Plum Creek, UF, and Economic Growth in the Gainesville Region

(EASP – Data and Analysis – Economics)

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Note: While this report reflects the best professional judgment of the authors, it does not necessarily represent the views of the University of Florida (UF). This work was funded by Plum Creek, Inc., which compensated UF's Bureau of Economic and Business Research for the effort of Dewey, Schaub, student assistants, and a portion of Denslow's effort. The remainder of Denslow's compensation was as an independent consultant.

Summary

The Envision Alachua Sector Plan will propose approval of 14 million square feet of R&D, Office, and Manufacturing space on land owned by Plum Creek in eastern Alachua County. This workspace will eventually support 30,000 (or more) employees. The vision is to change the composition of the region's economic base to complement the University of Florida (UF), rather than simply to depend on it, so that most of these employees constitute new base employment above current trends. This report has two main purposes. First, to project economic growth in Gainesville and Alachua County under the status quo economic structure—in which growth depends almost entirely on traditional sources of UF revenue which are likely to remain under pressure in coming decades. Second, to determine whether it is reasonable to think base employment could expand enough to fill the space Plum Creek proposes to develop over the next half century if UF, Plum Creek, the state of Florida, and local citizens, businesses, and government collaborate to achieve that goal. Our main findings are as follows:

1. UF and related institutions, including Shands and spinoff companies, dominate base employment in Alachua County. In 2010, combining direct, indirect, and induced impacts, the University of Florida (UF) supported approximately 80% to 90% of earnings and employment in Alachua County. If the current economic structure does not change, 80% to 90% of growth will depend on growth in UF's traditional revenue sources.

2. We project economic growth in Alachua County given this status quo economic structure under two scenarios: one based on a moderately pessimistic extrapolation of UF revenues based on current conditions and trends and one based on a moderately optimistic extrapolation. In the pessimistic case, from 2010 to 2040 real earnings grow at an average annual rate of 0.5% and employment falls at an average annual rate of 0.3%. In the optimistic case, from 2010 to 2040 real earnings grow at an average annual rate of 2.3% and employment at an average annual rate of 1%. Averaging these scenarios gives an average annual employment growth rate from 2010 to 2040 of 0.4%, approximately 18,000 total jobs from 2010 to 2040, or 600 per year. By comparison, the average annual employment growth rate from 1990 through 2004 was 1.9%, corresponding to about 2,000 additional jobs annually. Moreover, there is a real possibility of slower growth under the status quo. Under the status quo, Gainesville will become a sleepy college town, with some chance of becoming a stagnant one, rather than a growing one as it has been in the past, with few local business partners for UF.

3. There are good reasons for UF, the state of Florida, local residents, local business owners, local governments, Plum Creek, and other local developers to collaborate in an effort to expand the economic base. A way for UF to augment limited growth in revenue from traditional sources is to collaborate with business partners. Such collaboration is most important within the local labor market. This requires a different local economic structure—in particular strong growth in the regional economic base aside from UF. The state of Florida would benefit from such growth in Alachua County as it would increase the return on the

substantial historical investment in UF. Similarly, residents of Alachua County stand to gain from such growth in the economic base for several reasons, e.g.: diluting the impact of UF's exemption from the property tax base, helping pay public employee pensions by raising the number of workers per retiree, and improving employment opportunities, particularly for those in the eastern part of the county.

4. Education, infrastructure, and local policies related to business and development influence firm and worker location decisions. The people in a region can make choices that favor faster growth. However, if counties very rarely grow much faster than trend, such choices would invite skepticism. But in fact counties often grow much faster than trend. Leading up to 2010, one in five of the 647 U.S. counties that had a population of at least 40,000 in 1950 grew more than 20 percentage points over trend from 1980 to 2010 (e.g. a county projected to grow 20% based on past trends actually growing over 40%). Over a span of 50 years, the frequency and size of large upward trend breaks is much higher—trend extrapolation is very uninformative about future growth over such a long time span. From 1960 to 2010, one in four counties grew more than 34 percentage points above the national growth rate, and one in five grew more than 59 percentage points above the level expected given its past growth rate.

5. Published evidence and our analysis suggest that mild winters, relatively high educational attainment, and the presence of UF place Alachua County in a strong position to achieve above trend growth, conditional on appropriate investment and collaboration among local and state stakeholders to create an environment conducive to business growth.

6. We estimate full employment in Alachua County in 2010 at approximately 130,000, though actual employment was lower due to the lingering effects of the Great Recession. Assuming (based on available data) approximately 60 percent of new jobs will be in the economic base, our analysis suggests that starting from this level of employment, one in five typical large counties (with a populations of at least 40,000 in 1950) would add 16,000 or more jobs to the economic base above trend in 30 years. Over 50 years, with time for major adaptation of infrastructure and for workers and firms to fully adapt to changes, much higher growth is possible, with one in five typical large counties adding 46,000 or more above trend jobs to the economic base. Thus, we conclude increasing base employment in Alachua County by 30,000 above trend over 50 years is a reasonable goal, under the circumstances assumed, with larger increases quite possible.

1. Introduction

In this report we consider the potential for growth in the Gainesville region. More specifically, we consider the role a collaboration between Plum Creek, the University of Florida (UF), local residents, local government, and the state of Florida, might play in improving the quality and increasing the quantity of economic growth in Alachua County. In coming decades, the quality of economic growth in Florida, thought of approximately as the wage of the typical job, will face a number of serious and mutually reinforcing challenges, discussed in detail in Dewey and Denslow (2012a) and Dewey and Denslow (2012b). To summarize, the automation and elimination of the routine jobs that once constituted the middle of the U.S. employment skill distribution, for example bookkeepers and factory workers, known as labor market polarization, is likely to continue. Vanishing routine jobs will be replaced by non-routine jobs that are either cognitive, which tend to be high-wage, or manual, which tend to be low-wage. The fact that Florida is starting out short on high-skill jobs and that high-skill jobs tend to locate where there are existing concentrations of high-skill jobs works against the state, as does the boost in demand for low-skill service jobs that will accompany the growing influence of baby-boom retirees. Public support for large investments in education and infrastructure in Florida, required to attract high-skill jobs, is stretched thin, reinforcing that trend. The political impact of baby boom retirees coupled with relative growth in low-wage employment, and thus slower real income growth, is likely to reduce that support even more.

The role of UF as the main driver of regional growth, together with likely slowdowns in traditional UF funding sources, will represent particular challenges for Gainesville. However, the presence of Florida's flagship university, the youth and high educational attainment of the area's population, and the fact that the region is as yet relatively undeveloped compared to the dense urban areas to the south, provides opportunities for vigorous and high quality economic growth unavailable to other regions in Florida—if developers, UF, residents, and state and local government choose to pursue them. We believe this to be in the best interests of UF, local residents, and the state of Florida. With less growth in enrollment and more competition for increasingly limited public funding, UF will need to turn to new and innovative sources to support its efforts to become a top 10 public university. From the state's point of view, its massive historical investment in UF is far less likely to become a stranded asset if UF is part of a vibrant, dynamic, rapidly growing regional economy than if it is located in a sleepy college town where the only major source of economic growth is the university itself.

The modern workhorse regional economic model is the Rosen-Roback model. In it, workers migrate to cities where wages are high relative to the cost of purchasing goods and services and amenities. In this context, "city" simply refers to an area that constitutes a more or less self-contained and integrated labor and housing market. Amenities refer to whatever makes one city a more pleasant place to live than another holding constant wages and prices. Sunshine, beaches, and plentiful outdoor activities are relevant examples. The primary driver of differences in the cost of goods and services is the cost of housing services, dictated largely by land costs, public policies related to permitting and growth, and investment in transportation and other basic infrastructure that increases the supply of housing within a given commute. As workers move into a city, they drive up land costs until the city becomes no more attractive to the marginal worker than their next best choice.

Firms and workers may be divided into those that produce for local consumption and those that produce for export to other cities within the nation or abroad. Export firms constitute the economic base, and other firms support firms and workers in the base—for example providing supplies, restaurants, and retail outlets. All else equal, export firms move to the city that offers the most profit potential for their industry. Competition for workers and space for offices or production facilities drives up wages and rents until the city is no longer more attractive than the next best alternative. Just as cities differ in the level of consumption amenities they offer consumers, they may differ in the productive amenities they offer firms, so costs are weighed in relation to productivity advantages. Important examples of productive amenities are differences in airports, ports, rail, roads, worker skill, and the level of innovative activity. These are driven in significant part by local investments in infrastructure, education, and research. In this framework, UF is the crucial regional productivity enhancing asset.

State and local policies and investments play a crucial role in shaping the level and composition of growth in the long run. The future level and composition of economic activity cannot be taken as an input to such decision making, but rather as one of the things to be decided. Planning to continue past practices so as to provide for meeting the demands of trend growth goes a long way toward ensuring the trend continues, while planning to meet the needs of a region growing faster and better than trend helps ensure the region will indeed do so. To put it succinctly, if Gainesville collectively chooses to grow better and faster than it has in the past, it is more likely to do so.

This approach to thinking about Alachua county's potential growth differs from the simpler but widely and successfully used trend extrapolation approach. This approach is exemplified by Rayer, Smith, and Tayman (2009), who state (on page 776) "Though simple in design, trend extrapolation techniques have been found to produce forecasts of total population that are at least as accurate as those produced by more complex methods …." By contrast Glaeser et al. (2011) sum up the case for using the Rosen-Roback approach to modeling regional growth as follows (on page 34): "To us, these findings support the view that regional and urban change is best understood not as the application of time-invariant growth processes, but rather as a set of responses by people and firms to large-scale technological change. The responses are quite amenable to formal modeling, but only to formal models that respect the changing nature of transportation and other technologies." To look at how a county, such as Alachua, or the larger Gainesville region, might grow differently in the future than in the past, conceptually the economic approach is essential. The trend method can do no more than estimate the chance of being an outlier conditional on behaving like a typical county. Using the Rosen-Roback model allows us to tap into an enormous body of theoretical and empirical literature and provides a framework for thinking about how local decisions impact deviations from past trends.

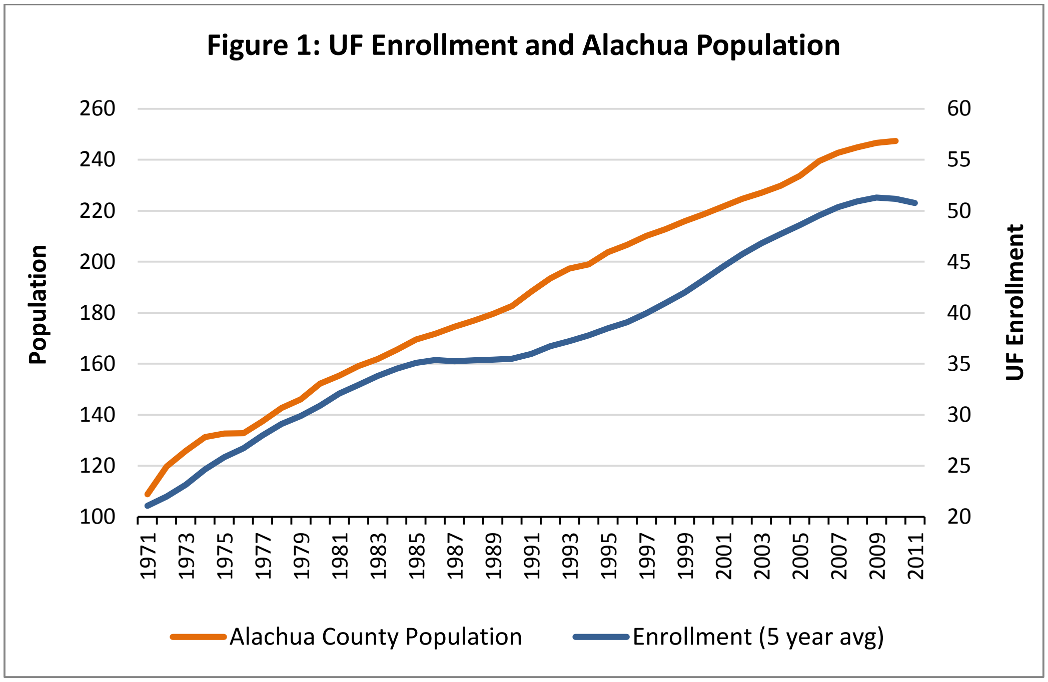
We make two basic arguments. First, Gainesville and UF need a new engine of economic growth if they are to become a dynamic city and university at the forefront of the knowledge economy, rather than stagnating. Second, despite the fact that projections that extrapolate from past trends suggest slow growth in coming decades, growth well above those projections is very possible—though not certain—with appropriate state and local policies and investments. The combination of UF, the land assembled by Plum Creek, and mild winters means Alachua is well positioned to grow faster and better—if collaboration between interested parties, sufficient investment in infrastructure, and appropriate state and local policies toward business and development are achieved.

The remainder of the report is organized as follows. Section 2 documents the degree of historical association between UF and the economy of Alachua County. Section 3 projects local economic growth for two alternative scenarios for enrollment and UF revenues, assuming the structure of the local economy and other underlying conditions and trends continue as in the past. Section 4 presents evidence regarding the probability of upward trend breaks in population and employment growth of a magnitude commensurate with the Plum Creek development plan. That is, while theory suggests Gainesville is more likely to grow faster and differently than it has in the past if it makes a concerted effort to do so, it does not say anything about the degree of increased probability. That requires empirical analysis. Section 5 applies the results of the empirical analysis of section 4 to Alachua County to illustrate the potential for accelerated growth of the local economic base. Section 6 concludes.

2. UF and Local Economic Growth

For decades, Gainesville has been the epitome of a college town. When UF was established in Alachua County in 1906, through a legislative consolidation of publicly funded colleges, the county's population was under 34,000. Over the years, as UF grew, Gainesville grew with it—as shown in Figures 1 and 2. In 2010, just over one student was enrolled per five county residents, and just over two were enrolled per five employees. UF has been central to the growth of Alachua's economy over time. Structurally, the area's economy depends on jobs created directly by UF and subsidiaries such as Shands, UF's supply chain including related construction, and businesses that support those employed by the University and its suppliers, for example restaurants and retailers. In this section we describe just how close the relationship between UF and Alachua County's economy has been historically.

Figure 3 depicts the sum of UF revenues and estimated student spending and total earnings in Alachua County from 1990 through 2010. Of course, for several reasons the relationship is not exact. First, all these variables are likely impacted by outside factors, for example national business cycles, which may impact different variables in different ways. This is particularly apparent in 2009 and 2010 in the graph showing the sum of UF revenue and student spending together with earnings in Alachua. Due to the recession, earnings were falling, yet due to increased federal revenue from the stimulus (the American Reinvestment and Recovery Act, ARRA), UF revenue rose. Second, UF policies may smooth revenues and enrollment over time. Third, some relationships work with a lag. However, the strong long run relationship between UF and Alachua County's economy is apparent.



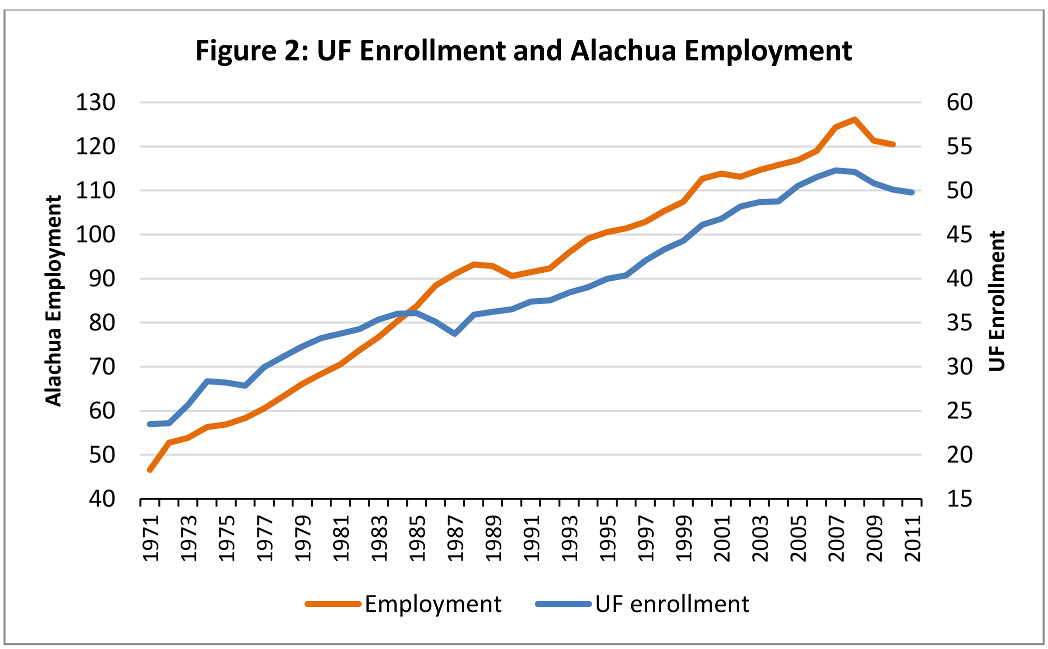
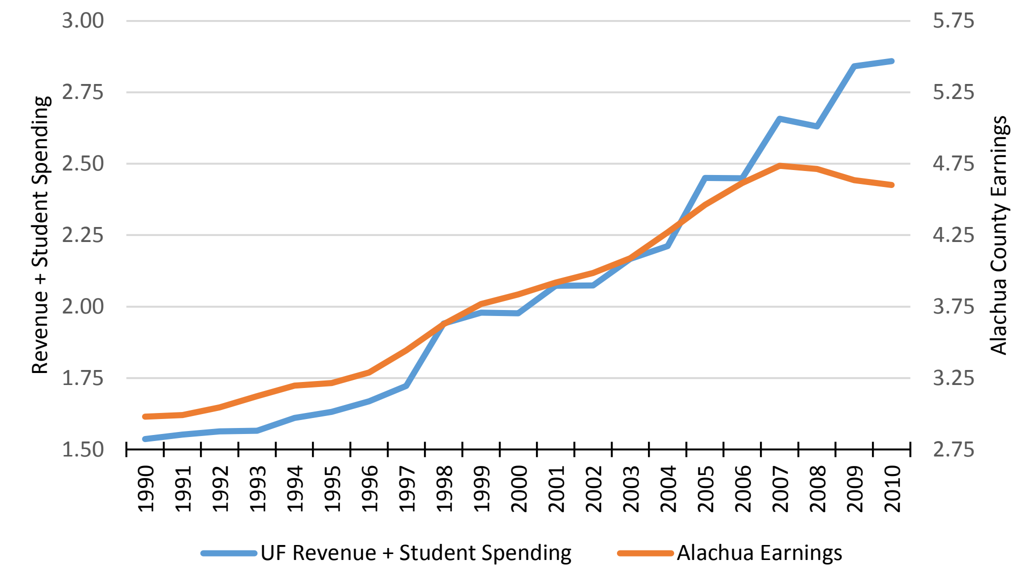


Figure 3: Revenue + Student Spending and Earnings



While Figures 1-3 clearly show that UF and Alachua County have tended to grow together over the years, they say nothing about how much of Alachua's economy is directly tied to UF and how much instead represents correlation due to outside factors. A simple way to analyze the impact of a given enterprise on economic activity within a region is with a multiplier analysis based on an input-output (I-O) model. We used RIMS II (Regional Input-Output Modeling System) employment and earnings multipliers from the U.S. Bureau of Economic Analysis (BEA). To estimate the impact of a given expenditure on final demand, the total expenditure is allocated across industries according to how it is spent, expenditures are multiplied by industry specific multipliers, and then the resulting products are summed.

To aid with the interpretation of the multipliers, consider the employment multiplier and suppose half of expenditures in industries in the economic base—those that produce things for sale or consumption outside the local region—are on wages and salaries and the other half on materials, supplies, space, and labor costs other than wages and salaries. Further suppose the salary for the typical job created is $50,000—slightly above the average earnings per non-farm wage and salary job in Florida. Then $1 million in expenditure means $500,000 in expenditure on wages and salaries, supporting 10 jobs. Finally, suppose one non base worker (for example physicians, construction contractors, retail clerks, and food service workers) on average provides the local goods and services (including the local non-labor purchases of base firms) needed to support three total workers—two in the economic base and themselves. Then 10 workers in the economic base create a demand for an additional 5 workers in local industries. The employment multiplier would be 15 jobs per $1 million of expenditure. While this is just an illustration with round numbers, hopefully it serves to make the logic of the multipliers easy to follow.

The results provide an estimate of the increase in final demand in the region associated with the base economic activity studied—in this case UF. They indicate the size of the hole that would be left in a regional economy were the activity removed. Further interpretation is complex and depends on many factors beyond the scope of a typical input-output multiplier analysis. Consider an exogenous expenditure cut resulting in a decrease in final labor demand equivalent to 1,000 jobs. If the regional and national economy are otherwise at full employment and if the area is attractive to business, new employers may quickly move in to hire those workers, while if the area is not otherwise attractive to new firms, highly mobile workers might quickly move to other regions to fill job postings. In conditions of high unemployment regionally and nationally, local unemployment may persist at a higher level for a long time, as competition among workers slowly drives down wages until a new equilibrium is reached. Put differently, this analysis sheds light on the degree to which the current economic structure in Alachua County depends on UF, but not on what adjustments would take place if UF were to shrink or grow by a large amount, or if some other element were to be added to the economic base.

Forty-five categories of UF expenditures were used, organized into seven different groups: operations, asset purchases, healthcare services, direct support organizations, Florida spin-off companies, student spending, and visitor spending. Data sources are described in the Data Appendix. For each of the forty-five categories, the most appropriate industry from the RIMS II multipliers was chosen, and the product of each expenditure and the appropriate multiplier was taken. Table 1 shows total expenditures for each of the seven groups for Fiscal Year (FY) 2010, the (weighted) average multipliers, and the total associated local final earnings and employment accounted for by these expenditures.

On average, $1 million of UF related spending supports 18.5 jobs in the county. By comparison, most of the spending on operations is for local salaries, not equipment, materials, or out of area purchases, so it supports more local jobs for a given expenditure. Similarly, one dollar spent on operations supports $1.09 in local earnings for the same reason, while the average dollar supports only $0.75 in earnings. In total, the analysis indicates $4.92 billion in UF expenditures supported $3.67 billion in local earnings and 91 thousand local jobs in FY 2010.

Averaging calendar years 2009 and 2010 to approximate FY 2010, according to data from the US Bureau of Labor Statistics (BLS) total employment (covered by unemployment insurance) in Alachua County was 116 thousand and total earnings was $4.56 billion. Thus UF related expenditures themselves account for approximately 80% of employment and earnings in Alachua County—with the fraction of earnings slightly higher than the fraction of employment, reflecting that jobs at UF pay somewhat more than other area jobs. Recall from Figure 3 that UF revenue continued to rise in 2009 and 2010 while the remainder of the local economy contracted during the recession. Hence, in a typical year, that fraction is likely somewhat smaller.

Table 1: UF FY 2010 Expenditures, Average Multipliers, and Local Impacts

Category	Spending ($Mil)	Multipliers: Earnings per $1	Multipliers: Jobs per $Mil	Final Demand: Earnings ($Mil)	Final Demand: Employment
Operations	1,577.8	1.092	25.2	1,722.4	39,726
Asset Purchases	349.4	0.420	11.1	146.8	3,879
Healthcare Services	1,541.6	0.639	15.0	984.8	23,104
Direct Support Orgs	106.4	0.822	20.6	87.5	2,190
Spin-off Companies	543.2	0.525	10.0	285.2	5,409
Student Spending	598.8	0.531	21.3	318.0	12,732
Visitor Spending	198.4	0.637	20.6	126.3	4,088
UF Total	4,915.5	0.747	18.5	3,671.0	91,130

UF has broader impacts as well. About 11% of Alachua County's population are retirees, many retired from jobs at UF or supported by UF. Their spending creates additional employment and earnings. Santa Fe College (SFC) is another major local employer which is in turn likely strongly associated with UF. First, state and community colleges generally serve mostly the local population, and as we have already shown most local employment, hence most local population, is tied to UF. Second, many students from other areas who ultimately want to transfer to UF complete their first two years at SFC. While UF accounts for the lion's share of the county's economic base, there is some employment in manufacturing and also in natural resources.

Table 2 shows the portion of local economic activity associated with each of these five sources: UF, retirees, SFC, manufacturing, and natural resources. Together they account for 98% of earnings and 96% of employment. There may be a small degree of double counting under manufacturing—since some UF spinoffs could be reflected there as well as in UF related spending. The residual, or unaccounted for, activity might arise because our calculations have left out some small source of base employment, for example local firms started by UF employees or ex UF employees not tracked as spinoffs, because the process of estimating multipliers and matching expenditures to industries is less than perfect, or because the estimates of total employment and earnings are themselves subject to error. The fact that the residual is so small suggests the analysis presents a reasonably complete picture of the local economy.

To approximate the full share of economic activity accounted for by UF, we apportion activity associated with retirees and SFC is between that tied to UF and that not according to the percentages of earnings and employment directly accounted for by UF expenditures. In the case of retirees, this is an overestimate, since some retirees who did not work in the area may still retire to it. In the case of SFC, it is an underestimate, since some students come to SFC just to be close to UF. But the net balance forms a useful approximation. Adding these to the direct UF impact indicates 89% of earnings and 87% of employment in the county are tied to UF.

Table 2: FY 2010 Alachua County Earnings and Employment

	Earnings		Employment	
	$Mil	%	#	%
Total	4,564.1		115,890	
UF	3,671.0	80.4	91,130	78.6
Retirees	411.7	9.0	10,523	9.1
Retirees-UF	326.8	7.2	8,167	7.0
Retirees-Not UF	84.8	1.9	2,355	2.0
SFC	81.5	1.8	1,452	1.3
SFC-UF	65.6	1.4	1,141	1.0
SFC-Not UF	16.0	0.3	310	0.3
Manufacturing	277.4	6.1	7,478	6.5
Natural Resources	30.8	0.7	986	0.9
Sub Total	4,472.3	98.0	111,568	96.3
Residual	91.8	2.0	4,322	3.7
UF Total	4,063.4	89.0	100,438	86.7

We do not contend these figures are exact. We are missing a significant amount of activity due to UF in the form of consulting undertaken by faculty and ex faculty. Two authors of this report, for example, have undertaken such activity, as have many of our colleagues. That might mean the share traceable to UF is even higher. On the other hand, while the IFAS UF impact study from which we draw some of our data attributed all health services expenditure to UF as part of base economic activity, some of that spending is made by employees in the county due to UF, and therefore not part of base funding but captured by the multipliers applied to base funding. Similarly, SFC funding could be modeled more precisely by splitting students into those attracted to the county by UF and those that are local, and for those that are local counting only money from out of county (federal aid and state revenue) as base funding. On balance, the actual share of earnings attributable to UF in 2010 could be a bit higher or a bit lower than indicated in Table 2. However, the data support a conclusion that 80% to 90% of the county’s economic activity depended on UF in FY 2010. Since the remainder of the economy had contracted in 2010, this percentage was likely be slightly smaller in many other years.

3. Status Quo Projections

Although UF's growth has led to substantial growth in Alachua County over the past century, current conditions and trends suggest future growth in enrollment and traditional sources of revenue may not be as strong. First, slower college age population growth will mean slower enrollment growth. Second, current UF policy is geared towards strengthening its graduate programs and research efforts. Since graduate programs are associated with fewer students, that emphasis implies slower enrollment growth. Third, absent structural changes in the tax base and voter attitudes toward public spending, the state's budget will continue to be pinched between growing Medicaid costs, K-12 education requirements, and infrastructure needs on one side and a very limited tax base on the other (Dewey, Denslow, and Schaub, 2013). Similarly, growing burdens of healthcare costs through Medicaid and Medicare, resistance to tax increases, and increasingly fierce competition for Federal research funding are likely to restrain federal funding growth.

We project economic growth for two scenarios under the status quo economic structure, one pessimistic and one optimistic. By status quo economic structure, we simply mean under the maintained assumption that UF remains the economic engine, continues in turn to rely on traditional sources of revenue, and continues to apportion its spending in approximately the same way. The inputs to these projections are assumptions about the future values of: 1) UF enrollment; 2) state revenue; 3) federal revenue; 4) other revenue; 5) student spending; 6) total earnings not related to UF; and 7) real earnings per job.

The optimistic scenario is not the best case scenario. It is within the realm of possibility that both the state and federal governments might decide to shift priorities strongly away from keeping taxes low and toward supporting higher education, leading to more rapid funding growth than seen in the past. But that is unlikely. Thus the optimistic scenario looks at current conditions and historical funding and enrollment trends and assumes things continue roughly as in the past, just on the more favorable side. Similarly, the pessimistic scenario is not a worst case scenario. With bad enough policy and low enough investment, the worst case would be truly horrible. Rather, the pessimistic case represents the low side of current conditions and likely trends.

Projections are not the same as forecasts. A projection illustrates a scenario based on a set of assumptions. Treating a projection as a forecast is roughly the same as predicting those assumptions will be approximately met in the future. A major purpose of this report is to argue that the future is not locked in and that the county's residents, developers, and state and local policymakers can choose an alternative path with better and faster growth. Further, the economic structure may change on its own, for better or worse. For example, if UF were to grow so slowly that the current structure would lead to a significant decline in employment, the prices of existing but unused fixed capital—mainly residential, industrial, an commercial structures—would fall enough to attract alternative activity since Florida is an attractive place to live, and thus change the underlying economic structure. In that sense, these projections are decidedly not the type that are suitable to interpret as unconditional forecasts.

Enrollment

Figure 4 depicts UF enrollment from 1990-2012 (data from the Integrated Postsecondary Education Data System, or IPEDS, at nces.ed.gov/ipedspas and from UF at http://www.ir.ufl.edu). The figure shows both total UF enrollment, in thousands, and UF enrollment per 1,000 students enrolled in any higher education institution in Florida (through 2010). Enrollment peaked at just over 52,000 in the 2007-2008 academic year, and fell to around 50,000 in the 2010-2011, 2011-2012, and 2012-2013 academic years. UF's share of total Florida enrollment, however, peaked at 6.1% in 2000 and fell to 4.2% in 2010.

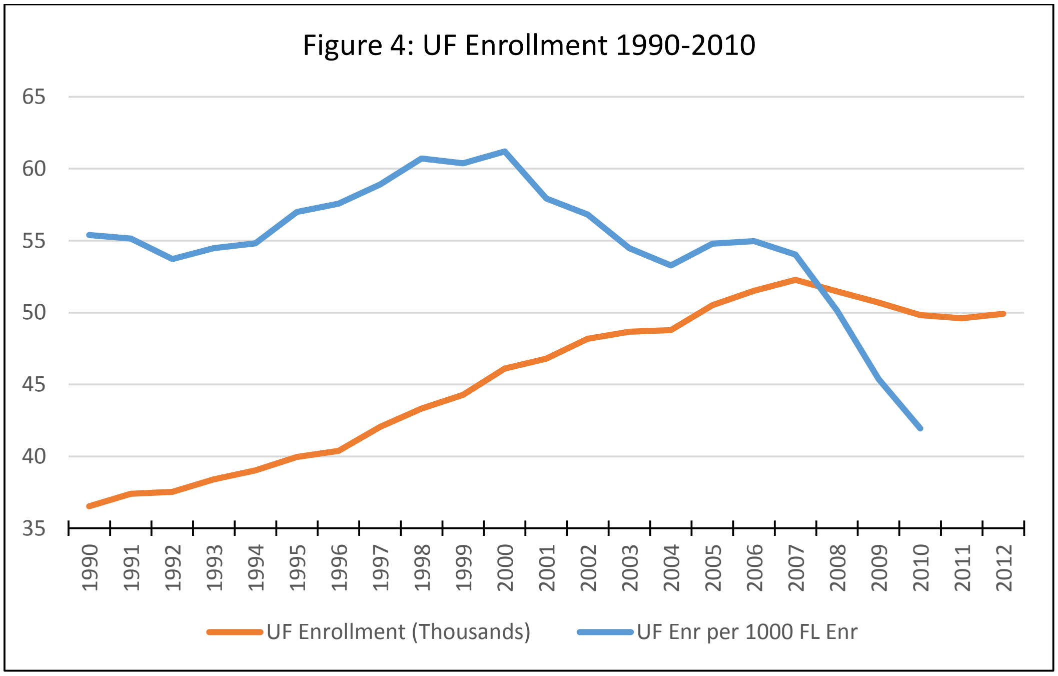


Table 3: Actual and Projected UF Enrollment

		Enrollment			
	FL Pop 18-24	per 100 FL Pop 18-24		Total	
Year	(Millions)	Pessimistic	Optimistic	Pessimistic	Optimistic
1990	1.23	2.98	2.98	36,531	36,531
2000	1.33	3.47	3.47	46,107	46,107
2010	1.74	2.86	2.86	49,827	49,827
2020	1.81	2.76	3.00	50,000	54,332
2030	1.96	2.55	3.00	50,000	58,750
2040	2.08	2.40	3.00	50,000	62,485

Most UF students are from Florida (82.06% in 2011), so the number of Floridians of roughly traditional college age is an important indicator of future enrollment. The second column of Table 3 shows the state population (in millions) from age 18 to age 24 for 1990, 2000, and 2010 and the BEBR projection of the population ages 18-24 for 2020, 2030, and 2040. For 1990, 2000, and 2010 the remaining columns show actual UF enrollment per 100 Floridians ages 18-24 and total UF enrollment. For 2020, 2030, and 2040, these remaining columns show our pessimistic and optimistic assumptions. In the pessimistic scenario we assume UF's enrollment remains constant at 50,000. In this scenario, UF enrollment per 100 Floridians age 18-24 continues to fall slowly as UF focuses on graduate programs and other universities and state colleges grow. In the optimistic scenario, we assume UF enrollment relative to the college age population recovers to 3 per 100 by 2020 and stabilizes there.

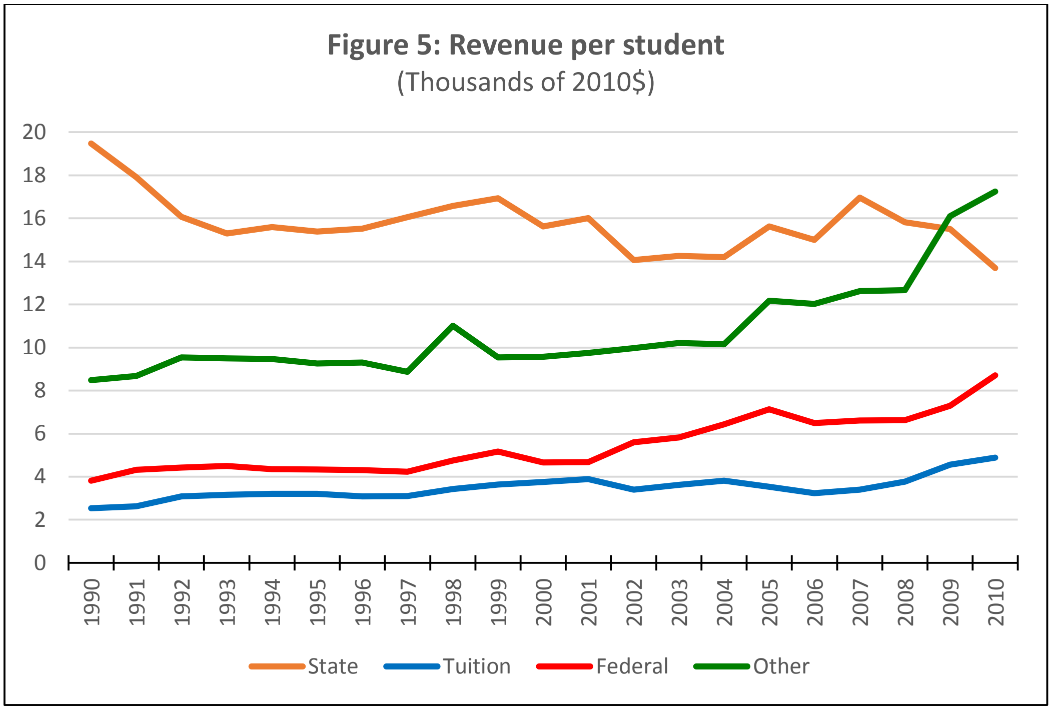
State Revenue

Turning to revenue assumptions, Figure 5 depicts real revenue per student enrolled for state revenue, tuition, federal revenue, and other direct revenue combined, by fiscal year (e.g. the 2009-2010 academic year is the 2010 fiscal year) in 2010 dollars. State revenue per student trended down until 2002. From 2002 to 2007 the state allocation recovered due to three factors: 1) the housing boom led to higher K-12 revenues from property taxes, allowing the state to shift sales tax money to other uses; 2) the construction boom also led directly to higher sales tax revenues; and 3) construction following the hurricanes in the middle of the 2000s further boosted revenues. However, the state allocation fell again after 2007—and would have fallen considerably more but for federal money transferred to the state through the State Fiscal Stabilization Fund, part of the American Recovery and Reinvestment Act (ARRA).

Though the state allocation did recover modestly for fiscal 2014, structurally there is reason to think the downward trend may persist. Hence, in the pessimistic scenario we assume the state allocation is $14,000 per enrollee in 2020, $13,000 in 2030 and $12,000 in 2040. Given Florida's relatively narrow tax base (no sales tax on services and no income tax) and expected growth in Medicaid costs, this is perhaps only slightly pessimistic—in the sense that reasonable people could certainly be more pessimistic. In the optimistic case, we assume state revenue is $15,000 per student in 2020, 2030, and 2040. Given that it was over $19,000 per student in 1990, this may not seem that optimistic. However, with resumed enrollment growth and higher Medicaid costs, and barring an expansion in the tax base or willingness on the part of voters to pay higher tax rates on the current tax base, it is difficult to see where the state could find revenues to provide more funding per student.

Federal Revenue

The jump in federal revenue shown in Figure 5 from in 2009 and 2010 reflects temporary stimulus funding. Further, some of the higher funding in 2002 through 2008 compared to earlier periods reflects the bubble, and thus was not sustainable. Federal healthcare costs will grow, and there seems to be little interest in paying higher federal tax rates to support education. For these reasons, the pessimistic scenario assumes federal funding is $6,000 per student in all three periods. The optimistic scenario assumes $8,000 in 2020, nearly double the level of 1990 through 2000, increasing to $10,000 in 2030 and $12,000 in 2040.



Tuition

Figure 5 shows increasing tuition from 2006 to 2010, and increases have occurred since then as well. However, public opinion turned decidedly against higher tuition, as has Governor Scott. (Call, 2013) Thus, for the pessimistic case we assume real tuition is $7,000 in 2020 and continues to rise $1,000 each decade, roughly as it did in the 1990s and 2000s. However, tuition at UF is far below that of other flagship public universities, and in 2012 the legislature passed a bill that would have allowed UF and FSU to increase tuition substantially, though it was vetoed by the governor. (Wilmath, 2012) Thus in the optimistic projection we assume tuition increases to $10,000 in 2020 and increases by $2,500 per decade thereafter.

Other Direct Revenue

Combined other sources of direct revenue grew only $2000 per student from 1990 to 2004, and then grew rapidly from 2004 to 2008, presumably influenced by the boom. The large jump in 2009, however, was largely due to a change in accounting for the Health Science Center Affiliate's Academic Enrichment Fund. In the pessimistic scenario we assume some of the gains in the late 2000s during the boom were temporary, so that other direct revenue per student only reaches $18,000 by 2020 and increases by $1,000 per decade thereafter. In the optimistic scenario we assume it increases to $19,000 by 2020 and thereafter grows $2,000 per decade.

Student Spending

Based on data from UF's Student Financial Affairs office, real student spending excluding tuition was $12,350 in FY 2010, and had grown just under 2% per year over the previous decade. In the pessimistic scenario, we assume this growth slows to 0.5% per year, and so student spending equals $13,982 in 2020, $13,645 in 2030, and $14,343 in 2040. In the optimistic scenario we assume growth is 2% per year, and so student spending equals $15,055 in 2020, $18,351 in 2030, and $22,370 in 2040.

Other Base Expenditures

Base spending included in Table 1 also includes spending by visitors, spending by direct support organizations (such as the UF Foundation), and health services spending. We simply assume the percentage growth in other sources of base spending equals the percentage growth in the total of state funding, federal funding, tuition, other direct revenue, and student spending.

Earnings per Employee

Holding the economic structure and thus the job mix constant, earnings per employee is driven largely by national factors—since workers are free to migrate to cities with higher wages. However, slack local demand might exert downward pressure on wages, and thus earnings per employee, during an adjustment period. From 1990 to 2010 real earnings per employee in Alachua grew from $31,744 to $39,688, or 1.12% annually. Excluding the biggest boom years and the following recession, earnings per employee grew 0.85% annually from 1990 to 2004. In the pessimistic scenario, we assume earnings per employee grow at an annual rate of 0.75%. This reflects slack labor demand due to a slow recovery from the recession and tight funding and slow enrollment growth for UF. For the optimistic scenario, we assume annual real growth is slightly faster than observed for the past two decades, at 1.25%.

Earnings Not Tied to UF Base Expenditures

From 1990 to 2010 real total earnings in Alachua grew from $2.99 billion to $4.58 billion, an average rate of 2.2%. Excluding the biggest boom years and the following recession, earnings grew 2.8% annually from 1990 to 2004. Total employment, and thus total earnings, are impacted more strongly by local factors than are earnings per employee. Thus in the pessimistic scenario we assume earnings not tied to UF base funding grow at 1.5% annually, and in the optimistic scenario we assume they grow at 2.5% annually.

Summary of Assumptions

These assumptions are collected in Table 4.

Table 4: Assumptions [a]

Projection	Actual	Low			High		
Year	2010	2020	2030	2040	2020	2030	2040
Enrollment	49.8	50.0	50.0	50.0	54.3	58.8	62.5
State Revenue per student	13.7	14.0	13.0	12.0	16.0	16.0	16.0
Tuition per student	4.9	7.0	8.0	9.0	10.0	12.5	15.0
Federal revenue per student	8.7	6.0	6.0	6.0	8.0	10.0	12.0
Other direct revenue per student	17.2	18.0	19.0	20.0	19.0	21.0	23.0
Student spending per student	12.4	13.0	13.6	14.3	15.1	18.4	22.4
Total direct + student spending (Billions)	2.8	2.9	3.0	3.1	3.7	4.6	5.5
Earnings per job	39.7	42.8	46.1	49.7	44.9	50.9	57.6
Annual Growth Rate of Other Earnings			1.5			2.5	

[a] Values in thousands unless otherwise noted. Dollars are 2010.

Status Quo Projections

Assuming the average multiplier associated with UF related base expenditures remains constant, the percentage change in earnings between a base period, here 2010, and some target date, here 2020, 2030, or 2040, equals the percentage change in UF related base expenditures multiplied by share of the economy dependent on UF in the base period, plus one minus that share multiplied by the percentage growth in the remainder of the economy. The average multiplier depends on both the pattern of expenditures across industries and the multiplier associated with each industry. Thus, assuming the average multiplier is constant is consistent with projecting growth under the status quo economic structure, which is the purpose at hand. Applying this method, assuming the economy was 85% dependent on UF in 2010, yields the results shown in Table 5.

Table 5: Status Quo Projections

Projection	Actual	Low			High		
Year	2010	2020	2030	2040	2020	2030	2040
Total Earnings (Billions)	4.6	4.8	5.0	5.2	6.0	7.4	9.1
Ann Growth, Past Decade (%)		0.4	0.5	0.5	2.7	2.2	2.0
Ann Growth Since 2010 (%)				0.4			2.3
Employment (Thousands)	115.9	112.3	109.5	105.6	133.2	146.3	157.4
Ann Growth, Past Decade (%)		-0.3	-0.3	-0.2	1.4	0.9	0.7
Ann Growth Since 2010 (%)				-0.3			1.0

In the pessimistic projection, from 2010 to 2040 total earnings grows at just 0.4% annually and employment falls at 0.3% annually, compared to average annual growth of 2.8%

and 1.9% from 1990 through 2004, respectively. Three things about this projection should be emphasized at this point. First, while as noted above it would have been possible to be even more pessimistic in many cases, in our judgment it is unlikely for the sum of all revenue sources to grow significantly below our pessimistic assumptions. Second, since a decline in employment would push down prices of fixed capital, attracting new residents and businesses, under the conditions of this projection the economic structure would change. However, that change would almost certainly be toward lower skilled employment absent a strategy and accompanying investment to alter that trajectory. In a state like Florida, it would be highly unlikely for total employment to actually fall. As a result, total earnings would simply grow slowly and the structure would shift toward lower skill jobs. Third, economic stagnation—flat employment and minimal growth in total earnings together with related shifts in the economic structure toward lower skill employment—is not something that can occur only in extreme circumstances. Rather, it is a real possibility if a number of things tend toward the low side of current conditions and trends, and decisions made for the future should take account of the possibility.

Turning to the optimistic projection, from 2010 to 2040 total earnings grows at 2.3% annually and employment grows at 1% annually. This growth in employment is only half the annual rate observed from 1990 to 2004. So, the main thing to emphasize regarding this projection is that even if enrollment and revenue sources all tend toward the high side of current conditions and trends, growth will be much slower than experienced in the past.

Of course, it is unlikely that all sources of UF growth will simultaneously tend toward the low or high side of the range of reasonable possibilities. Taking the midpoint of the 30 year growth rates under the two scenarios would put employment growing at 0.38% annually and total earnings growing at 1.38% annually. By comparison, the BEBR (medium) population projection has the population from ages 25-64 growing at 0.45% annually from 2010 to 2040 on average, and the population from ages 15-74 growing at 0.46% annually. Thus, under the county's current economic structure, for employment to grow even as fast as the medium BEBR projection for the working age population, things must tend somewhat toward our optimistic set of assumptions, or else the underlying structure must change.

Implications

We will discuss the consequences of such slow growth in more detail elsewhere. For now, though, we simply mention several examples of reasons faster growth, particularly if it involved diversifying the economic base, would be good for residents. First, teacher salaries rise with experience, but growth means a higher share of teachers are at lower points on the pay scale, keeping the cost of funding schools lower for a given average quality. Second, there is a similar effect regarding the burden of meeting public employee pensions—faster growth means any initial level of unfunded liability is easier to meet. Third, faster growth means a thicker labor market and more employment opportunities, especially for those on the east side of the county where unemployment has long been high. Fourth, expansion of the economic base would help make up for the reduction in the area's tax base due to UF being exempt, allowing lower average property tax rates.

From UF's view, it will be difficult to increase quality and impact with meager growth in resources. The analysis above suggests UF will have to lean increasingly on private grants and contracts to achieve quality growth in its research and graduate programs. In turn, promoting such growth will likely require closer cooperation with businesses, both UF spinoffs and others. However, partnerships with firms outside the local area are less promising than partnerships with firms in closer geographic proximity. A large body of recent research suggests that despite the rise of the internet, improved telecommunications, and reduced transportation costs, dynamic cities with geographic concentrations of high skill workers drive economic growth.[1] Whatever the exact mechanism, geographic proximity is part of the catalyst for innovation and productivity. The presence of a large high quality research institution can play an important role in promoting that sort of dynamic economic growth in the right environment.

UF is a major educational and research institution that would be attractive to firms looking for a collaborative relationship. This, however, requires a change in the underlying economic structure and much more rapid growth of firms in the economic base doing the sorts of things that complement UF's programs. Consider the following excerpt from an interview of Bill Clinton in the *London Financial Times* from October 15, 2011 on the relationship between the University of Central Florida and businesses in Orlando:

> [Creating jobs], is not something, he realizes, that can be legislated (though legislation can surely enable it); but it works when it comes about organically. Which takes him to Orlando, Florida, a subject on which the ex-president waxes lyrical. "Go down there tomorrow and, with the exception of a slight drop in visitors, you'd have a hard time knowing there was a recession." The reason is not just Disney, but the Department of Defense, which makes an annual investment there of $5 billion in research and training. What is it that Disney, Electronic Arts, the videogame kings, and the military all need? "Computer simulation!" he exclaims. "If you and I joined the air force tomorrow we'd have to go down there and train on simulators." Add to the mix a technology-savvy institution of learning and research – the University of Central Florida, 56,000 students strong, devising programmes so that its graduates can fit right into the nexus—and you've got the perfect positive feedback loop between the public and private sectors and NGOs that make for an incontestable economic powerhouse.[2]

From Florida's point of view, diversification of the economic base and more rapid growth in Alachua County would help the state get the most from its historic investment in UF. Thus, a change in local economic structure that saw a significant diversification and expansion of the

[1] See, for example, Glaeser, 2011.
[2] The context is by interviewer Simon Schama. Quotation marks set off Clinton's words. Clinton made similar comments on an Orlando radio program.

economic base would entail benefits for Florida, for UF, and for local workers and residents. While in theory the right combination of effort and investment on the part of UF, the state of Florida, and local business, governments, and developers could change the economic structure and achieve higher economic growth, if the odds are too strongly against success, such effort and investment would not be worthwhile. That is the subject of the next section—the frequency of large upward trend breaks. Or, more simply, how often do local areas exhibit much more rapid growth than expected based on past growth?

4. Growth Acceleration

BEBR's medium population projection, and other similar projections, call for the population of Alachua County to rise by about 20% from 2010 to 2030, from 247 thousand to 288 thousand, an average annual increase of only 0.76%. This is slightly below the projection of U.S. average annual growth of 0.93% over the same period from the U.S. Census Bureau. Alachua County is expected to maintain a roughly constant share of the U.S. population, or one out of every 1,300 U.S. residents.

Table 6: Population and Projections (Thousands)

Year	Alachua	U.S.
2010	247	310,233
2020	266	341,387
2030	288	373,504
2040	305	405,655

How realistic is the prospect of a major break from trend, say an increase of more than 40% from 2010 to 2030 rather than 20%, opened up by the possibility of developing Plum Creek land and having a major research university in the age of the knowledge economy? The research university, though among the largest, is not unique. A county with both such a large research institution and an enormous area of assembled land with development potential (not a national forest, for example), however, is at least very unusual.

When there is a highly unusual situation such as this, historical trends are less informative as guides. Even so, the potential for a substantial upward break from trend may appear to be lower if such breaks are indeed rare in the recent history of U.S. counties. If very few other counties have had unusual circumstances strong enough to propel large deviations above trend, there may be hidden constraints for which we need to search carefully.

Historical Distributions of County Growth

We first characterize the distribution of (percentage) population growth over the 20, 30, and 50 years ending in 2010 (that is, from 1990 to 2010, from 1980 to 2010, and from 1960 to 2010) for the 647 counties that had populations of at least 40,000 in 1950. We remove counties that were smaller because relatively small developments can cause small counties to experience large growth rates, and because random events can have a large proportional impacts on small counties. Three histograms depicting the distributions are shown below in Figures 6, 7, and 8.

Looking at 20 year growth, while the median county grew 13%, 25% of these counties grew more than 28% and 10% grew over 47%. Considering growth over 30 years, while the median county grew 19%, 25% grew more than 43% and 10% grew more than 85%. Finally, considering growth from 1960 to 2010, while the median county in this sample grew 46%, and total U.S. population grew 72%, 25% of these counties grew more than 106% and 10% grew more than 207%. Thus, looking only at the overall distribution, it is not rare for an individual county to grow much faster than others, with the potential difference much larger over larger spans of time. It is also worth noting that it is rare for a county to shrink substantially, or, that the distribution is skewed strongly to the right. An important reason for this, as noted in the previous section, is the supply of fixed capital, especially structures. A structure cannot readily be moved from one city to another. Hence, pressures that would lead to large outmigration put downward pressure on real estate prices, which slow the outmigration. (In a supply and demand framework, the supply of structure is very inelastic below the current level and much more elastic above it.)

Figure 6

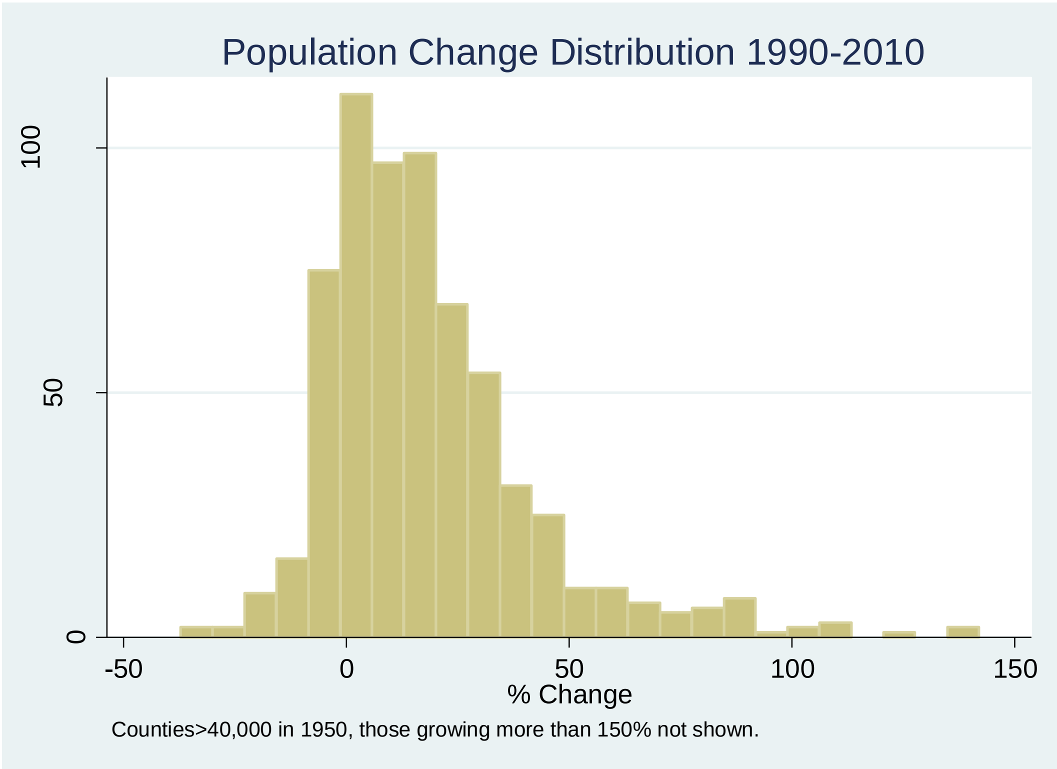


Figure 7

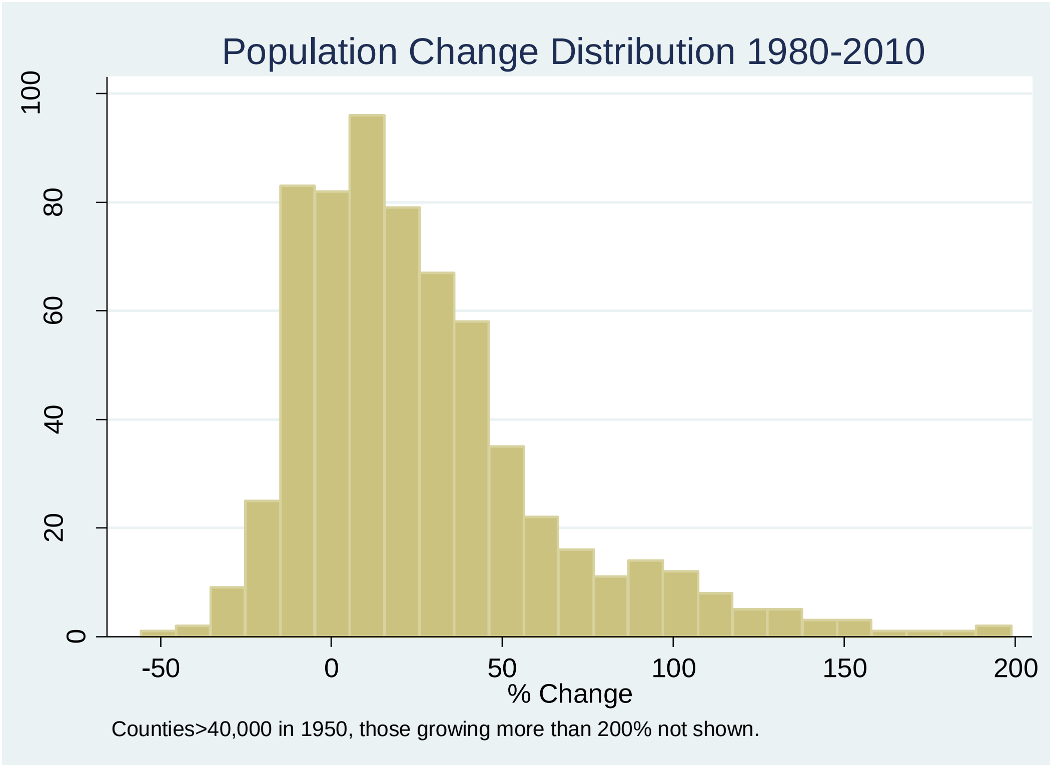
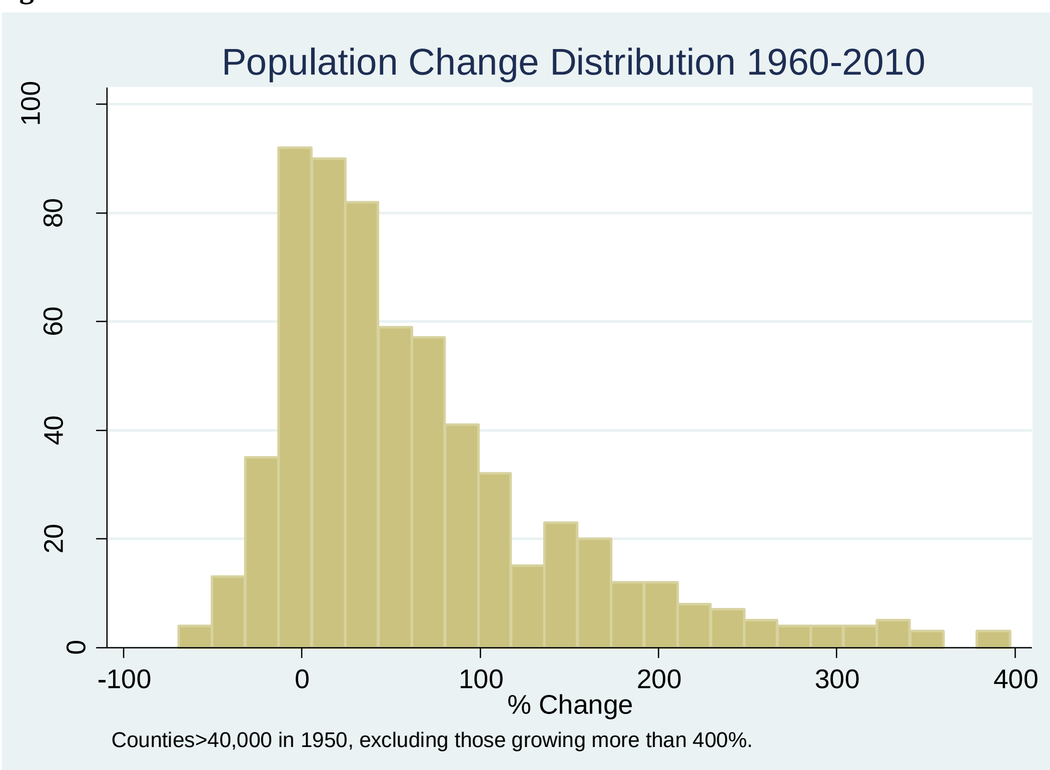


Figure 8



Growth Conditional on Past Growth and the Chances of Upward Trend Breaks

While looking at the distribution is informative, the fact that it is not rare to grow much faster than the typical county—that is that the variance of growth is high and the distribution is skewed to the right—does not by itself imply that positive trend breaks are very common. Perhaps the vast majority of the counties in the right tail of the distribution are simply following established trends, not growing above trend—that is perhaps they grew fast in the past and simply continued to do so. To get at this, we use growth from 1970 to 1990 to "predict" growth from 1990 to 2010. The relationship between current and past growth is estimated using fractional polynomial regression (Stata command fracpoly), for two reasons. First, it can approximate very complex relationships in a flexible and non-linear way. Second, and as a consequence, it allows the fit in the middle of the distribution, relevant for Alachua County, to be less affected by extreme growth rates in the initial period. We also employ quantile regression (Stata command qreg), or least absolute deviation regression, rather than ordinary least squares. The reason for this choice is the lack of symmetry in the distribution, owing at least in part to systematic forces that mitigate against strong negative growth, as shown in the histograms above.

Figure 9 below shows the results. The horizontal axis shows the percentage population increase from 1970 to 1990 and the vertical axis the percentage increase from 1990 to 2010. Alachua County grew 73% from 1970 to 1990 and 36% from 1990 to 2010. The blue x's show actual values and the red curve shows the average value of 1990 to 2010 growth conditional on 1970 to 1990 growth. Alachua County falls a few points below the projection. There is considerable variation around trend. The mean absolute deviation (MAD), the average amount by which the typical county varies from trend (up or down), is 10 percentage points. Large upward deviations from the trend reflected by the curve in the figure are not uncommon. Twenty percent of counties grew more than 9 percentage points beyond what would be expected of the median county given past growth, and ten percent of counties grew more than 16 percentage points beyond trend.

We conduct the same analysis for growth over 30 years—using growth from 1950 to 1980 to "predict" growth from 1980 to 2010. Figure 10 shows the results. It should not be surprising that there is even more variation around trend over longer timespans. The MAD is 22 percentage points, 20% of counties grew more than 20 percentage points faster than trend, and 10% grew more than 36 percentage points above trend.

Figure 9

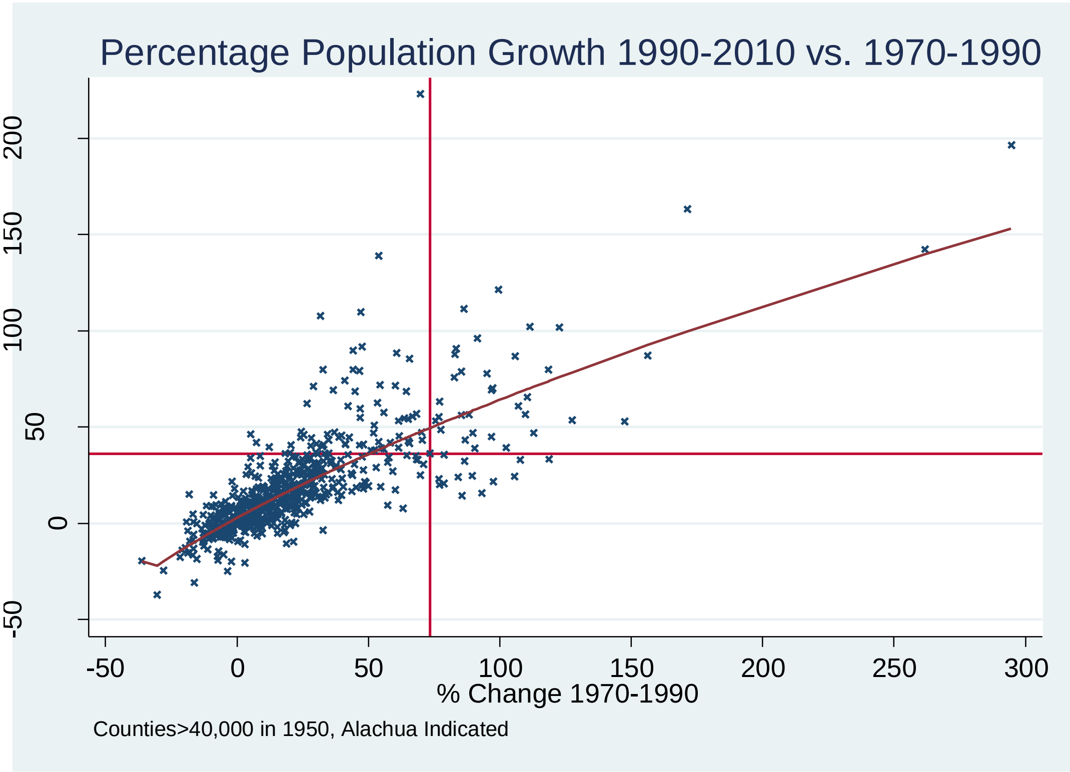
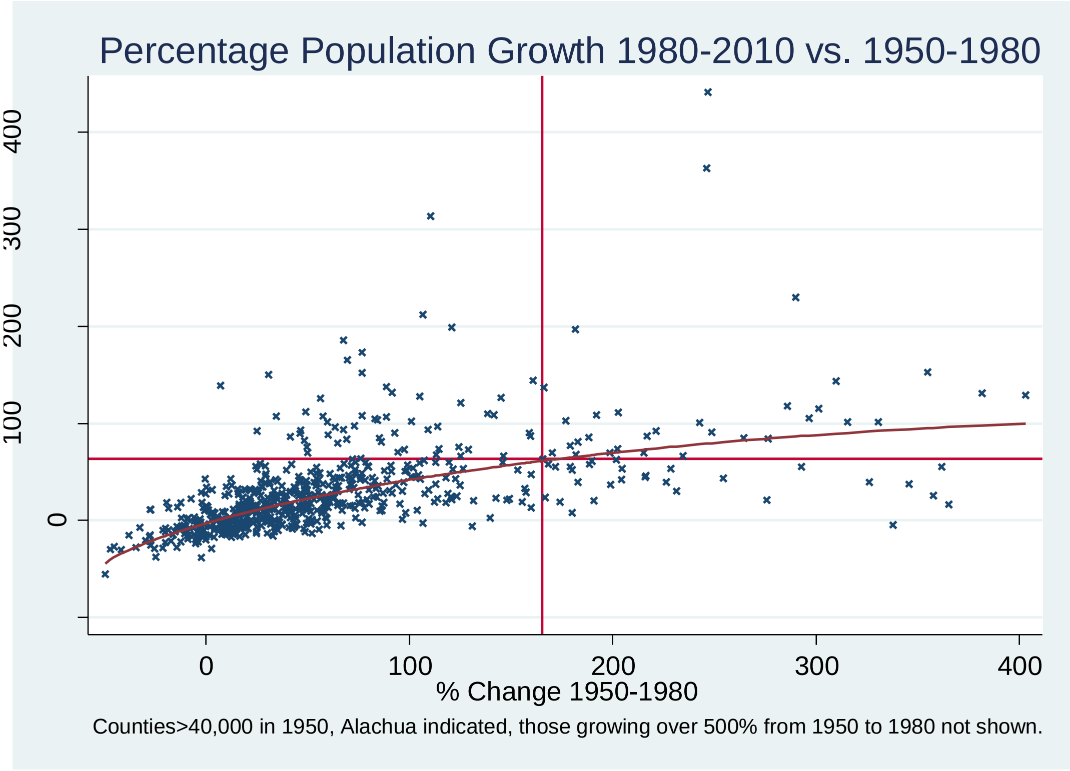


Figure 10



Of course, the relationships estimated above and depicted in Figures 9 and 10 could not have been used in 1990 or 1980 to predict population in 2010, because they were estimated using population in 2010. That is, the actual conditional relationship between observed growth from 1950 to 1980 and growth from 1980 to 2010, the curve in Figure 10, cannot be known with certainty until 2010 population is known. Extrapolative projections must be made using data at hand at the time of the projection. What we can predict about future growth is less than suggested by the analysis summarized in Figures 9 and 10, because we don't know the shape of the red curves ahead of time. That introduces another source of variability.

While the fact that the actual conditional relationship is not known when the projection is made (the launch date) increases variability and therefore the MAD, it should not systematically change the chance of being more than a certain level over trend, which is of interest here. A projection made in a given launch year, say 1980, for a given target year, say 2010, will differ from the actual conditional relationship, the red curve in Figure 10, by a random amount. If the projected relationship gives a higher predicted growth rate than the actual conditional relationship that is not yet observed at the launch date, fewer counties would be more than any given amount over the projected trend. But if the projected relationship gives a lower predicted growth than the actual relationship, more will be over. On average these will tend to cancel out in the calculation we are interested in, assuming the mean difference is zero in expectation (the projection methodology is not systematically biased).

We also perform this analysis for projection horizons of 10, 40, and 50 years ending on 2010. Extending the analysis to 40 years reduces our sample to 637 counties and extending to 50 years reduces it to 587 counties, since data on population size in 1910 and 1930 was not available for all counties. Over spans of 40 and 50 years, previous growth has far less predictive power. Table 7 shows the 80^{th} and 90^{th} percentiles of the distribution of deviation from trend resulting from these five analyses.

Table 7: Deviations from Trend

Projection Horizon	Percentile 80th	Percentile 90th
10	4.2	7.1
20	8.8	16.2
30	20.0	35.5
40	39.9	78.8
50	59.3	119.7

Some counties will grow more or less the same as predicted, some will grow notably faster or slower than expected, but not by a large amount, and some will grow substantially more or less than expected. To make this concrete, think of these five groups as quintiles of the set of counties with a population of at least 40,000 in 1950. The bottom two quintiles grow less than trend. The next grows more or less at trend. The next grows somewhat faster than trend. And, the top quintile is growing faster than two thirds of the counties that grew above expectations (the 10% that are slightly above the median in the middle quintile and the fourth quintile). Thus, being in the top quintile is not rare, it is just the top third of those growing above trend, but it is well above trend. Table 7 shows that over a span of 30 years, the top quintile grew 20 points or more over trend, and over 50 years, nearly 60 points over trend. Large positive breaks from trend in large counties are not rare events. Over 50 years, one in ten counties grows nearly 120 points over trend. Another way to put is that of those that grew over trend, one in five grew 120 points or more over trend. While not common, extremely large positive breaks from trend in large counties are not that rare.

The 50 counties that had growth from 1990 to 2010 at least 20 percentage points greater than predicted by the relation shown in Figure 9 are shown in Table 8. Pinal County, Arizona, in the first row, had 116,397 people in 1990. It grew 70% from 1970 to 1990, with a corresponding predicted growth of 48% from 1990 to 2010. But the population of Pinal County instead rose by a remarkable 223%, as it was suburbanized both northward from Tucson and southward from Phoenix. At this point in our research, we do not undertake a serious analysis of either the necessary or the sufficient conditions for strong upward breaks from trend—we are simply demonstrating that they are relatively common. Nonetheless, a few tentative observations are relevant. First, 13 of the counties are in North Carolina, frequently noted to be business friendly. Second, nearly three quarters are in states known for warm or mild winters. Third, many are home to, or close to, research universities, several are university towns, and several are noted for their high-tech presence. Four examples related to this last observation follow.

1. Wake County, North Carolina. The prominence of the Research Park Triangle is well known. In 2012 the original master plan from 1959 was changed to allow for continuing rapid development.
2. Guilford County, North Carolina. UNC Greensboro has 15,000 students. Greensboro has evolved from textiles and tobacco to “nano-tech, high-tech, and transportation/logistics,” helped by its location on I-73, I-40, and I-85. Also providing transportation is the Piedmont Triad International Airport, which has become a FedEx hub and hosts a Honda Aircraft jet plane facility.
3. Lee County, Alabama: Auburn University’s student body rose from 21,537 in 1990 to 25,078 in 2010, accounting only partly for the population gain. Auto suppliers for Kia and Hyundai and the Auburn Research Park, along with I-85 access to Atlanta, also played a role.
4. Weber County, Utah. The principal city is Ogden. Weber State College has become a university, with 26,000 students. Several aerospace industries have offices there, along with ski and winter sports companies. Jetway loading bridges are manufactured there.

Table 8: Accelerated Growth Counties

State	County	Population 1990	Growth 1970-1990	Growth 1990 to 2010 Actual	Predicted	Difference
Pinal	Arizona	116,397	70	223	48	175
Union	North Carolina	84,210	54	139	38	101
Johnston	North Carolina	81,306	32	108	25	83
Canyon	Idaho	90,076	47	110	34	76
Clark	Nevada	741,368	171	163	100	64
Rutherford	Tennessee	118,570	100	121	64	58
Weld	Colorado	131,821	48	92	35	57
Will	Illinois	357,313	44	90	32	57
Cabarrus	North Carolina	98,935	33	80	25	55
Wake	North Carolina	426,311	86	111	57	55
Iredell	North Carolina	93,205	29	71	23	48
Mecklenburg	North Carolina	511,211	44	80	32	48
Hall	Georgia	95,434	61	88	42	46
Washington	Arkansas	113,409	47	79	34	45
Sussex	Delaware	113,229	41	74	30	44
Collin	Texas	264,036	295	196	153	43
Harnett	North Carolina	67,833	37	69	28	41
Kane	Illinois	317,471	26	62	21	41
Baldwin	Alabama	98280	66	85	45	40
Duplin	North Carolina	39,995	5	46	7	40
Utah	Utah	263,590	91	96	60	36
New Hanover	North Carolina	120,284	45	68	33	36
Ada	Idaho	205,775	83	91	55	36
Fulton	Georgia	648,776	7	42	8	34
York	South Carolina	131,497	54	72	39	33
Webb	Texas	133,239	83	88	55	33
Hidalgo	Texas	383,545	111	102	70	32
Lee	Alabama	87,146	42	61	31	30
Montgomery	Tennessee	100,498	60	71	42	29
Alamance	North Carolina	108,213	12	40	12	28
Maury	Tennessee	54,812	24	48	20	28
Sampson	North Carolina	47297	5	34	7	27
Bronx	New York	1,203,789	-18	15	-11	26
DeKalb	Illinois	77,932	9	35	9	26
Placer	California	172796	123	102	76	26
Imperial	California	109,303	47	60	34	26
Weber	Utah	158,330	25	46	20	26
Clay	Missouri	153,411	24	45	20	25
Bell	Texas	191073	53	62	38	24
McHenry	Illinois	183,241	64	68	44	24
Pueblo	Colorado	123,051	4	29	6	23
Guilford	North Carolina	347,431	20	41	17	23
Clark	Washington	238,053	85	79	56	22
Twin Falls	Idaho	53,580	28	44	22	22
Pitt	North Carolina	108,480	47	55	34	21
Ellis	Texas	85,167	83	76	55	21
Kenosha	Wisconsin	128,181	9	30	9	21
Walworth	Wisconsin	75,000	18	36	16	21
Warren	Kentucky	77,720	34	46	26	20
Arlington	Virginia	170,895	-2	21	1	20

5. Alachua Acceleration

Examining Table 8 above suggests that with UF, relatively young and highly educated populace, and warm winters, Alachua County could attract growth far above trend—if an effort is made to do so. In an April 2006 working paper, "Forecasting 2020 U.S. County and MSA Populations," Peter Linneman and Albert Saiz of Wharton confirm this reasoning. They combine the Rosen-Roback approach and simple trend extrapolation to model population growth. They find population growth for U.S. counties varies positively with recent past growth, the fraction of the population between 25 and 65, low taxes, good weather, and the share of the population with high school diploma or more education. Writing in 2006, they projected that Alachua County's population would be 326,000 in 2020, or 60,000 higher than BEBR's current projection. Because of the Great Recession, their projection is unlikely to be attained. Even without the recession, it would be unlikely if Alachua County's policy approach was less friendly toward growth than other counties with otherwise similar circumstances.

The work of Linneman and Saiz, as well as a reading of Table 8, shows counties with higher education levels and warmer winters, like Alachua, are much more likely to experience upward trend breaks than the average county. In addition, Alachua is likely to remain younger than the rest of Florida as baby boomers retire to the state. Further, we suspect, and Linneman and Saiz argue, that counties that make a concerted effort to adopt policies friendly to business and growth will grow faster. So, among the group of counties with warm winters, major research universities, high educational attainment, and a friendly environment for growth and business, the 80th and 90th percentiles of growth would be higher than those shown in Table 7. Or, put differently, the levels of above trend growth shown in Table 7 would occur at much less than the 80th and 90th percentiles of the distribution of possible deviations for such counties.

So, if the residents, businesses, and local governments of Alachua and surrounding counties, UF, the state of Florida, and Plum Creek and other developers acted together to attract faster development, how much faster might employment grow? It would make little sense to try to offer precise bounds for future—the future is not known and this is not the sort of exercise for which accepted rules for constructing objective confidence intervals exist. However, the analysis above provides enough information to make some reasoned judgments. If the 80th percentile of above trend growth listed in Table 7 is not rare for the average county, it should be reasonably likely for Alachua to achieve if the appropriate efforts are made. Similarly, the 90th percentile for the typical county should be much more likely for Alachua under these circumstances.

To translate this to employment, we combine the 2010 census count and BEBR's 2040 population projection by age with U.S. labor force participation rates for 2010 and 2040 projected by the BLS in 2006 (Toossi, 2006) to estimate the full employment labor force and employment in 2010 and 2040. We use the rate projected for 2010, rather than the rate observed in 2010, to take out the effect of the recession. We also assume a 5% long run unemployment rate. Data are shown in Table 9. The published BEBR projections do not include a 16-19 year age category, so we multiplied the published 15-19 category by 0.8 to obtain an estimate.

Table 9: Population and Labor Force by Age, 2010 and 2040

Age	Population 2010	Population 2040	Labor Force Participation (%) 2010	Labor Force Participation (%) 2040	Labor Force 2010	Labor Force 2040
16-19[a]	18,871	20,006	40.8	35.1	6,624	7,022
20-24	41,515	41,411	74.7	73.3	30,430	30,354
25-34	36,980	40,034	84.5	84.9	31,396	33,989
35-44	25,508	30,856	83.2	82.8	21,121	25,549
45-54	29,470	33,522	81.7	82.4	24,283	27,622
55-59	14,800	17,120	72.8	74.9	11,085	12,823
60-64	12,371	14,810	53.7	57.6	7,126	8,531
65-69	8,593	13,369	31.1	35.7	3,068	4,773
70-74	5,987	11,961	16.9	18.4	1,102	2,201
75+	12,047	34,100	8.2	10.1	1,217	3,444
Total Labor Force					137,451	156,307
Full Employment					130,579	148,492

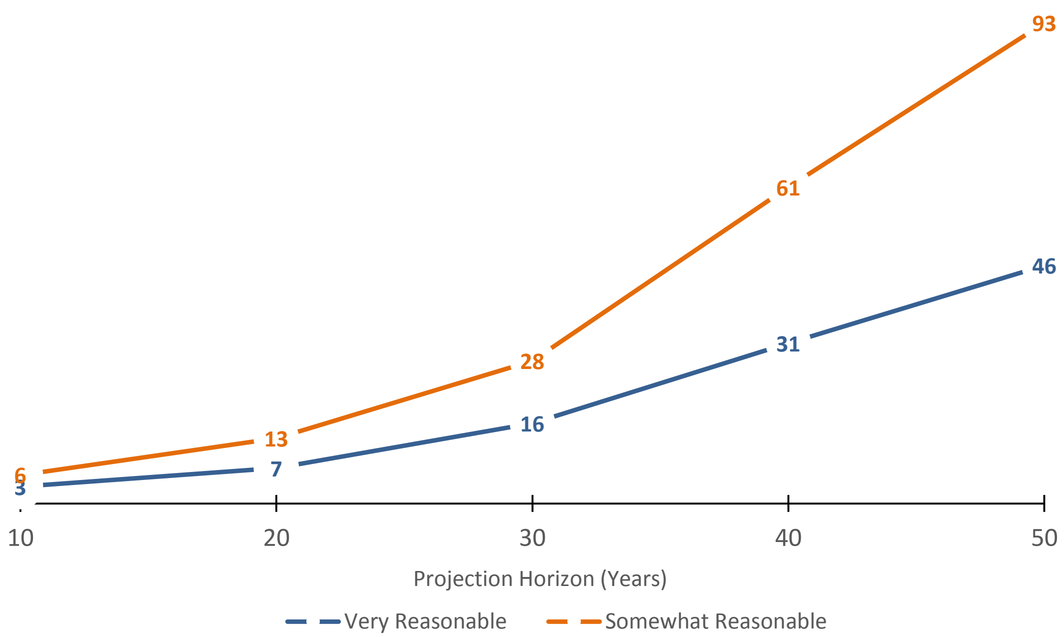
[a] The BEBR 2040 projection includes a 15-19 age group, not a 16-19 group. The 16-19 group in the table is therefore 0.8 times for the 15-19 age group. For consistency, the 2010 value is calculated the same way.

But for the recession, which led to a large decline in the actual labor force participation rate compared to what was projected for 2010 in 2006, the full labor force in Alachua County should have been approximately 137,000. This may be a slight overestimate, since as a college town, labor force participation in the 20-24 age group may be a bit lower than the national rate. This, however, does not substantially affect the difference between 2010 and 2040, since the population in that age group remains largely unchanged. The projected labor force for 2040 is approximately 156 thousand. Assuming long run unemployment of 5% would make long run equilibrium employment 131,000 in 2010 and 148,000 in 2040, an increase of 18,000.

Examining the 230 (type 2) direct employment multipliers available from BLS for Alachua County, the (unweighted) average multiplier is 1.69, the median is 1.59, the 15th percentile is 1.35 and the 85th percentile is 1.95. There is no way to know in advance exactly what employment multipliers would be associated with an upward trend break in Alachua County, or exactly what weights should be applied to arrive at the correct average. At the median, the share of base employment in total employment would be 63%, while at the average it would be 59%. Thus, for calculations, we assume 60% of employment will be in the economic base and 40% will derive from it.

Figure 11 illustrates the potential for above trend growth in base employment in Alachua County. The blue curve applies the 80th percentile trend break from Table 7 to the initial employment of 130,579 to get above trend total employment and multiplies by 0.6 to get above trend base employment. We label this “very reasonable” because we think if one of five randomly selected counties achieves that level of above trend growth, it is very reasonable to think Alachua could do so under the circumstances envisioned. The orange curve applies the 90th percentile from Table 7 to the same starting point. We label this curve “somewhat reasonable”, to connote that we would not be surprised if Alachua grew that rapidly under the assumed conditions, but that it is less likely. Over 30 years of sustained effort to achieve higher growth, an additional 16,000 base jobs seems very achievable, and 28,000 is not an unreasonable possibility. Over 50 years, much more above trend growth is reasonably possible. This estimate is slightly conservative, in the following sense. If growth substantially exceeds trend due to attracting additional base employment, proportionally less growth will be in the older age groups, meaning the base employment increase would be slightly larger than shown.

Figure 11: Potential for Above Trend Base Employment (Thousands)



6. Conclusion

Directly or indirectly, UF drove 80% to 90% of the economy of Alachua County in 2010. Given reasonable but optimistic assumptions about growth in traditional sources of UF revenue, economic activity in Alachua County will grow much more slowly over coming decades than it has since 1990. Given assumptions that are modestly pessimistic but still reasonable and consistent with current conditions and recent trends, earnings and employment in the county stagnate—employment falls at an average annual rate of 0.3% and total earnings grow at an average annual rate of only 0.5%. The residents of Alachua County would gain in a number of ways from accelerated growth in the economic base outside of UF. Similarly, UF stands to gain considerably through increased opportunities for partnerships with businesses, which could help make up for increasing pressures on traditional sources of revenue. The presence of UF, a relatively young and educated population, and warm winters mean Alachua is well positioned to grow much faster than trend if local residents, government, developers, businesses, and UF collaborate to foster an environment conducive to business growth.

Plum Creek's plan calls for 30,000 base jobs above trend over 50 years, which would translate to additional total employment of 50,000. Over a horizon of 50 years, it makes little sense to imply anything is known with a high degree of certainty—there are too many things about the future that are crucial but unknown. For example, while cities have thrived in the information age, rather than being rendered moot by low communications and transportations costs (Glaeser, 2011), that could change over a long enough time span. What is certain, however, is that one in five typical counties with populations of at least 40,000 in 1950 grew more than 59 percentage points above trend from 1960 to 2010. Alachua County is far more likely than the typical county to achieve growth that fast above trend—provided an appropriate climate to foster business growth is created and technological changes and changes in labor markets and commuting patterns do not render standard notions of cities and development moot. So, at that time scale, the most sensible thing to do is to turn the question around—there is no reason based on the available data to think Alachua could not achieve whatever growth path it chooses for itself over half a century. The analysis summarized in Figure 11 suggests that over 50 years a goal of attracting 30,000, or many more, base jobs above trend is entirely reasonable.

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Appendix A: Data Sources for Multiplier Analysis and Status Quo Projections

UF revenue data is from The National Center for Education Statistics (NCES) database of postsecondary schools known as IPEDS. UF revenue was collected under several categories: federal revenue, state revenue, tuition and fees, private funding, sales, and other. Data was by state fiscal year, and available for 1980 and 1984-2011. UF revenue was verified through UF's annual financial reports, although these were only available going back to fiscal year 2000. The exception was direct support organizations, where financial reports were the primary data source. Annual UF fall enrollment data was collected from UF's Office of Institutional Planning and Research for 1971-2012. UF employment and expenditure data was obtained from a study of UF's impact on the state of Florida in state fiscal year 2010 and 2006 conducted by faculty at UF's Institute of Food and Agricultural Sciences (IFAS) (Hodges, Mulkey, and Stevens, 2007, and Hodges, Stevens, and Rahmani, 2011). The 2010 employment data was verified through the Office of Institutional Planning and Research and UF's Human Resources Department.

Student spending data is from the IFAS study, obtained by them from UF's Office of Student Financial Affairs fact book. Some of this data was regional, but portions were based on U.S. Department of Labor statistics. Tuition and fees comes directly from UF tuition and fees; costs for books are obtained from UF bookstore; costs for food is based on the price of a campus meal plan; costs for room and board are based on UF dorm fees, or from data collected from local apartment complexes (depending on whether the student lives on or off campus); transportation, clothing maintenance, and personal costs are based on 1998 Department of Labor student-cost data and are adjusted for inflation. Computer allowance costs are based on current prices and assume that a new computer must be purchased every two years.

Expenditure data for UF spinoff companies was collected from the UF Office of Technology Licensing (OTL). OTL "works with UF employee inventors with potentially patentable or copyrightable technologies and to facilitate the transfer of technologies created at UF to the commercial sector for public benefit." All other UF expenditures from the impact study were obtained from the UF Division of Finance and the financial statements of UF and its respective organizations (e.g. Shands, Athletic Association, etc.).

Employment and earnings data for Alachua County, as well as the Consumer Price Index (CPI) for inflation-adjustments, was collected from the Bureau of Labor Statistics (BLS). Population counts, estimates, and projections are from BEBR and the U.S. Census Bureau. The NCES IPEDS database was used to collect enrollment data for all degree-granting public schools in Florida, including both 2-year and 4-year colleges. This data was used determine the change in UF's share of state college and university enrollment. UF enrollment by state was collected from UF's Office of Institutional Planning and Research.

Appendix B: Stata do file for population trend break analysis

```
cd "D:\jimd\PLUM CREEK\
log using "popultion projection work 10 30 2013.smcl", replace
set more off
use "countypop1900_2010 long.dta", clear
destring fipsstco, replace
xtset fipsstco year

gen L10pop=L10.pop
gen L20pop=L20.pop
gen L30pop=L30.pop
gen L40pop=L40.pop
gen L50pop=L50.pop
gen L60pop=L60.pop

gen pctch10=100*(pop/L10pop-1)
gen pctch20=100*(pop/L20pop-1)
gen pctch30=100*(pop/L30pop-1)
gen pctch40=100*(pop/L40pop-1)
gen pctch50=100*(pop/L50pop-1)

gen lagpctch10=L10.pctch10
gen lagpctch20=L20.pctch20
gen lagpctch30=L30.pctch30
gen lagpctch40=L40.pctch40
gen lagpctch50=L50.pctch50

gen insample=1 if year==2010
replace insample=0 if L60pop<40000
replace insample=0 if L60pop==.
replace insample=0 if pctch30==.
replace insample=0 if lagpctch30==.

keep if insample==1

fracpoly qreg pctch10 lagpctch10
predict err10, resid

fracpoly qreg pctch20 lagpctch20
predict p20
predict err20, resid

fracpoly qreg pctch30 lagpctch30
predict p30
predict err30, resid

fracpoly qreg pctch40 lagpctch40
predict err40, resid

fracpoly qreg pctch50 lagpctch50
predict err50, resid

gen abd10=abs(err10)
gen abd20=abs(err20)
gen abd30=abs(err30)
gen abd40=abs(err40)
```

```
gen abd50=abs(err50)

summ pctch20 pctch30 pctch40 pctch50, detail
summ err10 err20 err30 err40 err50, detail
summ abd10 abd20 abd30 abd40 abd50, detail

centile err10 err20 err30 err40 err50 , centile(80 90)

hist pctch20 if pctch20<=150, freq xtitle("% Change") title(Population Change
Distribution 1990-2010)/*
*/ note("Counties>40,000 in 1950, those growing more than 150% not shown.")
graph save Graph "D:\jimd\PLUM CREEK\Twenty year growth histogram.gph",
replace

hist pctch30 if pctch30<200, freq xtitle("% Change") title(Population Change
Distribution 1980-2010)/*
*/ note("Counties>40,000 in 1950, those growing more than 200% not shown.")
graph save Graph "D:\jimd\PLUM CREEK\Thirty year growth histogram.gph",
replace

hist pctch50 if pctch50<=400, freq xtitle("% Change") title(Population Change
Distribution 1960-2010)/*
*/ note("Counties>40,000 in 1950, excluding those growing more than 400%.")
graph save Graph "D:\jimd\PLUM CREEK\Fifty year growth histogram.gph",
replace

twoway (scatter pctch20 p20 lagpctch20 , sort msymbol(smx i)c(i l) ) , /*
*/ title(Percentage Population Growth 1990-2010 vs. 1970-1990) /*
*/ xlabel(-50 0 50 100 150 200 250 300) ylabel(-50 0 50 100 150 200) /*
*/ note("Counties>40,000 in 1950, Alachua indicated") xtitle(% Change 1970-
1990) legend(off) xline(73.338) yline(36.201)
graph save Graph "D:\jimd\PLUM CREEK\Twenty year growth figure.gph", replace

twoway (scatter pctch30 p30 lagpctch30 if lagpctch30<=500, sort msymbol(smx
i) c(i l) ) , /*
*/ title(Percentage Population Growth 1980-2010 vs. 1950-1980) xlabel(0 100
200 300 400) /*
*/ note("Counties>40,000 in 1950, Alachua indicated, those growing over 500%
from 1950 to 1980 not shown.") /*
*/ xtitle(% Change 1950-1980) legend(off) xline(165.439) yline(63.399)
graph save Graph "D:\jimd\PLUM CREEK\Thirty year growth figure.gph", replace

keep if err20>=20
keep state county L20pop lagpctch20 pctch20 p20 err20
save "agcounties.dta", replace

clear
log close
```

Appendix C: Stata log file from population trend break analysis

```
       log:  D:\jimd\PLUM CREEK\popultion projection work 10 30 2013.smcl
  log type:  smcl
 opened on:  30 Oct 2013, 11:28:13

. set more off

. use "countypop1900_2010 long.dta", clear

. destring fipsstco, replace
fipsstco has all characters numeric; replaced as long

. xtset fipsstco year
       panel variable:  fipsstco (strongly balanced)
        time variable:  year, 1900 to 2010, but with gaps
                delta:  1 unit

. gen L10pop=L10.pop
(4818 missing values generated)

. gen L20pop=L20.pop
(7918 missing values generated)

. gen L30pop=L30.pop
(11018 missing values generated)

. gen L40pop=L40.pop
(14097 missing values generated)

. gen L50pop=L50.pop
(17150 missing values generated)

. gen L60pop=L60.pop
(20177 missing values generated)

. gen pctch10=100*(pop/L10pop-1)
(4826 missing values generated)

. gen pctch20=100*(pop/L20pop-1)
(7926 missing values generated)

. gen pctch30=100*(pop/L30pop-1)
(11026 missing values generated)

. gen pctch40=100*(pop/L40pop-1)
(14105 missing values generated)

. gen pctch50=100*(pop/L50pop-1)
(17157 missing values generated)

. gen lagpctch10=L10.pctch10
(7918 missing values generated)

. gen lagpctch20=L20.pctch20
(14097 missing values generated)
```

```
. gen lagpctch30=L30.pctch30
(20177 missing values generated)

. gen lagpctch40=L40.pctch40
(26172 missing values generated)

. gen lagpctch50=L50.pctch50
(32048 missing values generated)

. gen insample=1 if year==2010
(34100 missing values generated)

. replace insample=0 if L60pop<40000
(14230 real changes made)

. replace insample=0 if L60pop==.
(20177 real changes made)

. replace insample=0 if pctch30==.
(4 real changes made)

. replace insample=0 if lagpctch30==.
(0 real changes made)

. keep if insample==1
(36553 observations deleted)

.
. fracpoly qreg pctch10 lagpctch10
........
-> gen double Ilagp__1 = X^2-.1058698406 if e(sample)
-> gen double Ilagp__2 = X^2*ln(X)+.1188677381 if e(sample)
   (where: X = (lagpctch10+22.43353271484375)/100)
Iteration  1:  WLS sum of weighted deviations =  2575.9867
Iteration  1: sum of abs. weighted deviations =  2575.0321
Iteration  2: sum of abs. weighted deviations =  2571.2753
Iteration  3: sum of abs. weighted deviations =  2569.4114
Iteration  4: sum of abs. weighted deviations =  2568.8944
Iteration  5: sum of abs. weighted deviations =  2568.8637
Iteration  6: sum of abs. weighted deviations =  2568.8581
Iteration  7: sum of abs. weighted deviations =  2568.7941

Median regression                                 Number of obs =       647
  Raw sum of deviations 4911.839 (about 5.0066185)
  Min sum of deviations 2568.794                  Pseudo R2     =    0.4770

------------------------------------------------------------------------------
     pctch10 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    Ilagp__1 |   65.71985   2.410865    27.26   0.000     60.98574    70.45396
    Ilagp__2 |   -82.9132   6.865198   -12.08   0.000    -96.39408   -69.43233
       _cons |   6.424234     .23786    27.01   0.000     5.957159    6.891309
------------------------------------------------------------------------------
Deviance:  -419.39. Best powers of lagpctch10 among 44 models fit: 2 2.

. predict err10, resid
```

```
.
. fracpoly qreg pctch20 lagpctch20
........
-> gen double Ilagp__1 = X^.5-.7662283642 if e(sample)
-> gen double Ilagp__2 = X^.5*ln(X)+.4080549584 if e(sample)
   (where: X = (lagpctch20+36.24896240234375)/100)
Iteration  1:  WLS sum of weighted deviations =  6688.4524

Iteration  1: sum of abs. weighted deviations =  6685.3128
Iteration  2: sum of abs. weighted deviations =   6684.927
Iteration  3: sum of abs. weighted deviations =  6672.6044
Iteration  4: sum of abs. weighted deviations =  6644.0954
Iteration  5: sum of abs. weighted deviations =  6642.7295
Iteration  6: sum of abs. weighted deviations =  6642.6723
Iteration  7: sum of abs. weighted deviations =  6642.6562
Iteration  8: sum of abs. weighted deviations =  6642.6051

Median regression                                    Number of obs =       647
  Raw sum of deviations 11300.66 (about 13.476464)
  Min sum of deviations 6642.605                     Pseudo R2     =    0.4122

------------------------------------------------------------------------------
     pctch20 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    Ilagp__1 |   63.00549    9.04737     6.96   0.000     45.23958    80.77139
    Ilagp__2 |   26.45433    5.52719     4.79   0.000     15.60084    37.30782
       _cons |   18.55159   .6051602    30.66   0.000     17.36326    19.73992
------------------------------------------------------------------------------
Deviance:  -343.79. Best powers of lagpctch20 among 44 models fit: .5 .5.

. predict p20
(option xb assumed; fitted values)

. predict err20, resid

.
. fracpoly qreg pctch30 lagpctch30
........
-> gen double Ilagp__1 = X-.1159010302 if e(sample)
-> gen double Ilagp__2 = X*ln(X)+.2497688804 if e(sample)
   (where: X = (lagpctch30+49.53970336914063)/1000)
Iteration  1:  WLS sum of weighted deviations =  14352.882

Iteration  1: sum of abs. weighted deviations =  14699.973
Iteration  2: sum of abs. weighted deviations =  14328.799
Iteration  3: sum of abs. weighted deviations =  14310.235
Iteration  4: sum of abs. weighted deviations =  14304.967
Iteration  5: sum of abs. weighted deviations =  14198.856
Iteration  6: sum of abs. weighted deviations =  14124.375
Iteration  7: sum of abs. weighted deviations =  14081.063
Iteration  8: sum of abs. weighted deviations =  14068.975
Iteration  9: sum of abs. weighted deviations =  14068.581
Iteration 10: sum of abs. weighted deviations =  14068.577
```

```
Median regression                                   Number of obs =       647
  Raw sum of deviations 19264.98 (about 18.595852)
  Min sum of deviations 14068.58                    Pseudo R2     =    0.2697

------------------------------------------------------------------------------
     pctch30 |      Coef.   Std. Err.      t    P>|t|    [95% Conf. Interval]
-------------+----------------------------------------------------------------
    Ilagp__1 |     134.58   13.52774     9.95   0.000     108.0162   161.1439
    Ilagp__2 |   -231.938   18.45013   -12.57   0.000    -268.1677  -195.7083
       _cons |   29.37943   1.182282    24.85   0.000     27.05783   31.70102
------------------------------------------------------------------------------
Deviance:  -203.38. Best powers of lagpctch30 among 44 models fit: 1 1.

. predict p30
(option xb assumed; fitted values)

. predict err30, resid

.
. fracpoly qreg pctch40 lagpctch40
........
-> gen double Ilagp__1 = ln(X)+1.669933974 if e(sample)
-> gen double Ilagp__2 = ln(X)^2-2.788679478 if e(sample)
   (where: X = (lagpctch40+68.4216194152832)/1000)
Iteration  1:  WLS sum of weighted deviations =   26949.97

Iteration  1: sum of abs. weighted deviations =  30601.379
Iteration  2: sum of abs. weighted deviations =  26930.191
Iteration  3: sum of abs. weighted deviations =  26628.214
Iteration  4: sum of abs. weighted deviations =  25998.859

Median regression                                   Number of obs =       637
  Raw sum of deviations  30828.3 (about 31.810453)
  Min sum of deviations 25998.86                    Pseudo R2     =    0.1567

------------------------------------------------------------------------------
     pctch40 |      Coef.   Std. Err.      t    P>|t|    [95% Conf. Interval]
-------------+----------------------------------------------------------------
-
    Ilagp__1 |   57.04678   4.200945    13.58   0.000     48.79733   65.29623
    Ilagp__2 |   3.482122   .4512569     7.72   0.000     2.595983   4.368261
       _cons |    47.0845   2.245306    20.97   0.000     42.67536   51.49364
------------------------------------------------------------------------------
Deviance:  -108.53. Best powers of lagpctch40 among 44 models fit: 0 0.

. predict err40, resid
(10 missing values generated)

.
. fracpoly qreg pctch50 lagpctch50
........
-> gen double Ilagp__1 = X-.22125133 if e(sample)
-> gen double Ilagp__2 = X*ln(X)+.3337478926 if e(sample)
   (where: X = (lagpctch50+27.89187622070313)/1000)
Iteration  1:  WLS sum of weighted deviations =  39421.061

Iteration  1: sum of abs. weighted deviations =  40247.372
```

```
Iteration  2: sum of abs. weighted deviations =   39320.37
Iteration  3: sum of abs. weighted deviations =  38601.241
Iteration  4: sum of abs. weighted deviations =  38065.835
Iteration  5: sum of abs. weighted deviations =  37981.798
Iteration  6: sum of abs. weighted deviations =  37951.609
Iteration  7: sum of abs. weighted deviations =  37941.526
Iteration  8: sum of abs. weighted deviations =  37927.636
Iteration  9: sum of abs. weighted deviations =   37926.42

Median regression                                    Number of obs =       587
  Raw sum of deviations 41818.14 (about 42.075485)
  Min sum of deviations 37926.42                     Pseudo R2     =    0.0931

------------------------------------------------------------------------------
     pctch50 |      Coef.   Std. Err.      t    P>|t|    [95% Conf. Interval]
-------------+----------------------------------------------------------------
    Ilagp__1 |   177.3113   14.77098    12.00   0.000     148.3006    206.322
    Ilagp__2 |  -83.86743   8.831065    -9.50   0.000    -101.2119  -66.52292
       _cons |   67.11592   3.578603    18.75   0.000     60.08742   74.14442
------------------------------------------------------------------------------
Deviance:   -57.34. Best powers of lagpctch50 among 44 models fit: 1 1.

. predict err50, resid
(60 missing values generated)

. gen abd10=abs(err10)

. gen abd20=abs(err20)

. gen abd30=abs(err30)

. gen abd40=abs(err40)
(10 missing values generated)

. gen abd50=abs(err50)
(60 missing values generated)

. summ pctch20 pctch30 pctch40 pctch50, detail

                           pctch20
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -19.50943      -37.23782
 5%    -7.674883      -30.81048
10%    -4.443714      -24.72658       Obs                 647
25%     2.067166      -24.53347       Sum of Wgt.         647

50%     13.47646                      Mean           19.03446
                        Largest       Std. Dev.      26.57938
75%     27.95268       142.1445
90%     46.77222       163.1984       Variance       706.4635
95%     69.14704       196.3009       Skewness       2.466794
99%     111.3464       222.8348       Kurtosis       14.03524
```

```
                            pctch30
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -29.16463      -55.68448
 5%    -15.64252      -38.37384
10%    -9.948726      -37.42954       Obs                 647
25%    -.2287914      -30.10575       Sum of Wgt.         647

50%     18.59585                      Mean           29.48408
                        Largest       Std. Dev.       47.2192
75%     42.90431       313.3065
90%     84.66392       321.3612       Variance       2229.653
95%     108.7669       362.9585       Skewness       3.093308
99%     198.9072       441.1278       Kurtosis       20.07234

                            pctch40
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -31.44514      -56.35535
 5%     -15.9306      -48.68603
10%    -9.273969      -45.66998       Obs                 647
25%     4.554885      -42.06474       Sum of Wgt.         647

50%     31.81045                      Mean           52.49401
                        Largest       Std. Dev.      85.70483
75%     68.53957       447.9374
90%     140.3316       613.9973       Variance       7345.318
95%     189.1332       776.0911       Skewness       4.803716
99%      341.886       1069.069       Kurtosis       44.27657

                            pctch50
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -42.71235      -69.01162
 5%    -19.34847      -57.42894
10%     -9.22814       -51.9727       Obs                 647
25%     8.278934       -50.5489       Sum of Wgt.         647

50%     46.42651                      Mean            81.7026
                        Largest       Std. Dev.      140.5233
75%     105.6321       615.1226
90%     207.0975       1296.977       Variance       19746.79
95%     296.7019       1436.239       Skewness        5.85382
99%     499.5724       1796.722       Kurtosis       58.33204

. summ err10 err20 err30 err40 err50, detail
```

Residuals

	Percentiles	Smallest		
1%	-14.09515	-26.61538		
5%	-8.183175	-18.23748		
10%	-5.506893	-16.98956	Obs	647
25%	-2.661415	-16.36176	Sum of Wgt.	647
50%	8.88e-16		Mean	.3015249
		Largest	Std. Dev.	5.936108
75%	3.120161	18.84985		
90%	7.094812	18.86033	Variance	35.23738
95%	9.211919	26.76987	Skewness	2.207341
99%	12.42477	67.7654	Kurtosis	29.40737

Residuals

	Percentiles	Smallest		
1%	-35.37671	-44.75614		
5%	-18.22993	-42.89234		
10%	-13.36049	-42.16897	Obs	647
25%	-5.899209	-41.00531	Sum of Wgt.	647
50%	0		Mean	1.637814
		Largest	Std. Dev.	16.62226
75%	7.013125	75.62318		
90%	16.1783	83.12877	Variance	276.2995
95%	26.47064	100.7435	Skewness	2.778971
99%	57.28527	175.3236	Kurtosis	25.03461

Residuals

	Percentiles	Smallest		
1%	-56.57001	-98.01559		
5%	-32.42232	-80.03088		
10%	-24.46684	-69.67889	Obs	647
25%	-12.02841	-63.24984	Sum of Wgt.	647
50%	0		Mean	6.203059
		Largest	Std. Dev.	37.78547
75%	15.03462	223.0266		
90%	35.13907	267.9021	Variance	1427.741
95%	67.90623	283.7775	Skewness	3.53431
99%	150.1705	361.8054	Kurtosis	25.62281

```
                              Residuals
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -80.58166      -134.8353
 5%    -46.26207      -94.38994
10%    -37.20752      -93.11196       Obs                 637
25%    -22.29884      -87.31365       Sum of Wgt.         637

50%     3.55e-15                      Mean           15.98684
                        Largest       Std. Dev.      77.75834
75%     30.84148       382.4473
90%     78.69135       410.8761       Variance       6046.359
95%     141.7091       726.5093       Skewness       5.838454
99%     281.1649       1044.136       Kurtosis       63.03944

                              Residuals
-------------------------------------------------------------
      Percentiles      Smallest
 1%     -138.205      -210.4449
 5%    -78.29494      -159.5831
10%    -55.99665      -158.8228       Obs                 587
25%    -33.90414       -158.316       Sum of Wgt.         587

50%    -4.26e-14                      Mean           24.25422
                        Largest       Std. Dev.      133.9395
75%     42.94571       457.2475
90%     119.5428       1187.167       Variance       17939.79
95%     209.0056       1266.062       Skewness        6.82792
99%     414.1636       1790.233       Kurtosis       75.36164

. summ abd10 abd20 abd30 abd40 abd50, detail

                                abd10
-------------------------------------------------------------
      Percentiles      Smallest
 1%      .023427              0
 5%     .2017052       8.88e-16
10%     .4034718       7.11e-15       Obs                 647
25%      1.26251       .0182597       Sum of Wgt.         647

50%     2.866665                      Mean           3.970315
                        Largest       Std. Dev.      4.420479
75%     5.324107       18.86033
90%     8.851383       26.61538       Variance       19.54064
95%     11.16255       26.76987       Skewness       5.677736
99%     17.63296        67.7654       Kurtosis        71.2238
```

abd20

	Percentiles	Smallest		
1%	.0394629	0		
5%	.5072834	0		
10%	1.139001	0	Obs	647
25%	3.054132	.0144981	Sum of Wgt.	647
50%	6.624716		Mean	10.26678
		Largest	Std. Dev.	13.16876
75%	12.24858	75.62318		
90%	23.44715	83.12877	Variance	173.4162
95%	33.83139	100.7435	Skewness	4.939673
99%	57.28527	175.3236	Kurtosis	47.04214

abd30

	Percentiles	Smallest		
1%	.140287	0		
5%	1.117129	7.11e-15		
10%	2.52304	1.42e-14	Obs	647
25%	6.21956	.0263875	Sum of Wgt.	647
50%	12.97543		Mean	21.74432
		Largest	Std. Dev.	31.50764
75%	25.26377	223.0266		
90%	46.60415	267.9021	Variance	992.7315
95%	69.05991	283.7775	Skewness	5.111098
99%	150.1705	361.8054	Kurtosis	40.92918

abd40

	Percentiles	Smallest		
1%	.2258587	0		
5%	1.709261	3.55e-15		
10%	4.260104	1.42e-14	Obs	637
25%	11.02822	.1214997	Sum of Wgt.	637
50%	24.7429		Mean	40.81454
		Largest	Std. Dev.	68.07272
75%	43.09733	382.4473		
90%	83.12476	410.8761	Variance	4633.895
95%	141.7091	726.5093	Skewness	7.783112
99%	281.1649	1044.136	Kurtosis	94.97254

```
                            abd50
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .4923283              0
 5%     3.092377              0
10%      6.63525       4.26e-14       Obs                 587
25%     17.77493        .337757       Sum of Wgt.         587

50%     37.36905                      Mean            64.6106
                        Largest       Std. Dev.      119.7807
75%     68.04223       457.2475
90%     135.9948       1187.167       Variance       14347.41
95%     209.4226       1266.062       Skewness       8.685005
99%     414.1636       1790.233       Kurtosis       105.2853

.
. centile err10 err20 err30 err40 err50 , centile(80 90)

                                                       -- Binom. Interp. --
    Variable |     Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
       err10 |     647          80      4.198592        3.549778    4.572863
             |                  90      7.132305        5.918731    7.854604
       err20 |     647          80      8.830209        7.686033     10.3092
             |                  90      16.20273        13.32684    19.93077
       err30 |     647          80      19.96548        16.29335    23.58267
             |                  90      35.47926        30.63219    48.51613
       err40 |     637          80      39.91707        34.75896     49.5966
             |                  90      78.76006        67.16734    100.2463
       err50 |     587          80      59.28683        50.00907    72.31149
             |                  90      119.6627        97.46951     148.548

. hist pctch20 if pctch20<=150, freq xtitle("% Change") title(Population
Change Distribution 1990-2010)/*
> */ note("Counties>40,000 in 1950, those growing more than 150% not shown.")
(bin=25, start=-37.237816, width=7.1752939)

. graph save Graph "D:\jimd\PLUM CREEK\Twenty year growth histogram.gph",
replace
(file D:\jimd\PLUM CREEK\Twenty year growth histogram.gph saved)

. hist pctch30 if pctch30<200, freq xtitle("% Change") title(Population
Change Distribution 1980-2010)/*
> */ note("Counties>40,000 in 1950, those growing more than 200% not shown.")
(bin=25, start=-55.684483, width=10.183668)

. graph save Graph "D:\jimd\PLUM CREEK\Thirty year growth histogram.gph",
replace
(file D:\jimd\PLUM CREEK\Thirty year growth histogram.gph saved)

. hist pctch50 if pctch50<=400, freq xtitle("% Change") title(Population
Change Distribution 1960-2010)/*
> */ note("Counties>40,000 in 1950, excluding those growing more than 400%.")
(bin=25, start=-69.01162, width=18.651523)

. graph save Graph "D:\jimd\PLUM CREEK\Fifty year growth histogram.gph",
replace
```

```
(file D:\jimd\PLUM CREEK\Fifty year growth histogram.gph saved)

. twoway (scatter pctch20 p20 lagpctch20 , sort msymbol(smx i)c(i l) ) , /*
> */ title(Percentage Population Growth 1990-2010 vs. 1970-1990) /*
> */ xlabel(-50 0 50 100 150 200 250 300) ylabel(-50 0 50 100 150 200) /*
> */ note("Counties>40,000 in 1950, Alachua indicated") xtitle(% Change 1970-
1990) legend(off) xline(73.338
> ) yline(36.201)

. graph save Graph "D:\jimd\PLUM CREEK\Twenty year growth figure.gph",
replace
(file D:\jimd\PLUM CREEK\Twenty year growth figure.gph saved)

. twoway (scatter pctch30 p30 lagpctch30 if lagpctch30<=500, sort msymbol(smx
i) c(i l) ) , /*
> */ title(Percentage Population Growth 1980-2010 vs. 1950-1980) xlabel(0 100
200 300 400) /*
> */ note("Counties>40,000 in 1950, Alachua indicated, those growing over
500% from 1950 to 1980 not shown.
> ") /*
> */ xtitle(% Change 1950-1980) legend(off) xline(165.439) yline(63.399)

. graph save Graph "D:\jimd\PLUM CREEK\Thirty year growth figure.gph",
replace
(file D:\jimd\PLUM CREEK\Thirty year growth figure.gph saved)

. keep if err20>=20
(597 observations deleted)

. keep state county L20pop lagpctch20 pctch20 p20 err20

. save "agcounties.dta", replace
file agcounties.dta saved

. clear

. log close
       log:  D:\jimd\PLUM CREEK\popultion projection work 10 30 2013.smcl
  log type:  smcl
 closed on:  30 Oct 2013, 11:29:06
------------------------------------------------------------------------------
```