land designated as LSOG. This variable was a positive and significant determinant of employment growth for both rural and metropolitan counties. The LSOG variable measures a host of ecological characteristics associated with late successional forest ecosystems and may indicate the forest available for harvest on public lands. The positive sign can be explained by the increasing harvests over this time period seen in figure 6.

For the pre NWFP period from 1992 to 1994 the land use classifications for *RESERVED* and *UNRESERVED* land were feasibly known as discussed in Chapter Three. Land that would be managed for only biodiversity purposes under the *RESERVED* category is positively associated with net migration in rural and metropolitan counties. State land in metropolitan counties was also positively associated with net migration. Total effects positively associated with employment growth are *RESERVED* NWFP land in both rural and metropolitan counties. State land in rural counties was also associated positively with employment growth. Not until recently did state land have a biodiversity focus therefore counties with larger proportions of state land may have benefited from more harvest over this time period. NWFP land allocated for purposes that did not preclude timber harvest

(*UNRESERVED*) are negatively associated with employment growth possibly due to anticipated decreases in natural amenities and harvests.

Due to spatial autocorrelation in the final period of analysis, corrected total effects are presented alongside uncorrected results. The corrected results indicate that changes in net migration and employment growth were not due to NWFP land management in rural and metropolitan counties. However the uncorrected results indicate positive effects of *RESERVED* land and negative effects of *UNRESERVED* land on net migration in metropolitan counties. In addition wilderness land in metropolitan counties was negatively associated with net migration and employment growth. These results must be interpreted with caution given the presence of spatial autocorrelation. Results uncorrected and corrected for spatial autocorrelation indicate a positive total effect of rural wilderness land on employment growth for the final period of analysis.

Table 16. Total effects when land management in Metropolitan and Rural counties is distinguished

	Net Migration		**Employment Growth**	
	Parameter	**T-statistic**	**Parameter**	**T-statistic**
1980 to 1990				
NATFORMETRO	-0.221	-1.073	-0.363	-0.669
BLMMETRO	-0.242	-0.382	-1.155	-0.700
WILDmetro	0.323	1.232	0.532	0.766
NATPARKMETRO	-2.403	-0.499	-5.266	-0.416
STATEMETRO	0.222	0.741	-0.360	-0.452
NATFORRURAL	-0.043	-0.445	0.125	0.519
BLMRURAL	-0.089	-0.350	0.117	0.177
WILDRURAL	0.158*	1.483	0.287	1.021
NATPARKRURAL	1.425*	0.915	-5.895	-1.454
STATERURAL	0.152	1.163	0.309	0.894
1990 to 1992				
NATFORMETRO	-0.067	-0.803	-0.623***	-2.640
BLMMETRO	0.034	0.182	-1.297***	-2.297
WILDmetro	-0.054	-1.109	-0.082	-0.574
NATPARKMETRO	2.042**	1.711	-3.273	-0.909
STATEMETRO	0.121**	1.834	0.170	0.932
NATFORRURAL	0.005	0.187	-0.324***	-3.972
BLMRURAL	0.061	1.023	0.336**	1.907
WILDRURAL	0.003	0.112	0.110	1.227
NATPARKRURAL	1.511***	3.666	1.103	0.922
STATERURAL	0.000	0.016	0.055	0.649
LSOGMETRO	0.325	0.326	8.598***	3.081
LSOGRURAL	0.650	1.378	4.184***	3.103
1992 to 1994				
RESERVEDMETRO	0.166*	1.567	0.707*	1.525
UNRESERVEDMETRO	-0.122	-1.448	-0.344*	-0.939
WILDmetro	-0.046	-1.049	-0.001	-0.005
NATPARKMETRO	0.887	0.944	0.218	0.052
STATEMETRO	0.137***	2.278	0.366	1.406
RESERVEDRURAL	0.090**	1.822	0.396**	1.894
UNRESERVEDRURAL	-0.096	-1.427	-0.379	-1.357
WILDRURAL	-0.016	-0.506	-0.172	-1.340
NATPARKRURAL	-0.143	-0.407	-0.122	-0.086
STATERURAL	0.022	0.710	0.264***	1.980

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level and * indicates significance at the 15% level

Table 16. Total effects when land management in Metropolitan and Rural counties is distinguished (Continued)

	Net Migration		Employment Growth	
	Parameter	T-statistic	Parameter	T-statistic
1994 to 2003				
RESERVEDMETRO	0.656***	2.048	0.737	1.044
UNRESERVEDMETRO	-0.587***	-2.210	-0.756	-1.319
WILDmetro	-0.291***	-2.004	-0.318	-1.076
NATPARKMETRO	2.770	0.943	0.340	0.055
STATEMETRO	0.190	0.998	0.089	0.225
RESERVEDRURAL	-0.087	-0.550	0.110	0.335
UNRESERVEDRURAL	0.191	0.930	0.022	0.052
WILDRURAL	0.034	0.339	0.374**	1.855
NATPARKRURAL	-1.433	-1.340	-3.269*	-1.496
STATERURAL	0.122	1.213	0.142	0.672
1994 to 2003 corrected for spatial autocorrelation				
RESERVEDMETRO	0.159	0.384	-0.074	-0.102
UNRESERVEDMETRO	-0.343	-0.976	-0.382	-0.617
WILDmetro	-0.137	-0.749	-0.061	-0.203
NATPARKMETRO	4.313	1.106	0.316	0.044
STATEMETRO	0.125	0.479	-0.254	-0.565
RESERVEDRURAL	-0.214	-0.733	0.036	0.115
UNRESERVEDRURAL	0.154	0.519	0.553	1.237
WILDRURAL	-0.056	-0.415	0.462***	2.646
NATPARKRURAL	-0.098	-0.039	-1.168	-0.355
STATERURAL	0.015	0.086	0.335	1.594

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level and * indicates significance at the 15% level

Distinguishing NWFP effects on employment in distinct industry sectors

Geroski's test for exogenous regressors was performed on the NWFP variables in the three industry disaggregation models. The null hypothesis of exogenous regressors was rejected in one equation of the agriculture employment disaggregation for the 1992 to 1994 period (table 17). The *RESERVED* variable was endogenous in the net migration equation at a 10.4% level of confidence. This variable was consequently instrumented and these results are presented alongside the un-instrumented results in table 21. A lack of exogeneity of the *RESERVED* land share measure was also found in two equations of the service employment disaggregation (table 18). These variables were instrumented and the total effects are presented alongside the un-instrumented results in table 23. The *RESERVED* NWFP land share measures were found to be exogenous in all periods of the manufacturing employment disaggregation.

Table 17. Exogeneity test of agriculture employment disaggregation

Period		Net Migration		Employment Growth	
		Estimate	**t-statistic**	**Estimate**	**t-statistic**
1992 to 1994					
	Error *RESERVED*	1.187**	1.624	-10.189	-0.676
	Error *UNRESERVED*	-0.986	-1.197	5.088	0.260
1994 to 2000					
	Error *RESERVED*	-1.080	-0.430	24.887	1.373
	Error *UNRESERVED*	4.677	1.046	-23.779	-1.198

Note: *** indicates significance at the 5% level and ** indicates significance at the 15% level

Table 18. Exogeneity test of service employment disaggregation

Period	Variable Name	Net Migration Equation		Employment Growth Equation	
		Estimate	**t-statistic**	**Estimate**	**t-statistic**
1992 to 1994					
	Error *RESERVED*	1.075**	1.528	-5.203	-0.556
	Error *UNRESERVED*	-0.656	-0.809	10.847	0.905
1994 to 2000					
	Error *RESERVED*	1.491	1.421	-39.405**	-1.735
	Error *UNRESERVED*	-0.158	-0.071	26.286	1.039

Note: *** indicates significance at the 5% level and ** indicates significance at the 15% level

Table 19. Exogeneity test of manufacturing employment disaggregation

Period	Variable Name	Net Migration Equation		Employment Growth Equation	
		Estimate	t-statistic	Estimate	t-statistic
1992 to 1994					
	Error *RESERVED*	0.413	0.494	-28.143	-0.508
	Error *UNRESERVED*	0.044	0.052	11.332	0.158
1994 to 2000					
	Error *RESERVED*	1.225	1.144	-4.678	-0.062
	Error *UNRESERVED*	0.234	0.147	20.958	0.252

Note: *** indicates significance at the 5% level and ** indicates significance at the 15% level

Agriculture employment disaggregation

Cross county effects of the exogenous variables have effects on changes in agricultural employment and net migration in all four periods of analysis. For the first period of analysis land management variables have no total effect on net migration or changes in agricultural industry employment growth (Table 20). From 1990 to 1992 non-wilderness national park and national forest land designation have a positive and significant total effect on net migration. These results hold when corrected and uncorrected for spatial autocorrelation. The NATPARK coefficient must be interpreted with caution since this land classification only exists in a few counties of the sample.

For the 1992 to 1994 period, endogeneity of the *RESERVED* land share necessitates the use of an instrumental variable (table 21). Use of the *RESERVED* instrumental variable, *RESERVED*hat, does not dramatically change the total effects results corrected for spatial autocorrelation. The state forestry variable in the net migration equation is positive and significant in both cases, while the *UNRESERVED* variable is positive and marginally significant in the employment growth equation when *RESERVED*hat is not used.

In the final period of analysis, the land management variables are exogenous in the general model. Results corrected for spatial autocorrelation indicate land managed by the state department forestry is positively associated with net migration and employment growth in the agricultural sector. NATPARK is negatively associated with net migration but should be interpreted with caution as explained above. Additionally *UNRESERVED* land and wilderness are positively associated with growth in the agricultural employment disaggregation.

Table 20. Total effects for agriculture industry disaggregation

	Net Migration		Agriculture industry Employment Growth	
	Parameter Estimate	**t-statistic**	**Parameter Estimate**	**t-statistic**
1980 to 1990				
NATFOR	0.112	0.286	3.147	0.466
BLM	-0.294	-0.217	-9.505	-0.392
WILD	0.011	0.020	-8.285	-0.818
NATPARK	-0.731	-0.099	-101.210	-0.748
STFOR	0.369	0.477	1.717	0.130
1990 to 1992				
NATFOR	0.033*	1.554	-0.128	-0.348
BLM	0.044	0.925	0.601	0.693
WILD	0.003	0.164	0.302	0.824
NATPARK	1.340***	4.097	3.462	0.594
STFOR	0.011	0.465	-0.078	-0.195
LSOG	-0.046	-0.133	-4.573	-0.784
1992 to 1994				
RESERVED	0.066*	1.508	-1.672	-1.357
UNRESERVED	-0.055	-1.166	1.920	1.416
WILD	-0.015	-0.596	0.522	0.813
NATPARK	0.085	0.273	7.585	0.927
STFOR	0.043*	1.628	0.081	0.112
1994 to 2000				
RESERVED	0.025	0.194	-0.393	-0.503
UNRESERVED	0.060	0.426	1.377*	1.579
WILD	-0.017	-0.238	0.667*	1.565
NATPARK	-1.426*	-1.641	-2.317	-0.442
STFOR	0.076	0.984	1.355***	2.837

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level and * indicates significance at the 15% level

Table 20. Total effects for agriculture industry disaggregation (Continued)

corrected for spatial autocorrelation				
1980 to 1990				
NATFOR	0.231	0.466	6.046	0.487
BLM	-0.152	-0.105	-12.656	-0.329
WILD	0.254	0.533	-2.518	-0.204
NATPARK	-2.607	-0.280	-160.784	-0.661
STFOR	0.694	0.593	13.972	0.479
1990 to 1992				
NATFOR	0.031*	1.630	-0.322	-0.876
BLM	0.050	1.138	0.936	1.059
WILD	0.004	0.220	0.369	1.092
NATPARK	1.351***	4.581	2.253	0.372
STFOR	0.012	0.556	-0.040	-0.106
LSOG	-0.031	-0.099	-3.723	-0.632
1992 to 1994				
RESERVED	0.054	1.307	-1.793	-1.441
UNRESERVED	-0.061	-1.218	2.017*	1.471
WILD	-0.013	-0.574	0.497	0.763
NATPARK	0.053	0.162	8.145	0.980
STFOR	0.050***	2.028	0.087	0.118
1994 to 2000				
RESERVED	0.057	0.578	-0.414	-0.599
UNRESERVED	0.041	0.325	1.432**	1.816
WILD	-0.028	-0.480	0.664**	1.733
NATPARK	-1.339**	-1.665	-2.668	-0.562
STFOR	0.115**	1.868	1.327***	3.113

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level and * indicates significance at the 15% level

Table 21. Total effects for agriculture industry disaggregation with *RESERVED* land instrumented

	Net Migration		**Agriculture industry Employment Growth**	
	Parameter Estimate	**t-statistic**	**t-statistic**	**t-statistic**
1992 to 1994				
RESERVEDhat	0.015	0.412	-0.205	-0.193
UNRESERVED	-0.021	-0.463	0.852	0.653
WILD	-0.001	-0.046	0.213	0.342
NATPARK	0.158	0.499	6.072	0.734
STFOR	0.033	1.274	0.318	0.442
corrected for spatial autocorrelation				
1992 to 1994				
RESERVEDhat	0.004	0.102	-0.421	-0.394
UNRESERVED	-0.021	-0.446	1.058	0.802
WILD	-0.001	-0.057	0.202	0.319
NATPARK	0.202	0.641	6.921	0.823
STFOR	0.044**	1.825	0.315	0.430

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level and * indicates significance at the 15% level

Service employment disaggregation

All four periods of analysis in the service industry employment disaggregation were corrected for spatially autocorrelation (table 22). The *RESERVED* land classification was also instrumented for the final two periods (table 23). For the 1980 to 1990 period none of the land management total effects were significantly different from zero at reasonable confidence levels. During the period from 1990 to 1992, characterized by uncertainty regarding future policy, only the NATPARK total effect is significant in the net migration equation. However in the service industry employment growth equation total effects for national forest and NATPARK are positive and statistically significant. This result implies counties containing higher shares of land managed by the forest service had higher degrees of growth in the service sector.

When the *RESERVED* and *UNRESERVED* land classifications enter specification in the 1992 to 1994 period, the *RESERVED* land share measure is instrumented. These results are presented in table 23. While *RESERVED* land has a marginally significant and positive total effect on net migration *RESERVED*hat does not. In addition *RESERVED* land is significant and positive in the service employment growth equation while *RESERVED*hat is marginally significant at the 16% level of confidence. This implies that *RESERVED* land may potentially have had an effect on employment growth or net migration when considered to be endogenously determined by economic, political and ecological factors. *UNRESERVED* land is positive and a statistically significant determinant of service industry employment growth when *RESERVED*hat is utilized. This is true regardless of the form of instrumental variables used. NATPARK is a negative and significant determinant of service industry employment while State forest land has a positive total effect.

For the final period of analysis only the state forest land total effect is a statistically significant determinant of net migration when *RESERVED* land is not instrumented. Similarly none of the total effects are statistically significant determinants of service industry employment growth when *RESERVED* land is not instrumented. However when endogeneity of the *RESERVED* land share measure is accounted for, the total effect of *UNRESERVED* land on service sector employment growth is negative. This suggests counties with a higher proportion of NWFP land allocated to uses that included timber harvest experienced less service sector growth over this nine year time period.

Table 22. Total effects for service industry disaggregation

	Net Migration		Service Industry Employment Growth	
	Parameter	t-statistic	Parameter	t-statistic
1980 to 1990				
NATFOR	-0.057	-0.522	0.055	0.070
BLM	0.039	0.131	-0.280	-0.128
WILD	0.147	1.199	0.894	0.932
NATPARK	0.440	1.875	-20.356*	13.801
STFOR	0.099	0.148	-0.041	1.131
1990 to 1992				
NATFOR	0.031*	1.450	0.676***	2.623
BLM	0.045	0.947	-0.767	-1.260
WILD	0.004	0.187	-0.190	-0.740
NATPARK	1.307***	4.192	29.665***	7.296
STFOR	0.010	0.023	0.142	0.508
LSOG	-0.009	0.352	-1.682	4.064
1992 to 1994				
RESERVED	0.068*	1.526	1.044***	2.888
UNRESERVED	-0.053	-1.116	0.254	0.638
WILD	-0.012	-0.484	-0.227	-1.206
NATPARK	0.071	0.332	-11.038***	-4.593
STFOR	0.043**	0.026	0.624***	0.213
1994 to 2000				
RESERVED	-0.020	-0.138	-2.548	-1.038
UNRESERVED	0.091	0.556	0.628	0.228
WILD	-0.004	-0.047	-0.733	-0.557
NATPARK	-1.319	1.016	-2.149	-0.132
STFOR	0.054	0.090	0.012	1.502
corrected for spatial autocorrelation				
1980 to 1990				
NATFOR	-0.108	-1.093	-0.071	-0.116
BLM	-0.018	-0.061	-0.519	-0.240
WILD	0.128	1.132	0.691	0.926
NATPARK	-0.879	-0.491	-37.531***	-3.039
STFOR	0.041	0.309	-0.493	-0.618

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level and * indicates significance at the 15% level

Table 22. Total effects for service industry disaggregation (Continued)

	Net Migration		Service Industry Employment Growth	
	Parameter	t-statistic	Parameter	t-statistic
1990 to 1992				
NATFOR	0.027	1.280	0.851***	3.707
BLM	0.040	0.665	0.349	0.594
WILD	0.001	0.051	-0.019	-0.095
NATPARK	1.326***	4.167	32.476***	8.152
STFOR	0.012	0.502	0.180	0.845
LSOG	0.066	0.190	-2.962	-0.807
1992 to 1994				
RESERVED	0.070*	1.574	0.990***	2.775
UNRESERVED	-0.055	-1.152	0.277	0.697
WILD	-0.012	-0.498	-0.236	-1.253
NATPARK	0.052	0.154	-11.016***	-4.577
STFOR	0.044**	1.697	0.621***	2.916
1994 to 2000				
RESERVED	0.031	0.297	-3.183**	-1.946
UNRESERVED	0.125	0.776	-1.913	-0.782
WILD	0.009	0.145	-0.856	-0.911
NATPARK	-0.943	-1.026	-3.458	-0.243
STFOR	0.108*	1.595	-1.876**	-1.749

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level and * indicates significance at the 15% level

Table 23. Total effects for service industry disaggregation with *RESERVED* land instrumented

	Net Migration		**Service Industry Employment Growth**	
	Parameter	**t-statistic**	**Parameter**	**t-statistic**
1992 to 1994				
RESERVEDhat	0.011	0.304	0.461	1.419
UNRESERVED	-0.013	-0.282	0.655**	1.644
WILD	0.004	0.176	-0.100	-0.531
NATPARK	0.149	0.443	-10.445***	-4.132
STFOR	0.034	1.299	0.517***	2.365
1994 to 2000				
RESERVEDhat	-0.035	-0.280	-0.213	-0.098
UNRESERVED	0.111	0.688	-1.139	-0.411
WILD	-0.168	-0.021	-1.188	-0.912
NATPARK	-1.307	-1.275	-3.675	-0.221
STFOR	0.050	0.561	0.457	0.306
corrected for spatial autocorrelation				
1992 to 1994				
RESERVEDhat	0.010	0.285	0.406	1.275
UNRESERVED	-0.013	-0.286	0.697**	1.759
WILD	0.004	0.150	-0.105	-0.558
NATPARK	0.114	0.334	-10.480***	-4.152
STFOR	0.033	1.288	0.515***	2.361
1994 to 2000				
RESERVEDhat	-0.052	-0.494	-0.722	-0.378
UNRESERVED	0.185	1.176	-4.164*	-1.515
WILD	0.020	0.318	-1.244	-1.278
NATPARK	-0.652	-0.745	-11.742	-0.811
STFOR	0.095	1.406	-1.440	-1.283

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level and * indicates significance at the 15% level

Manufacturing employment disaggregation

During the 1980 to 1990 period none of the federal land management variables had statistically significant total effects. However in the net migration equation land managed by state forestry departments had a positive and significant total effect on manufacturing employment growth (see table 24).

Cross county effects of the regressors on net migration and manufacturing employment growth necessitates the correction for spatial autocorrelation in the 1990 to 1992 period. These results are presented alongside the uncorrected results at the base of table 24. Non-wilderness national park and national forest management have positive impacts on net migration. Lands managed by the forest service negatively impacted county level manufacturing employment. This result suggests decreased timber harvests on federal land slowed manufacturing employment growth in NWFP counties. The significance of the total effect on LSOG changes between the models uncorrected and corrected for spatial autocorrelation, suggesting no significant effect of anticipated natural amenities or available forest for harvest.

The period from 1992 to 1994 is characterized by positive and significant effects of Reserve land don Net Migration. Counties with more land allocated to *UNRESERVED* NWFP land uses experienced decreases in manufacturing employment growth. During this time period, there were no changes in manufacturing employment growth associated with *RESERVED* NWFP land allocations.

Results corrected for spatial autocorrelation in the final period from 1994 to 2000 are presented at the bottom of table 24. Neither the corrected nor uncorrected results yield statistically significant total effects of land management variables on net migration or manufacturing industry employment. This result suggests there were no prolonged effects on net migration or manufacturing employment after NWFP enactment.

Table 24. Total effects for manufacturing industry disaggregation

	Net Migration		Manufacturing Industry Employment Growth	
	Parameter	t-statistic	Parameter	t-statistic
1980 to 1990				
NATFOR	-0.040	-0.296	0.103	0.118
BLM	-0.015	-0.039	0.400	0.152
WILD	0.170	1.055	-0.366	-0.321
NATPARK	1.387	0.602	3.044	0.185
STFOR	0.145	0.755	2.841***	2.062
1990 to 1992				
NATFOR	0.030	1.317	-0.527***	-3.172
BLM	0.039	0.776	0.254	0.647
WILD	0.002	0.098	0.156	0.941
NATPARK	1.313***	4.021	2.792	1.070
STFOR	0.011	0.431	0.031	0.174
LSOG	0.006	0.015	5.383***	2.048
1992 to 1994				
RESERVED	0.092*	1.495	1.513	0.227
UNRESERVED	-0.097	-1.415	-11.649*	-1.562
WILD	-0.020	-0.572	1.441	0.401
NATPARK	0.267	0.574	16.448	0.347
STFOR	0.046	1.248	1.670	0.423
1994 to 2000				
RESERVED	0.022	0.164	3.269	0.438
UNRESERVED	0.054	0.365	3.033	0.366
WILD	-0.005	-0.065	-3.170	-0.788
NATPARK	-1.051	-1.166	-47.628	-0.960
STFOR	0.070	0.873	1.219	0.268
Corrected for spatial autocorrelation				
1990 to 1992				
NATFOR	0.032*	1.452	-0.296**	-1.887
BLM	0.041	0.793	0.235	0.587
WILD	0.001	0.038	0.063	0.438
NATPARK	1.245***	3.058	-1.142	-0.405
STFOR	0.011	0.454	0.017	0.113
LSOG	-0.005	-0.015	3.624	1.436

Table 24. Total effects for manufacturing industry disaggregation (Continued)

	Net Migration		Service Industry Employment Growth	
	Parameter	t-statistic	Parameter	t-statistic
1994 to 2000				
RESERVED	0.049	0.409	4.958	0.849
UNRESERVED	0.046	0.321	1.111	0.167
WILD	0.282	0.042	-3.785	-1.187
NATPARK	-0.960	-1.080	-43.554	-1.100
STFOR	0.100	1.359	1.759	0.490

Note: *** indicates significance at the 5% level and ** indicates significance at the 10% level and * indicates significance at the 15% level

Conclusion

Distinguishing the effects of land management in metropolitan and rural counties

The prevailing wisdom in the region predicted the majority of economic losses would be felt by rural communities within the planning area. This idea rested on the assumption that lumber and wood products industry was located in rural areas. However most of the region's lumber and wood products industry was located in or near metropolitan areas (Neimi et al. 1999). Therefore job losses due to anticipated policy actions affecting future harvests would have likely occurred to a greater extent in these metropolitan areas. The negative total effect of BLM and forest service management in metropolitan counties reflects this pattern of employment impacts in metropolitan areas over the 1990 to 1992 period.

After the Gang of Four report was issued in late 1991 the land share classifications were feasibly known. While the NWFP would not be enacted until 1994, the general allocation of the land use classifications was known after 1992 (as established previously). Rational agents used this information and made migration and employment decisions accordingly. Net migration may have been encouraged by natural amenities or discouraged by disamenities associated with the land use allocations. Employment in different industry sectors may have been indirectly affected in addition to direct impacts. Consequently the total effects over the 1990 to 1992 period indicate migration was associated with rural and metropolitan counties which had existing conditions that supported natural amenities which would be secured under the RESERVED classification. Employment growth may have consequently been spurred by the increased migration in these areas despite the job losses from decreased timber harvests. In UNRESVED areas where future natural amenity levels were not certain, job losses due to expected future declines in harvests were not compensated by increased amenity based migration and associated employment. These losses again occurred in metropolitan counties as opposed to rural counties where prevailing wisdom predicted.

Results indicate that the management of land under the NWFP land allocations had no total employment growth or net migration effects in rural and metropolitan counties after NWFP enactment.

Distinguishing NWFP effects on employment in distinct industry sectors

By distinguishing changes in total employment growth specific to different industry disaggregations, statistically significant total effects of the *RESERVED* and *UNRESERVED* land classifications are determined.

I would like reflect back on the general model when applied to total county employment growth in Chapter Four.

For the 1990 to 1992 periods, national forest management has significant effects on service, manufacturing and the original total county employment model. We see service sector employment increases alongside manufacturing decreases associated with counties containing more land under national forest management. In Chapter four the total effect of national forest land on total employment was significant and negative. It is thus apparent that the negative effect from National Forest management on manufacturing during this period outweighed positive service sector employment effects which may have been due to amenities associated with these public lands.

The results for the manufacturing and service sector employment models suggest that over the 1992 to 1994 period manufacturing jobs were lost as a result of *UNRESERVED* land allocation however service industry growth was encouraged in counties with more *UNRESERVED* management. The associated decrease in manufacturing employment makes sense since harvests were not forthcoming. As workers lost jobs in manufacturing related employment the service sector may have subsequently absorbed some of these displaced workers.

In addition *RESERVED* land was unassociated with changes in the manufacturing or agriculture employment disaggregations while potentially encouraging growth in the service sector over the 1992 to 1994 period. Amenities associated with this land allocation may have been the drivers of these service sector changes as an indirect result of increased migration. The extent to which service sector employment replaced equivalent manufacturing wage jobs is unknown, however higher paying service sector jobs are not ruled out since they are represented in the SIC disaggregation.

From 1994 to 2000, lingering effects of NWFP enactment on employment growth in manufacturing sectors did not occur however are seen in the agricultural and service sectors. Counties containing land allocated for *UNRESERVED* uses were associated with employment growth in the agricultural sector and decreases in the service sector. This suggests FEMAT policy may have effectively cushioned agricultural employment effects of the NWFP. However, as a result of these *UNRESERVED* land allocations which did not preclude timber harvest, a decrease in service sector employment occurred. Since natural amenity levels were not certain in these counties, growth in the service sector may have been discouraged by less migration in these areas.

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Appendices

Appendix A. Variable Names, Definitions and Sources

Name	Variable definition	Source
EG	% change in employment	County Business Patterns
NM	% Net migration	U.S. Bureau of Census
OREGON	Indicator variable equal to 1 for Oregon counties.	
WASHINGTON	Indicator variable equal to 1 for Washington counties.	
HSGRAD	% of people >25 years who graduated from high school	City and County Data Book
INTER5	Indicator variable equal to 1 for counties containing Interstate 5	Rand McNally Road Atlas
METRO	Indicator variable equal to 1 for counties in a metropolitan statistical area	U.S. Bureau of Census
INCOME	Median Household Income	City and County Data Book
HEALTHEXP	Percentage of government expenditures on health and hospitals	U.S.A. Counties
EDUCEXP	Percentage of government expenditures on education	U.S.A. Counties
FEDEXP	Per capita federal expenditures and obligations	U.S.A. Counties
POPDEN	Population per square mile	City and County Data Book
EXPTAX	Ratio of local government expenditures to local tax revenue	U.S.A. Counties
OWNHOME	Percentage of households owning their homes	U.S.A. Counties
ROADDEN	Arterial interstate miles plus primary arterial miles/county land area.	U.S. Department of Transportation
CRIME	Serious crimes per 100,000 population	U.S.A. Counties
COGRAD	Percentage of people >25 years who have graduated from college	U.S.A. Counties

Appendix A. Variable Names, Definitions and Sources (continued)

WOODEARN	Lumber and wood products (SIC 24) payroll earnings divided by total county payroll	Bureau of Labor Statistics
DIVIDEND	% of personal income derived from dividends	Regional economic information systems
EMPDEN	Total employment divided by county land area.	City and County Data Book
UNEMPLOY	Unemployment rate	City and County Data Book
JANTEMP	Average daily high temperature in January	McGranahan, 1999.
JANSUN	Average daily hours of sunlight in January	McGranahan, 1999.
JULYTEMP	Average daily high temperature in July	McGranahan, 1999.
JULYHUMID	Average daily high humidity in July	McGranahan, 1999.
JANRAIN	Average January rainfall in the largest city/town in the county	Western Regional Climate Center, Western U.S. Climate Historical Summaries
BIGMETRO	Indicator variable equal to 1 if the county is in Portland or Seattle MSA.	Rand McNally Road Atlas
COAST	Indicator variable equal to 1 if the county is on the Pacific coast	Rand McNally Road Atlas
WILD	Percentage of county land classified as wilderness	U.S. Forest Service, Forest Inventory and Analysis Map Maker
STFOR	Percentage of county land managed by state forestry department	U.S. Forest Service, Forest Inventory and Analysis Map Maker
NATFOR	Percentage of county land managed by U.S. Forest Service, not counting acres in wilderness areas	U.S. Forest Service, Forest Inventory and Analysis Map Maker

Appendix A. Variable Names, Definitions and Sources (Continued)

BLM	Percentage of county land managed by Bureau of Land Management, not counting acres in wilderness areas	U.S. Forest Service, Forest Inventory and Analysis Map Maker
NATPARK	Percentage of county land managed by National Park Service	U.S. Forest Service, Forest Inventory and Analysis Map Maker
RESERVED	Percentage of county land classified as late successional reserves, adaptive management area, managed late successional reserves, or riparian reserves under the NWFP.	Northwest Forest Plan Regional Ecosystem Office and own calculations (see text)
UNRESERVED	Percentage of county land classified as matrix land under the NWFP	Northwest Forest Plan Regional Ecosystem Office and own calculations (see text)
ADJNWFP	Indicator variable that takes the value 1 if a county does not contain NWFP land but is adjacent to a county that does	Northwest Forest Plan Regional Ecosystem Office

Appendix B. Acronyms used

BLM – Bureau of Land Management

BLS – Bureau of Labor Statistics

CUSUM – Cumulative sum of residuals

ESA - Endangered Species Act

FEMAT - Forest Management Assessment Team

HCA – Habitat Conservation Area

ISC - Interagency Scientific Committee

LCV - League of Conservation Voters

LSOG - Late-successional old growth

LSR - Late Successional Reserve

MSA - metropolitan statistical areas

NAICS – North American Industrial Classification System

NEPA - National Environmental Policy Act

NFMA - National Forest Management Act

NWFP - Northwest Forest Plan

REO - Regional Ecosystem Office

RESET – Regression Error Specification Test

ROD – Record of Decision

SAT - Scientific Analysis Team

SIC – Standard industrial classification

SLA - Softwood Lumber Agreement

USDA – United States Department of Agriculture

USFS – United States Forest Service

Appendix C. Chapter Four structural equation results

Distinguishing the effects of land management in metropolitan and rural counties

Three Stage Least Squares parameter estimates when land management in Metropolitan and Rural counties is distinguished, 1980-1990

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.218	[.311]	**Constant**	-1.503	[.015]
EG	0.386	[.000]	**NM**	1.246	[.003]
OR	-0.104	[.015]	**OR**	-0.042	[.801]
WA	-0.124	[.011]	**WA**	0.113	[.454]
INTER5	0.011	[.540]	**INTER5**	0.039	[.460]
METRO	-0.033	[.214]	**METRO**	0.176	[.019]
INCOME	0.000	[.003]	**HSGRAD**	0.009	[.115]
HEALTHEXP	0.193	[.038]	**COGRAD**	0.018	[.000]
EDUCEXP	-0.121	[.273]	**WOODEARN**	0.027	[.811]
POPDEN	0.046	[.422]	**ROADDEN**	909.633	[.015]
EXPTAX	-0.007	[.313]	**DVIDEND**	0.519	[.430]
OWNHOME	0.009	[.000]	**UNEMPLOY**	0.004	[.629]
ROADDEN	-84.001	[.507]	**EMPDEN**	-0.565	[.071]
CRIME	0.000	[.057]	**JANTEMP**	-0.002	[.674]
JANTEMP	0.003	[.149]	**JANSUN**	0.001	[.296]
JANSUN	-0.001	[.053]	**JULYTEMP**	0.005	[.327]
JULYTEMP	-0.002	[.251]	**JULYHUMID**	-0.001	[.789]
JULYHUMID	-0.002	[.028]	**JANRAIN**	-0.004	[.585]
JANRAIN	0.002	[.402]	**COAST**	0.094	[.161]

Three Stage Least Squares parameter estimates when land management in Metropolitan and Rural counties is distinguished, 1980-1990 (Continued)

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
COAST	-0.017	[.472]	**BIGMETRO**	-0.036	[.727]
BIGMETRO	0.009	[.797]	**EDUCEXP**	0.611	[.040]
FEDEXP	0.011	[.014]	**FEDEXP**	-0.042	[.002]
WILDmetro	0.118	[.440]	**WILDmetro**	0.129	[.774]
STFORmetro	0.361	[.043]	**STFORmetro**	-0.637	[.222]
NATFORmetro	-0.081	[.510]	**NATFORmetro**	-0.087	[.804]
BLMmetro	0.204	[.593]	**BLMmetro**	-0.853	[.431]
NATPARKmetro	-0.369	[.892]	**NATPARKmetro**	-2.271	[.785]
WILDrural	0.047	[.471]	**WILDrural**	0.090	[.663]
STFORrural	0.033	[.670]	**STFORrural**	0.119	[.598]
NATFORrural	-0.091	[.080]	**NATFORrural**	0.178	[.232]
BLMrural	-0.134	[.330]	**BLMrural**	0.228	[.578]
NATPARKrural	3.702	[.000]	**NATPARKrural**	-7.671	[.005]
Mean of dependent variable		0.078		0.289	
Standard deviation		0.117		0.272	
r squared		0.841		0.754	

Three Stage Least Squares parameter estimates when land management in Metropolitan and Rural counties is distinguished, 1990 - 1992

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.191	[.038]	**Constant**	-0.104	[.717]
EG	0.315	[.000]	**NM**	1.111	[.006]
OR	0.003	[.870]	**OR**	-0.013	[.792]
WA	0.015	[.422]	**WA**	-0.040	[.421]
INTER5	0.009	[.147]	**INTER5**	-0.014	[.421]
METRO	0.026	[.003]	**METRO**	-0.024	[.312]
INCOME	0.000	[.281]	**HSGRAD**	0.004	[.093]
HEALTHEXP	0.028	[.273]	**COGRAD**	0.003	[.034]
EDUCEXP	0.076	[.024]	**WOODEARN**	-0.026	[.598]
POPDEN	0.018	[.332]	**ROADDEN**	56.616	[.585]
EXPTAX	-0.001	[.506]	**DVIDEND**	0.179	[.276]
OWNHOME	0.003	[.000]	**UNEMPLOY**	0.004	[.233]
ROADDEN	2.395	[.953]	**EMPDEN**	-0.217	[.014]
CRIME	0.000	[.371]	**JANTEMP**	-0.005	[.013]
JANTEMP	0.002	[.000]	**JANSUN**	0.000	[.984]
JANSUN	0.000	[.714]	**JULYTEMP**	0.001	[.728]
JULYTEMP	-0.001	[.426]	**JULYHUMID**	-0.001	[.209]
JULYHUMID	0.000	[.671]	**JANRAIN**	0.004	[.092]
JANRAIN	-0.002	[.023]	**COAST**	-0.007	[.788]
COAST	-0.006	[.504]	**BIGMETRO**	0.016	[.580]
BIGMETRO	-0.006	[.542]	**EDUCEXP**	-0.223	[.006]
FEDEXP	-0.002	[.298]	**FEDEXP**	0.004	[.369]

Three Stage Least Squares parameter estimates when land management in Metropolitan and Rural counties is distinguished, 1990 – 1992 (Continued)

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
WILDmetro	-0.029	[.506]	**WILDmetro**	-0.022	[.860]
STFORmetro	0.067	[.244]	**STFORmetro**	0.036	[.816]
NATFORmetro	0.130	[.082]	**NATFORmetro**	-0.549	[.006]
BLMmetro	0.442	[.009]	**BLMmetro**	-1.335	[.005]
NATPARKmetro	3.071	[.003]	**NATPARKmetro**	-5.540	[.078]
WILDrural	-0.031	[.258]	**WILDrural**	0.106	[.163]
STFORrural	-0.017	[.509]	**STFORrural**	0.054	[.449]
NATFORrural	0.107	[.000]	**NATFORrural**	-0.330	[.000]
BLMrural	-0.045	[.389]	**BLMrural**	0.269	[.080]
NATPARKrural	1.163	[.001]	**NATPARKrural**	-0.575	[.607]
PUBLICHARV	0.045	[.025]	**1993 INCOME**	0.000	[.897]
1993 WOODEARN	0.008	[.611]	**PUBLICHARV**	-0.089	[.149]
TIMBERPAY	0.000	[.204]	**TIMBERPAY**	0.000	[.000]
BUSHVOTE	-0.001	[.000]	**BUSHVOTE**	0.002	[.017]
LCV	0.000	[.308]	**LCV**	0.000	[.873]
GOPREP	-0.041	[.011]	**GOPREP**	0.078	[.112]
ROADLESS	0.012	[.211]	**ROADLESS**	-0.043	[.059]
LSOGmetro	-2.380	[.008]	**LSOGmetro**	8.237	[.000]
LSOGrural	-0.667	[.131]	**LSOGrural**	3.463	[.001]
Mean of dependent variable		0.029		0.042	
Standard deviation of dependent variable		0.025		0.080	
r squared		0.628		0.686	

Three Stage Least Squares parameter estimates when land management in Metropolitan and Rural counties is distinguished, 1992 – 1994

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.232	[.001]	**Constant**	-0.220	[.605]
EG	0.139	[.000]	**NM**	1.510	[.043]
OR	0.042	[.000]	**OR**	0.126	[.115]
WA	0.050	[.000]	**WA**	0.079	[.360]
INTER5	0.001	[.853]	**INTER5**	-0.055	[.042]
METRO	0.006	[.470]	**METRO**	-0.002	[.955]
INCOME	0.000	[.760]	**HSGRAD**	0.002	[.559]
HEALTHEXP	0.002	[.948]	**COGRAD**	0.003	[.243]
EDUCEXP	-0.001	[.961]	**WOODEARN**	-0.225	[.009]
POPDEN	-0.009	[.612]	**ROADDEN**	97.126	[.600]
EXPTAX	0.001	[.483]	**DVIDEND**	0.283	[.264]
OWNHOME	0.002	[.000]	**UNEMPLOY**	0.022	[.001]
ROADDEN	-34.737	[.407]	**EMPDEN**	-0.056	[.663]
CRIME	0.000	[.087]	**JANTEMP**	-0.001	[.678]
JANTEMP	0.001	[.039]	**JANSUN**	0.001	[.144]
JANSUN	0.000	[.169]	**JULYTEMP**	-0.003	[.228]
JULYTEMP	0.000	[.877]	**JULYHUMID**	0.001	[.575]
JULYHUMID	0.000	[.407]	**JANRAIN**	-0.005	[.183]
JANRAIN	0.000	[.735]	**COAST**	-0.055	[.177]
COAST	-0.017	[.023]	**BIGMETRO**	0.018	[.633]
BIGMETRO	-0.010	[.225]	**EDUCEXP**	-0.106	[.347]
FEDEXP	-0.001	[.132]	**FEDEXP**	-0.002	[.733]

Three Stage Least Squares parameter estimates when land management in Metropolitan and Rural counties is distinguished, 1992 – 1994 (Continued)

Net Migration Equation			Employment Growth Equation		
	Parameter	P-value		Parameter	P-value
RESERVEDmetro	0.068	[.381]	RESERVEDmetro	0.456	[.250]
UNRESERVEDmetro	-0.074	[.232]	UNRESERVEDmetro	-0.160	[.605]
STFORmetro	0.086	[.071]	STFORmetro	0.160	[.480]
NATPARKmetro	0.857	[.228]	NATPARKmetro	-1.122	[.740]
WILDmetro	-0.046	[.174]	WILDmetro	0.069	[.651]
ADJNWFPmetro	-0.001	[.908]	ADJNWFPmetro	0.097	[.057]
RESERVEDrural	0.035	[.359]	RESERVEDrural	0.260	[.155]
UNRESERVEDrural	-0.043	[.396]	UNRESERVEDrural	-0.235	[.315]
STFORrural	-0.015	[.551]	STFORrural	0.231	[.037]
NATPARKrural	-0.126	[.640]	NATPARKrural	0.094	[.935]
WILDrural	0.008	[.717]	WILDrural	-0.149	[.150]
ADJNWFPrural	0.001	[.994]	ADJNWFPrural	0.008	[.824]
Mean of dependent variable		0.025		0.063	
Standard deviation of dependent variable		0.026		0.091	
r squared		0.773		0.623	

Three Stage Least Squares parameter estimates when land management in Metropolitan and Rural counties is distinguished, 1994 – 2003; CORRECTED FOR SPATIAL AUTOCORRELATION

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	0.344	[.258]	**Constant**	-2.743	[.000]
EG	0.334	[.000]	**NM**	0.185	[.678]
OR	0.139	[.000]	**OR**	0.073	[.570]
WA	0.152	[.000]	**WA**	0.083	[.533]
INTER5	-0.011	[.554]	**INTER5**	-0.067	[.141]
METRO	0.035	[.228]	**METRO**	0.161	[.018]
INCOME	0.000	[.001]	**HSGRAD**	0.027	[.000]
HEALTHEXP	-0.005	[.968]	**COGRAD**	0.020	[.000]
EDUCEXP	-0.135	[.230]	**WOODEARN**	-0.235	[.101]
POPDEN	0.208	[.001]	**ROADDEN**	571.744	[.103]
EXPTAX	-0.003	[.092]	**DVIDEND**	-0.215	[.591]
OWNHOME	0.006	[.004]	**UNEMPLOY**	0.009	[.360]
ROADDEN	-696.582	[.000]	**EMPDEN**	-0.499	[.037]
CRIME	0.000	[.464]	**JANTEMP**	0.015	[.003]
JANTEMP	0.005	[.005]	**JANSUN**	0.000	[.908]
JANSUN	0.001	[.037]	**JULYTEMP**	0.009	[.124]
JULYTEMP	-0.010	[.000]	**JULYHUMID**	-0.005	[.011]
JULYHUMID	-0.001	[.162]	**JANRAIN**	0.002	[.693]
JANRAIN	-0.002	[.375]	**COAST**	-0.007	[.903]
COAST	-0.074	[.002]	**BIGMETRO**	-0.014	[.830]
BIGMETRO	-0.014	[.662]	**EDUCEXP**	-0.294	[.237]
FEDEXP	-0.017	[.000]	**FEDEXP**	-0.014	[.220]

Three Stage Least Squares parameter estimates when land management in Metropolitan and Rural counties is distinguished, 1994 – 2003; CORRECTED FOR SPATIAL AUTOCORRELATION (Continued)

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
RESERVEDmetro	0.184	[.527]	**RESERVEDmetro**	-0.104	[.880]
UNRESERVEDmetro	-0.215	[.384]	**UNRESERVEDmetro**	-0.318	[.586]
STFORmetro	0.210	[.244]	**STFORmetro**	-0.278	[.516]
NATPARKmetro	4.207	[.112]	**NATPARKmetro**	-0.480	[.939]
WILDmetro	-0.117	[.388]	**WILDmetro**	-0.036	[.904]
ADJNWFPmetro	0.114	[.002]	**ADJNWFPmetro**	-0.244	[.009]
RESERVEDrural	-0.166	[.176]	**RESERVEDrural**	0.000	[.999]
UNRESERVEDrural	0.251	[.174]	**UNRESERVEDrural**	0.558	[.177]
STFORrural	0.107	[.172]	**STFORrural**	0.276	[.143]
NATPARKrural	0.069	[.948]	**NATPARKrural**	-1.872	[.383]
WILDrural	-0.041	[.612]	**WILDrural**	0.455	[.006]
ADJNWFPrural	0.048	[.056]	**ADJNWFPrural**	0.127	[.046]
Mean of dependent variable		0.101		0.309	
Standard deviation of dependent variable		0.093		0.187	
r squared		0.810		0.743	

Distinguishing NWFP effects on employment in distinct industry sectors

Three Stage Least Squares parameter estimates for agricultural employment growth and net migration, 1980-1990; CORRECTED FOR SPATIAL AUTOCORRELATION

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-1.639	[.007]	**Constant**	35.250	[.031]
EG	0.036	[.005]	**NM**	17.488	[.173]
OR	-0.207	[.000]	**OR**	4.413	[.348]
WA	-0.192	[.008]	**WA**	5.807	[.111]
INTER5	-0.040	[.106]	**INTER5**	0.537	[.660]
METRO	0.098	[.001]	**METRO**	-1.007	[.494]
INCOME	0.000	[.569]	**HSGRAD**	-0.465	[.004]
HEALTHEXP	-0.053	[.765]	**COGRAD**	0.144	[.219]
EDUCEXP	-0.151	[.403]	**WOODEARN**	-3.298	[.399]
POPDEN	0.032	[.729]	**ROADDEN**	1129.530	[.912]
EXPTAX	-0.068	[.008]	**DVIDEND**	-18.320	[.389]
OWNHOME	0.021	[.000]	**UNEMPLOY**	0.592	[.070]
ROADDEN	277.285	[.144]	**EMPDEN**	1.295	[.876]
CRIME	0.000	[.253]	**JANTEMP**	-0.325	[.007]
JANTEMP	0.012	[.000]	**JANSUN**	0.043	[.163]
JANSUN	-0.001	[.087]	**JULYTEMP**	-0.136	[.343]
JULYTEMP	0.003	[.366]	**JULYHUMID**	0.004	[.952]
JULYHUMID	-0.001	[.644]	**JANRAIN**	0.411	[.038]
JANRAIN	-0.015	[.003]	**COAST**	0.520	[.748]
COAST	-0.006	[.856]	**BIGMETRO**	-1.172	[.594]
BIGMETRO	-0.003	[.954]	**EDUCEXP**	1.011	[.909]
FEDEXP	0.014	[.065]	**FEDEXP**	-0.092	[.790]

Three Stage Least Squares parameter estimates for agricultural employment growth and net migration, 1980-1990; CORRECTED FOR SPATIAL AUTOCORRELATION (Continued)

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
WILD	0.344	[.002]	**WILD**	-6.962	[.216]
STFOR	0.193	[.110]	**STFOR**	1.840	[.730]
NATFOR	0.014	[.850]	**NATFOR**	2.014	[.576]
BLM	0.302	[.183]	**BLM**	-9.992	[.446]
NATPARK	3.160	[.070]	**NATPARK**	-115.194	[.125]
Mean of dependent variable		0.078		2.753	
Standard deviation		0.117		4.834	
r squared		0.656		.513	

Three Stage Least Squares parameter estimates for agricultural employment growth and net migration, 1990 – 1992; CORRECTED FOR SPATIAL AUTOCORRELATION

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.147	[.070]	**Constant**	-2.241	[.140]
EG	0.008	[.588]	**NM**	-11.926	[.000]
OR	0.005	[.753]	**OR**	0.318	[.169]
WA	0.025	[.141]	**WA**	0.484	[.027]
INTER5	-0.005	[.389]	**INTER5**	-0.040	[.591]
METRO	0.020	[.003]	**METRO**	0.366	[.000]
INCOME	0.000	[.424]	**HSGRAD**	-0.008	[.544]
HEALTHEXP	0.075	[.032]	**COGRAD**	-0.027	[.007]
EDUCEXP	0.035	[.270]	**WOODEARN**	0.472	[.079]
POPDEN	-0.003	[.877]	**ROADDEN**	342.559	[.591]
EXPTAX	-0.003	[.182]	**DVIDEND**	6.040	[.000]
OWNHOME	0.003	[.000]	**UNEMPLOY**	0.007	[.795]
ROADDEN	25.099	[.611]	**EMPDEN**	-0.976	[.051]
CRIME	0.000	[.887]	**JANTEMP**	0.003	[.737]
JANTEMP	0.001	[.016]	**JANSUN**	0.001	[.572]
JANSUN	0.000	[.977]	**JULYTEMP**	0.004	[.715]
JULYTEMP	-0.001	[.261]	**JULYHUMID**	0.006	[.132]
JULYHUMID	0.000	[.611]	**JANRAIN**	-0.006	[.570]
JANRAIN	-0.001	[.307]	**COAST**	-0.234	[.028]
COAST	-0.010	[.144]	**BIGMETRO**	0.173	[.129]
BIGMETRO	-0.001	[.894]	**EDUCEXP**	0.739	[.062]
FEDEXP	-0.001	[.709]	**FEDEXP**	0.046	[.074]

Three Stage Least Squares parameter estimates for agricultural employment growth and net migration, 1990 – 1992; CORRECTED FOR SPATIAL AUTOCORRELATION (Continued)

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
STFOR	0.012	[.603]	**STFOR**	0.104	[.735]
NATPARK	1.333	[.000]	**NATPARK**	18.371	[.002]
WILD	0.001	[.958]	**WILD**	0.418	[.136]
NATFOR	0.034	[.115]	**NATFOR**	0.051	[.882]
BLM	0.043	[.366]	**BLM**	1.538	[.062]
PUBLICHARV	0.023	[.230]	**1993 INCOME**	0.000	[.013]
1993 WOODEARN	-0.018	[.381]	**PUBLICHARV**	-0.188	[.534]
TIMBERPAY	0.000	[.132]	**TIMBERPAY**	-0.001	[.008]
BUSHVOTE	-0.001	[.012]	**BUSHVOTE**	-0.007	[.035]
LCV	0.000	[.210]	**LCV**	-0.002	[.651]
GOPREP	-0.025	[.120]	**GOPREP**	-0.124	[.613]
ROADLESS	-0.008	[.394]	**ROADLESS**	0.249	[.030]
LSOGSHARE	-0.001	[.998]	**LSOGSHARE**	-4.095	[.412]
Mean of dependent variable		0.029		0.084	
Standard deviation of dependent variable		0.025		0.371	
r squared		0.715		0.770	

Three Stage Least Squares parameter estimates for agricultural employment growth and net migration, 1992 – 1994; CORRECTED FOR SPATIAL AUTOCORRELATION AND RESERVED INSTRUMENTED

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.196	[.016]	**Constant**	1.167	[.698]
EG	0.008	[.278]	**NM**	0.601	[.912]
OR	0.054	[.000]	**OR**	-0.218	[.681]
WA	0.059	[.000]	**WA**	-0.002	[.997]
INTER5	-0.009	[.107]	**INTER5**	0.184	[.312]
METRO	0.013	[.052]	**METRO**	-0.178	[.335]
INCOME	0.000	[.008]	**HSGRAD**	-0.034	[.206]
HEALTHEXP	0.027	[.461]	**COGRAD**	0.009	[.662]
EDUCEXP	0.027	[.408]	**WOODEARN**	0.434	[.527]
POPDEN	0.016	[.406]	**ROADDEN**	1442.480	[.241]
EXPTAX	0.001	[.649]	**DVIDEND**	1.574	[.381]
OWNHOME	0.002	[.000]	**UNEMPLOY**	-0.030	[.534]
ROADDEN	-92.318	[.059]	**EMPDEN**	-0.107	[.896]
CRIME	0.000	[.134]	**JANTEMP**	0.005	[.771]
JANTEMP	0.001	[.007]	**JANSUN**	0.001	[.836]
JANSUN	0.000	[.132]	**JULYTEMP**	0.003	[.873]
JULYTEMP	0.000	[.788]	**JULYHUMID**	0.002	[.820]
JULYHUMID	0.000	[.390]	**JANRAIN**	-0.008	[.752]
JANRAIN	-0.001	[.348]	**COAST**	-0.172	[.496]
COAST	-0.018	[.024]	**BIGMETRO**	0.360	[.130]
BIGMETRO	-0.007	[.439]	**EDUCEXP**	-0.223	[.786]
FEDEXP	-0.003	[.016]	**FEDEXP**	0.021	[.561]

Three Stage Least Squares parameter estimates for agricultural employment growth and net migration, 1992 – 1994; CORRECTED FOR SPATIAL AUTOCORRELATION AND RESERVED INSTRUMENTED (Continued)

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
RESERVED	0.010	[.792]	**RESERVED**	-0.402	[.697]
UNRESERVED	-0.028	[.557]	**UNRESERVED**	1.081	[.401]
STFOR	0.040	[.091]	**STFOR**	0.268	[.713]
NATPARK	0.148	[.627]	**NATPARK**	6.637	[.421]
WILD	-0.003	[.905]	**WILD**	0.236	[.702]
ADJNWFP	0.005	[.502]	**ADJNWFP**	-0.086	[.678]
Mean of dependent variable		0.039		0.036	
Standard deviation of dependent variable		0.031		0.524	
r squared		0.787		0.326	

Three Stage Least Squares parameter estimates for agricultural employment growth and net migration, 1994 – 2000 CORRECTED FOR SPATIAL AUTOCORRELATION

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.191	[.411]	**Constant**	-2.161	[.261]
EG	0.095	[.000]	**NM**	-2.060	[.219]
OR	0.153	[.000]	**OR**	-0.592	[.068]
WA	0.159	[.000]	**WA**	-0.692	[.042]
INTER5	-0.008	[.611]	**INTER5**	-0.358	[.002]
METRO	0.031	[.100]	**METRO**	0.080	[.513]
INCOME	0.000	[.232]	**HSGRAD**	0.080	[.000]
HEALTHEXP	-0.313	[.002]	**COGRAD**	0.048	[.000]
EDUCEXP	-0.427	[.000]	**WOODEARN**	0.115	[.747]
POPDEN	0.014	[.827]	**ROADDEN**	-2710.670	[.003]
EXPTAX	-0.002	[.193]	**DVIDEND**	0.082	[.939]
OWNHOME	0.007	[.000]	**UNEMPLOY**	0.057	[.027]
ROADDEN	-153.191	[.309]	**EMPDEN**	1.978	[.001]
CRIME	0.000	[.953]	**JANTEMP**	0.053	[.000]
JANTEMP	-0.001	[.742]	**JANSUN**	-0.007	[.023]
JANSUN	0.001	[.003]	**JULYTEMP**	-0.060	[.000]
JULYTEMP	-0.002	[.422]	**JULYHUMID**	-0.022	[.000]
JULYHUMID	0.001	[.346]	**JANRAIN**	-0.030	[.084]
JANRAIN	-0.001	[.601]	**COAST**	-0.400	[.010]
COAST	-0.016	[.447]	**BIGMETRO**	-0.091	[.561]
BIGMETRO	-0.006	[.817]	**EDUCEXP**	1.039	[.120]
FEDEXP	-0.012	[.001]	**FEDEXP**	-0.030	[.364]

Three Stage Least Squares parameter estimates for agricultural employment growth and net migration, 1994 – 2000 CORRECTED FOR SPATIAL AUTOCORRELATION (Continued)

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
RESERVED	0.097	[.309]	**RESERVED**	-0.296	[.711]
UNRESERVED	-0.095	[.488]	**UNRESERVED**	1.517	[.091]
STFOR	-0.012	[.857]	**STFOR**	1.563	[.002]
NATPARK	-1.085	[.190]	**NATPARK**	-5.426	[.331]
WILD	-0.092	[.149]	**WILD**	0.606	[.160]
ADJNWFP	0.007	[.709]	**ADJNWFP**	0.240	[.076]
Mean of dependent variable		0.038		0.130	
Standard deviation of dependent variable		0.077		0.416	
r squared		0.787		0.535	

Three Stage Least Squares parameter estimates for service employment growth and net migration, 1980-1990; CORRECTED FOR SPATIAL AUTOCORRELATION

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.458	[.160]	**Constant**	-8.153	[.001]
EG	0.094	[.001]	**NM**	0.264	[.893]
OR	-0.198	[.001]	**OR**	-0.511	[.489]
WA	-0.144	[.041]	**WA**	-0.857	[.124]
INTER5	-0.014	[.543]	**INTER5**	-0.076	[.677]
METRO	0.070	[.010]	**METRO**	-0.319	[.155]
INCOME	0.000	[.795]	**HSGRAD**	0.080	[.001]
HEALTHEXP	-0.002	[.989]	**COGRAD**	0.047	[.008]
EDUCEXP	-0.069	[.690]	**WOODEARN**	-0.043	[.941]
POPDEN	-0.046	[.590]	**ROADDEN**	940.078	[.546]
EXPTAX	0.005	[.746]	**DVIDEND**	4.624	[.155]
OWNHOME	0.012	[.000]	**UNEMPLOY**	0.183	[.000]
ROADDEN	207.159	[.264]	**EMPDEN**	-1.278	[.308]
CRIME	0.000	[.035]	**JANTEMP**	-0.005	[.774]
JANTEMP	0.009	[.001]	**JANSUN**	-0.001	[.803]
JANSUN	-0.001	[.046]	**JULYTEMP**	0.018	[.417]
JULYTEMP	-0.005	[.059]	**JULYHUMID**	0.007	[.528]
JULYHUMID	-0.004	[.001]	**JANRAIN**	0.001	[.975]
JANRAIN	-0.008	[.059]	**COAST**	-0.173	[.475]

Three Stage Least Squares parameter estimates for service employment growth and net migration, 1980-1990; CORRECTED FOR SPATIAL AUTOCORRELATION (Continued)

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
COAST	0.043	[.173]	**BIGMETRO**	0.753	[.024]
BIGMETRO	0.026	[.565]	**EDUCEXP**	0.297	[.825]
FEDEXP	0.001	[.888]	**FEDEXP**	0.058	[.258]
NWIL	0.063	[.497]	**NWIL**	0.658	[.450]
STFOR	0.087	[.420]	**STFOR**	-0.504	[.520]
NATFOR	-0.101	[.199]	**NATFOR**	-0.042	[.937]
BLM	0.031	[.884]	**BLM**	-0.514	[.806]
NATPARK	2.661	[.087]	**NATPARK**	-37.299	[.001]
Mean of dependent variable		0.078		1.104	
Standard deviation		0.117		0.935	
r squared		0.670		0.718	

Three Stage Least Squares parameter estimates for service employment growth and net migration, 1990 – 1992; CORRECTED FOR SPATIAL AUTOCORRELATION

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.173	[.136]	**Constant**	-2.429	[.024]
EG	-0.008	[.799]	**NM**	-3.589	[.092]
OR	0.011	[.575]	**OR**	0.375	[.020]
WA	0.028	[.202]	**WA**	0.407	[.007]
INTER5	-0.006	[.255]	**INTER5**	-0.111	[.035]
METRO	0.019	[.004]	**METRO**	0.110	[.132]
INCOME	0.000	[.363]	**HSGRAD**	0.004	[.692]
HEALTHEXP	0.066	[.041]	**COGRAD**	-0.012	[.072]
EDUCEXP	0.042	[.225]	**WOODEARN**	-0.132	[.479]
POPDEN	0.005	[.804]	**ROADDEN**	-1335.440	[.004]
EXPTAX	-0.002	[.419]	**DVIDEND**	0.445	[.564]
OWNHOME	0.003	[.000]	**UNEMPLOY**	0.019	[.297]
ROADDEN	0.582	[.990]	**EMPDEN**	0.924	[.010]
CRIME	0.000	[.978]	**JANTEMP**	0.036	[.000]
JANTEMP	0.002	[.109]	**JANSUN**	0.000	[.899]
JANSUN	0.000	[.942]	**JULYTEMP**	0.010	[.230]
JULYTEMP	-0.001	[.463]	**JULYHUMID**	0.000	[.900]
JULYHUMID	0.000	[.587]	**JANRAIN**	-0.014	[.086]
JANRAIN	-0.001	[.360]	**COAST**	-0.047	[.527]
COAST	-0.010	[.156]	**BIGMETRO**	-0.001	[.989]
BIGMETRO	0.000	[.978]	**EDUCEXP**	0.989	[.000]
FEDEXP	0.000	[.963]	**FEDEXP**	0.034	[.073]

Three Stage Least Squares parameter estimates for service employment growth and net migration, 1990 – 1992; CORRECTED FOR SPATIAL AUTOCORRELATION (Continued)

Net Migration Equation			Employment Growth Equation		
	Parameter	P-value		Parameter	P-value
STFOR	0.013	[.572]	STFOR	0.223	[.292]
NATPARK	1.582	[.113]	NATPARK	37.236	[.000]
WILD	0.001	[.964]	WILD	-0.015	[.938]
NATFOR	0.034	[.295]	NATFOR	0.948	[.000]
BLM	0.042	[.422]	BLM	0.492	[.408]
PUBLICHARV	0.023	[.229]	1993 INCOME	0.000	[.206]
1993 WOODEARN	-0.023	[.194]	PUBLICHARV	0.115	[.585]
TIMBERPAY	0.000	[.118]	TIMBERPAY	-0.001	[.000]
BUSHVOTE	0.000	[.060]	BUSHVOTE	-0.006	[.011]
LCV	0.000	[.173]	LCV	-0.005	[.034]
GOPREP	-0.026	[.181]	GOPREP	-0.532	[.002]
ROADLESS	-0.009	[.412]	ROADLESS	-0.001	[.989]
LSOGSHARE	0.043	[.907]	LSOGSHARE	-2.724	[.442]
Mean of dependent variable		0.029		0.185	
Standard deviation of dependent variable		0.025		0.343	
r squared		0.715		0.874	

Three Stage Least Squares parameter estimates for service employment growth and net migration, 1992 – 1994; CORRECTED FOR SPATIAL AUTOCORRELATION AND RESERVED LAND INSTRUMENTED

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.229	[.041]	**Constant**	0.908	[.332]
EG	0.010	[.765]	**NM**	0.902	[.606]
OR	0.056	[.000]	**OR**	-0.045	[.783]
WA	0.061	[.000]	**WA**	-0.172	[.346]
INTER5	-0.008	[.182]	**INTER5**	-0.121	[.029]
METRO	0.010	[.270]	**METRO**	0.194	[.001]
INCOME	0.000	[.062]	**HSGRAD**	0.026	[.002]
HEALTHEXP	0.014	[.785]	**COGRAD**	0.018	[.004]
EDUCEXP	0.011	[.753]	**WOODEARN**	-0.375	[.078]
POPDEN	0.008	[.708]	**ROADDEN**	-1052.030	[.005]
EXPTAX	0.002	[.422]	**DVIDEND**	-1.534	[.006]
OWNHOME	0.002	[.000]	**UNEMPLOY**	0.031	[.035]
ROADDEN	-56.318	[.315]	**EMPDEN**	0.481	[.056]
CRIME	0.000	[.364]	**JANTEMP**	0.003	[.648]
JANTEMP	0.002	[.009]	**JANSUN**	-0.003	[.056]
JANSUN	0.000	[.171]	**JULYTEMP**	-0.026	[.000]
JULYTEMP	0.000	[.974]	**JULYHUMID**	-0.007	[.002]
JULYHUMID	0.000	[.587]	**JANRAIN**	0.007	[.341]
JANRAIN	-0.001	[.418]	**COAST**	-0.146	[.063]

Three Stage Least Squares parameter estimates for service employment growth and net migration, 1992 – 1994; CORRECTED FOR SPATIAL AUTOCORRELATION AND RESERVED LAND INSTRUMENTED (Continued)

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
COAST	-0.018	[.064]	**BIGMETRO**	-0.037	[.606]
BIGMETRO	-0.004	[.674]	**EDUCEXP**	-0.769	[.002]
FEDEXP	-0.001	[.318]	**FEDEXP**	-0.024	[.031]
RESERVED	0.006	[.871]	**RESERVED**	0.397	[.212]
UNRESERVED	-0.020	[.696]	**UNRESERVED**	0.709	[.073]
STFOR	0.028	[.360]	**STFOR**	0.485	[.030]
NATPARK	0.220	[.558]	**NATPARK**	-10.583	[.000]
WILD	0.005	[.848]	**WILD**	-0.109	[.563]
ADJNWFP	0.000	[.994]	**ADJNWFP**	0.191	[.003]
Mean of dependent variable		0.025		0.038	
Standard deviation of dependent variable		0.026		0.212	
r squared		0.664		0.620	

Three Stage Least Squares parameter estimates for service employment growth and net migration, 1994 – 2000; CORRECTED FOR SPATIAL AUTOCORRELATION AND RESERVED INSTRUMENTED

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	0.098	[.693]	**Constant**	0.354	[.947]
EG	-0.003	[.895]	**NM**	-1.018	[.814]
OR	0.063	[.035]	**OR**	-0.574	[.501]
WA	0.060	[.068]	**WA**	-0.513	[.539]
INTER5	-0.025	[.192]	**INTER5**	0.974	[.001]
METRO	0.013	[.546]	**METRO**	-1.020	[.002]
INCOME	0.000	[.548]	**HSGRAD**	-0.032	[.529]
HEALTHEXP	-0.174	[.099]	**COGRAD**	-0.063	[.063]
EDUCEXP	-0.188	[.199]	**WOODEARN**	0.593	[.552]
POPDEN	0.151	[.018]	**ROADDEN**	3381.530	[.171]
EXPTAX	-0.004	[.030]	**DVIDEND**	4.503	[.130]
OWNHOME	0.007	[.000]	**UNEMPLOY**	-0.077	[.253]
ROADDEN	-431.538	[.008]	**EMPDEN**	-3.044	[.064]
CRIME	0.000	[.976]	**JANTEMP**	0.008	[.777]
JANTEMP	0.004	[.010]	**JANSUN**	-0.004	[.604]
JANSUN	0.000	[.471]	**JULYTEMP**	0.089	[.021]
JULYTEMP	-0.007	[.004]	**JULYHUMID**	-0.010	[.425]
JULYHUMID	-0.001	[.115]	**JANRAIN**	0.007	[.882]
JANRAIN	-0.002	[.383]	**COAST**	0.395	[.276]

Three Stage Least Squares parameter estimates for service employment growth and net migration, 1994 – 2000; CORRECTED FOR SPATIAL AUTOCORRELATION AND RESERVED INSTRUMENTED (Continued)

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
COAST	-0.038	[.069]	**BIGMETRO**	0.784	[.058]
BIGMETRO	-0.023	[.407]	**EDUCEXP**	-3.753	[.034]
FEDEXP	-0.011	[.006]	**FEDEXP**	-0.044	[.577]
RESERVED	-0.054	[.604]	**RESERVED**	-0.775	[.676]
UNRESERVED	0.172	[.201]	**UNRESERVED**	-3.976	[.119]
STFOR	0.091	[.164]	**STFOR**	-1.343	[.275]
NATPARK	-0.687	[.441]	**NATPARK**	-12.406	[.396]
WILD	0.016	[.823]	**WILD**	-1.223	[.206]
ADJNWFP	0.037	[.119]	**ADJNWFP**	-0.834	[.022]
Mean of dependent variable		0.038		0.839	
Standard deviation of dependent variable		0.077		1.088	
r squared		0.742		0.617	

Three Stage Least Squares parameter estimates for manufacturing employment growth and net migration, 1980-1990

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	0.989	[.072]	**Constant**	-9.808	[.001]
EG	0.189	[.000]	**NM**	1.676	[.400]
OR	-0.221	[.022]	**OR**	0.270	[.727]
WA	-0.240	[.040]	**WA**	0.496	[.490]
INTER5	0.102	[.037]	**INTER5**	-0.407	[.112]
METRO	0.098	[.035]	**METRO**	-0.409	[.128]
INCOME	0.000	[.608]	**HSGRAD**	0.012	[.604]
HEALTHEXP	0.231	[.242]	**COGRAD**	0.038	[.046]
EDUCEXP	-0.786	[.019]	**WOODEARN**	-0.305	[.586]
POPDEN	0.029	[.833]	**ROADDEN**	1707.250	[.382]
EXPTAX	0.014	[.406]	**DVIDEND**	2.300	[.457]
OWNHOME	0.010	[.015]	**UNEMPLOY**	0.000	[.993]
ROADDEN	56.705	[.856]	**EMPDEN**	-1.304	[.419]
CRIME	0.000	[.445]	**JANTEMP**	-0.020	[.479]
JANTEMP	0.007	[.105]	**JANSUN**	0.008	[.200]
JANSUN	-0.002	[.071]	**JULYTEMP**	0.076	[.008]
JULYTEMP	-0.016	[.003]	**JULYHUMID**	-0.011	[.451]
JULYHUMID	0.000	[.818]	**JANRAIN**	0.029	[.430]
JANRAIN	-0.007	[.292]	**COAST**	1.002	[.003]

Three Stage Least Squares parameter estimates for manufacturing employment growth and net migration, 1980-1990 (Continued)

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
COAST	-0.176	[.013]	**BIGMETRO**	1.089	[.013]
BIGMETRO	-0.195	[.038]	**EDUCEXP**	4.734	[.004]
FEDEXP	-0.032	[.020]	**FEDEXP**	0.151	[.027]
WILD	0.239	[.120]	**WILD**	-0.651	[.534]
STFOR	-0.393	[.065]	**STFOR**	2.597	[.025]
NATFOR	-0.059	[.614]	**NATFOR**	0.169	[.812]
BLM	-0.091	[.800]	**BLM**	0.426	[.847]
NATPARK	0.810	[.723]	**NATPAR**	0.720	[.959]
Mean of dependent variable		0.078		0.191	
Standard deviation		0.117		1.035	
r squared		0.149		0.438	

Three Stage Least Squares parameter estimates for manufacturing employment growth and net migration, 1990 - 1992

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.160	[.061]	**Constant**	2.238	[.076]
EG	0.017	[.708]	**NM**	-0.197	[.109]
OR	0.013	[.434]	**OR**	-0.229	[.057]
WA	0.031	[.064]	**WA**	-0.011	[.782]
INTER5	-0.006	[.262]	**INTER5**	-0.109	[.019]
METRO	0.020	[.002]	**METRO**	-0.007	[.305]
INCOME	0.000	[.269]	**HSGRAD**	0.000	[.956]
HEALTHEXP	0.063	[.085]	**COGRAD**	0.140	[.307]
EDUCEXP	0.038	[.231]	**WOODEARN**	357.713	[.223]
POPDEN	0.006	[.770]	**ROADDEN**	-0.794	[.137]
EXPTAX	-0.002	[.450]	**DVIDEND**	-0.021	[.098]
OWNHOME	0.003	[.000]	**UNEMPLOY**	-0.329	[.175]
ROADDEN	0.654	[.990]	**EMPDEN**	-0.007	[.151]
CRIME	0.000	[.866]	**JANTEMP**	-0.001	[.311]
JANTEMP	0.002	[.008]	**JANSUN**	0.000	[.969]
JANSUN	0.000	[.817]	**JULYTEMP**	0.001	[.490]
JULYTEMP	-0.001	[.274]	**JULYHUMID**	-0.005	[.433]
JULYHUMID	0.000	[.623]	**JANRAIN**	0.010	[.867]
JANRAIN	-0.001	[.425]	**COAST**	0.080	[.205]
COAST	-0.011	[.127]	**BIGMETRO**	-0.444	[.032]
BIGMETRO	-0.002	[.781]	**EDUCEXP**	-0.042	[.001]
FEDEXP	0.000	[.885]	**FEDEXP**	0.008	[.964]

Three Stage Least Squares parameter estimates for manufacturing employment growth and net migration, 1990 – 1992 (Continued)

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
STFOR	0.010	[.669]	**STFOR**	-0.145	[.961]
NATPARK	1.265	[.000]	**NATPARK**	0.151	[.335]
WILD	0.000	[.986]	**WILD**	-0.594	[.000]
NATFOR	0.039	[.150]	**NATFOR**	0.167	[.667]
BLM	0.035	[.510]	**BLM**	0.000	[.433]
PUBLICHARV	0.019	[.317]	**1993 INCOME**	0.148	[.345]
1993 WOODEARN	-0.027	[.219]	**PUBLICHARV**	0.000	[.230]
TIMBERPAY	0.000	[.232]	**TIMBERPAY**	0.000	[.972]
BUSHVOTE	0.000	[.067]	**BUSHVOTE**	-0.001	[.730]
LCV	0.000	[.261]	**LCV**	0.031	[.805]
GOPREP	-0.022	[.156]	**GOPREP**	-0.046	[.439]
ROADLESS	-0.006	[.462]	**ROADLESS**	5.370	[.029]
LSOGSHARE	-0.086	[.812]	**LSOGSHARE**	2.238	[.076]
Mean of dependent variable		0.029		-0.073	
Standard deviation of dependent variable		0.025		0.148	
r squared		0.722		0.536	

Three Stage Least Squares parameter estimates for manufacturing employment growth and net migration, 1992 – 1994; CORRECTED FOR SPATIAL AUTOCORRELATION

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.205	[.003]	**Constant**	-27.001	[.020]
EG	0.006	[.000]	**NM**	21.035	[.346]
OR	0.031	[.008]	**OR**	4.750	[.021]
WA	0.049	[.000]	**WA**	4.548	[.046]
INTER5	-0.006	[.251]	**INTER5**	-0.361	[.597]
METRO	0.008	[.211]	**METRO**	1.745	[.016]
INCOME	0.000	[.831]	**HSGRAD**	0.068	[.508]
HEALTHEXP	0.065	[.057]	**COGRAD**	0.048	[.528]
EDUCEXP	0.006	[.842]	**WOODEARN**	-4.616	[.078]
POPDEN	-0.021	[.265]	**ROADDEN**	3103.440	[.503]
EXPTAX	-0.004	[.039]	**DVIDEND**	23.838	[.001]
OWNHOME	0.002	[.000]	**UNEMPLOY**	0.746	[.000]
ROADDEN	5.771	[.898]	**EMPDEN**	-0.790	[.804]
CRIME	0.000	[.176]	**JANTEMP**	0.058	[.397]
JANTEMP	0.000	[.449]	**JANSUN**	0.040	[.014]
JANSUN	0.000	[.265]	**JULYTEMP**	-0.018	[.813]
JULYTEMP	0.000	[.826]	**JULYHUMID**	0.013	[.653]
JULYHUMID	0.000	[.301]	**JANRAIN**	0.086	[.368]
JANRAIN	-0.001	[.325]	**COAST**	-0.985	[.334]

Three Stage Least Squares parameter estimates for manufacturing employment growth and net migration, 1992 – 1994; CORRECTED FOR SPATIAL AUTOCORRELATION (Continued)

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
COAST	-0.017	[.013]	**BIGMETRO**	0.657	[.457]
BIGMETRO	-0.004	[.616]	**EDUCEXP**	3.144	[.314]
FEDEXP	-0.001	[.199]	**FEDEXP**	-0.135	[.339]
RESERVED	0.085	[.026]	**RESERVED**	-1.089	[.826]
UNRESERVED	-0.033	[.427]	**UNRESERVED**	-7.260	[.171]
STFOR	0.033	[.159]	**STFOR**	0.695	[.810]
NATPARK	0.307	[.271]	**NATPARK**	-8.450	[.785]
WILD	-0.029	[.179]	**WILD**	2.792	[.245]
ADJNWFP	-0.001	[.883]	**ADJNWFP**	1.105	[.160]
Mean of dependent variable		0.025		0.327	
Standard deviation of dependent variable		0.026		2.555	
r squared		0.734		0.597	

Three Stage Least Squares parameter estimates for manufacturing employment growth and net migration, 1994 - 2000

Net Migration Equation			Employment Growth Equation		
	Parameter	**P-value**		**Parameter**	**P-value**
Constant	-0.142	[.594]	**Constant**	3.713	[.489]
EG	-0.036	[.172]	**NM**	-3.803	[.442]
OR	0.114	[.004]	**OR**	0.470	[.604]
WA	0.120	[.010]	**WA**	0.511	[.596]
INTER5	-0.019	[.372]	**INTER5**	0.449	[.179]
METRO	0.028	[.247]	**METRO**	0.584	[.098]
INCOME	0.000	[.238]	**HSGRAD**	-0.051	[.349]
HEALTHEXP	-0.165	[.154]	**COGRAD**	-0.074	[.033]
EDUCEXP	-0.382	[.046]	**WOODEARN**	0.571	[.544]
POPDEN	0.059	[.396]	**ROADDEN**	444.152	[.860]
EXPTAX	-0.003	[.163]	**DVIDEND**	4.830	[.104]
OWNHOME	0.006	[.001]	**UNEMPLOY**	0.009	[.894]
ROADDEN	-233.475	[.163]	**EMPDEN**	-1.191	[.471]
CRIME	0.000	[.785]	**JANTEMP**	0.008	[.824]
JANTEMP	0.003	[.127]	**JANSUN**	0.001	[.885]
JANSUN	0.001	[.099]	**JULYTEMP**	0.020	[.604]
JULYTEMP	-0.002	[.497]	**JULYHUMID**	-0.004	[.785]
JULYHUMID	-0.001	[.574]	**JANRAIN**	0.030	[.539]
JANRAIN	-0.001	[.827]	**COAST**	-0.030	[.946]
COAST	-0.018	[.492]	**BIGMETRO**	0.181	[.689]
BIGMETRO	0.010	[.749]	**EDUCEXP**	-4.644	[.016]
FEDEXP	-0.007	[.167]	**FEDEXP**	0.015	[.876]

Three Stage Least Squares parameter estimates for manufacturing employment growth and net migration, 1994 – 2000 (Continued)

Net Migration Equation			**Employment Growth Equation**		
	Parameter	**P-value**		**Parameter**	**P-value**
RESERVED	-0.112	[.483]	**RESERVED**	-2.625	[.254]
UNRESERVED	0.114	[.463]	**UNRESERVED**	0.974	[.703]
STFOR	0.054	[.528]	**STFOR**	0.217	[.882]
NATPARK	-1.396	[.157]	**NATPARK**	-7.164	[.656]
WILD	-0.030	[.715]	**WILD**	-0.748	[.545]
ADJNWFP	0.002	[.954]	**ADJNWFP**	-0.330	[.390]
Mean of dependent variable		0.034		0.458	
Standard deviation of dependent variable		0.073		3.243	
r squared		0.711		0.315	