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PRACTICE IN SCHOOL ENROLLMENT PROJECTIONS



Xiaomin Ruan

**For 13th NM Data User Conference
Geospatial & Population Studies
University of New Mexico
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Challenges to Small Area Population Estimation/Projections

- Smaller the area is, more variant each age cohort is .
- Smaller the area is, more variant each demographic component is, like birth, death, migration, etc.
- The smaller the area is, less data resource is available for estimation models, and less financial resource to local data users.

Challenges to NM School Enrollment Projections

- Each grade level enrollment needs to be summed up to match school total enrollment, and each school level enrollment needs to be summed up to match school district enrollment.
- Each grade level enrollment each year needs to be compatible with lower grade level in previous year, at both school and school district level.
- Varying tendency in birth and migration in border state like NM makes first grade or kindergarten enrollment hard to predict.

Key Points to Forecast School Enrollment

- Grade progression ratio, if stable and reliable, can be used to predict higher grade enrollments.
- For the starting grade, like grade 9 in high school or kindergarten or grade 1, birth data would be the first source to explore when we are trying to capture future enrollment dynamics.
- As a border state, NM school and school districts also face migration changes, which may be a strong factor when we forecast school enrollments

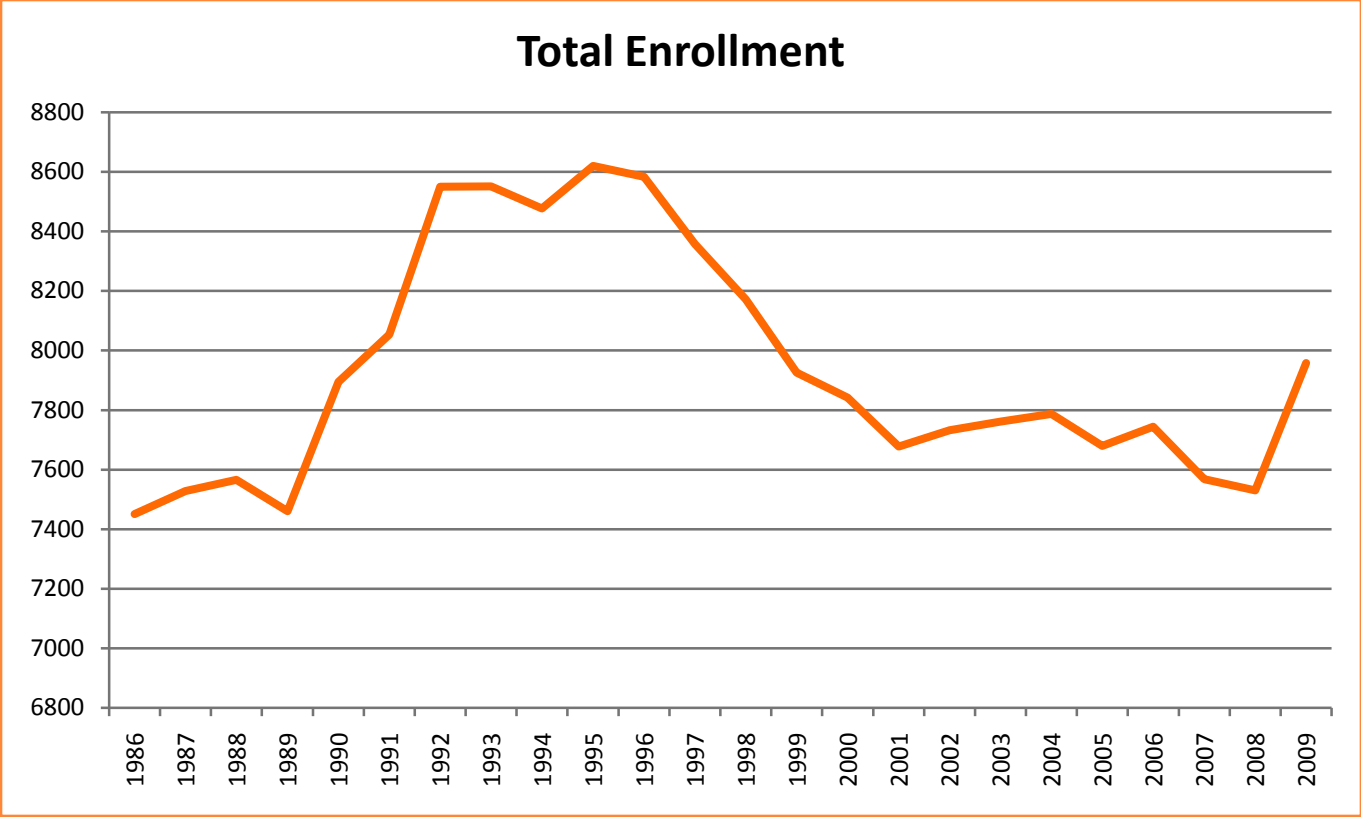
Two School District Examples: Clovis and Central



Clovis Municipal Schools Facts

- Clovis Municipal Schools has 8,415 students in SY 2010-11. It serves 1 high school, 3 Jr. high schools, and 13 elementary schools.
- Located in Curry County, Clovis District enrollment is heavily affected by group quarters like Cannon Air Force Base.

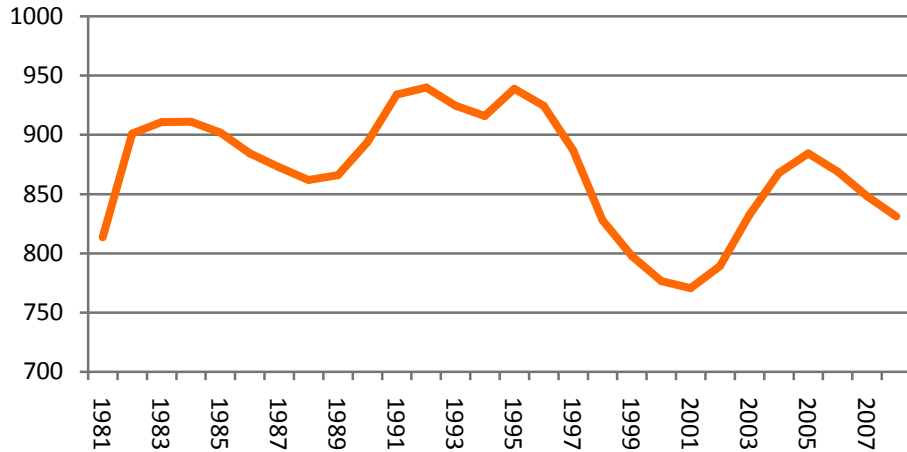
Clovis Municipal Schools Historical Enrollment



Data Preparation

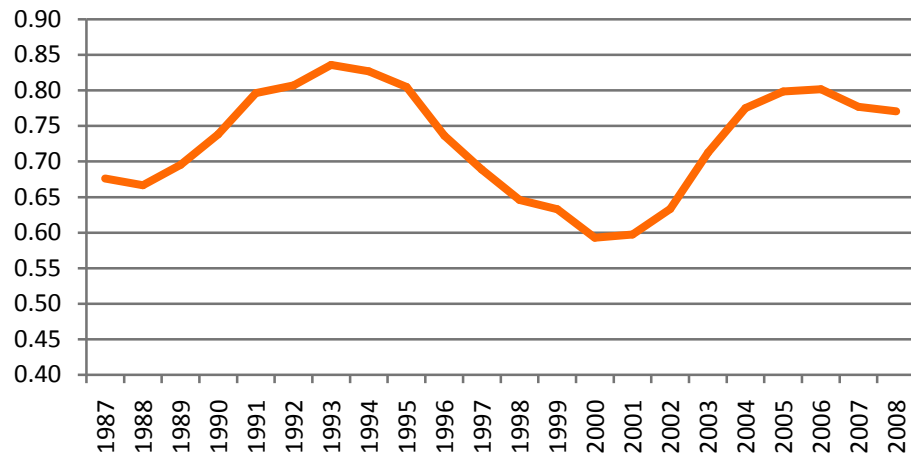
- County level live birth data were distributed to each school district according to geocoding results and birth-age mothers' shares, and then averaged by 3 years to smooth out bumps.
- Each grade enrollment at each school and school district level were averaged in 3 years.
- Actual grade progression ratios are calculated from SY1986-87 to SY2009-10, all-yr, 15-yr, 10-yr, and 5-yr averages are calculated.
- Sam cohort kg/birth, g01/birth, g07/birth, and g09/birth are calculated and pictured.

birth_3yr

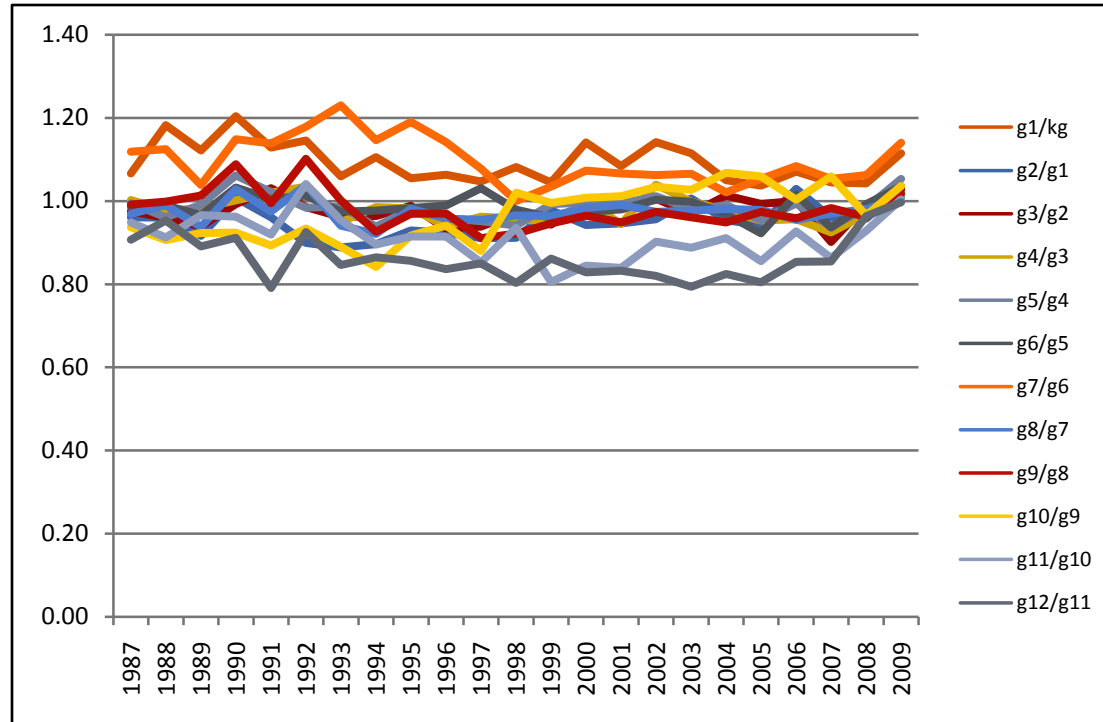


Neither 3-yr average birth nor the same cohort kg/birth ratio showed any trend stable enough to be the basis for forecasting.

kg/birth



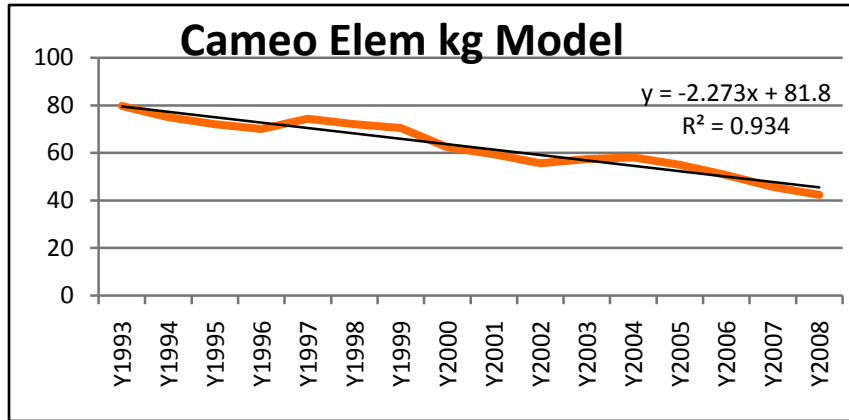
Real Grade Progression Ratios Chart for Clovis, 1987-2009



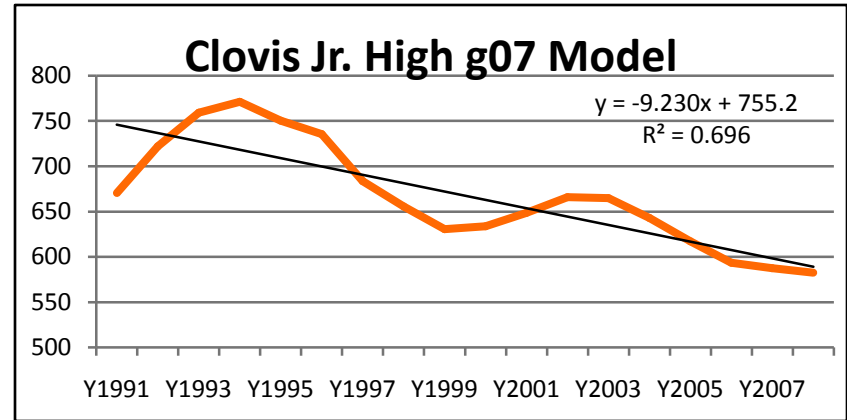
The grade progression ratios, however, demonstrated very stable trends over time, provided a solid basis to use grade progression for higher grades.

Solution for Kindergarten and Grade 07

Kindergarten



Grade 07



A simple OLS regression model is applied to each school's kindergarten enrollment. Then all the school regression results are summed up and averaged with the school district level kindergarten enrollment regression outcome.

Whenever kindergarten enrollment is not stable, grade one is used in regression instead.



Other Grade Enrollment Projection

The averaged kindergarten enrollment forecasts are then multiplied with each grade progression ratio to derive the second or higher grade enrollment, both at school level and school district level.

After all grade enrollment forecasts are developed, the sum total from all schools is compared against the school district forecasts to make sure their trends are consistent.

Model Validation

The validation data is the average of school level and district level against actual enrollments using three most recent school years.

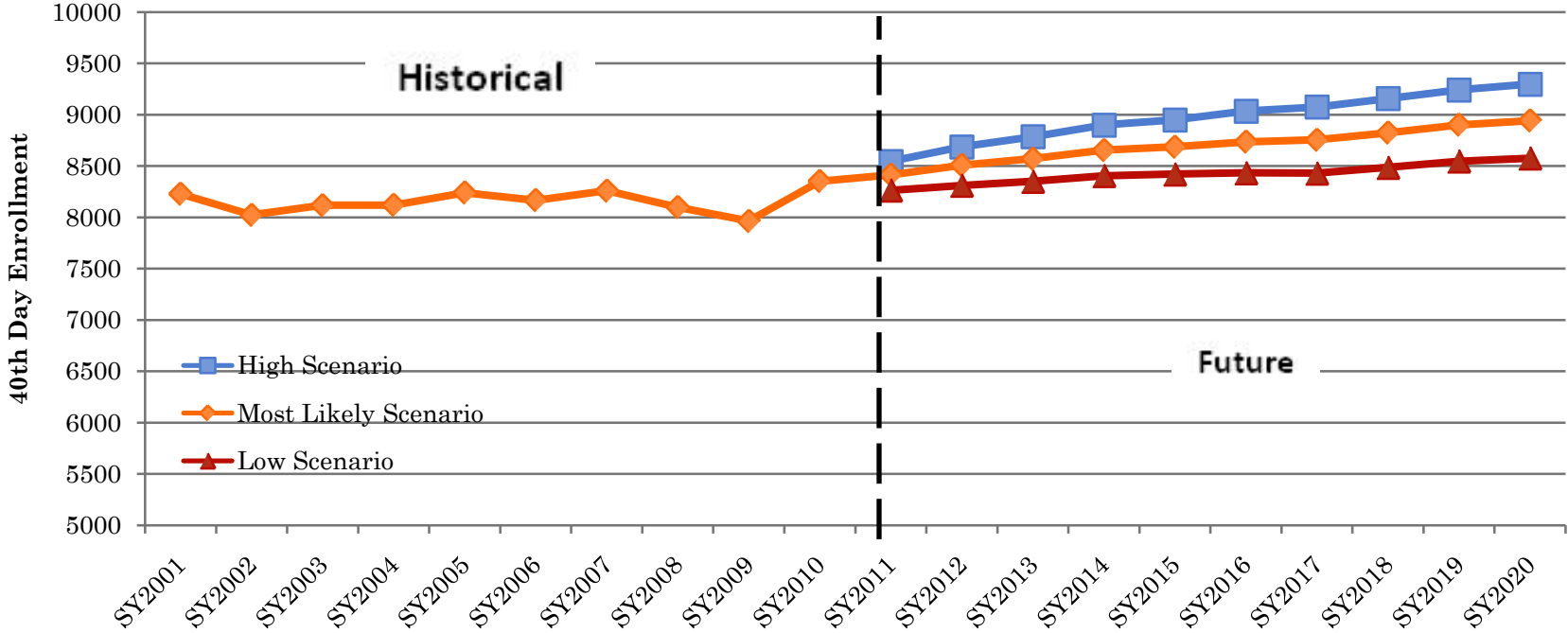
	SY2008	SY2009	SY2010	AVE
Actual Enrollment	7965	7966	8354	
Estimated	7987	8187	8895	
Percentage Diff.	0.28%	2.77%	6.48%	3.18%

After SY 2010-11 enrollment data published, we compared our projections against the newly data as well.

	SY2011
Actual Enrollment	8415
Projected	8391
Percentage Diff.	-0.29%

Projection Trend

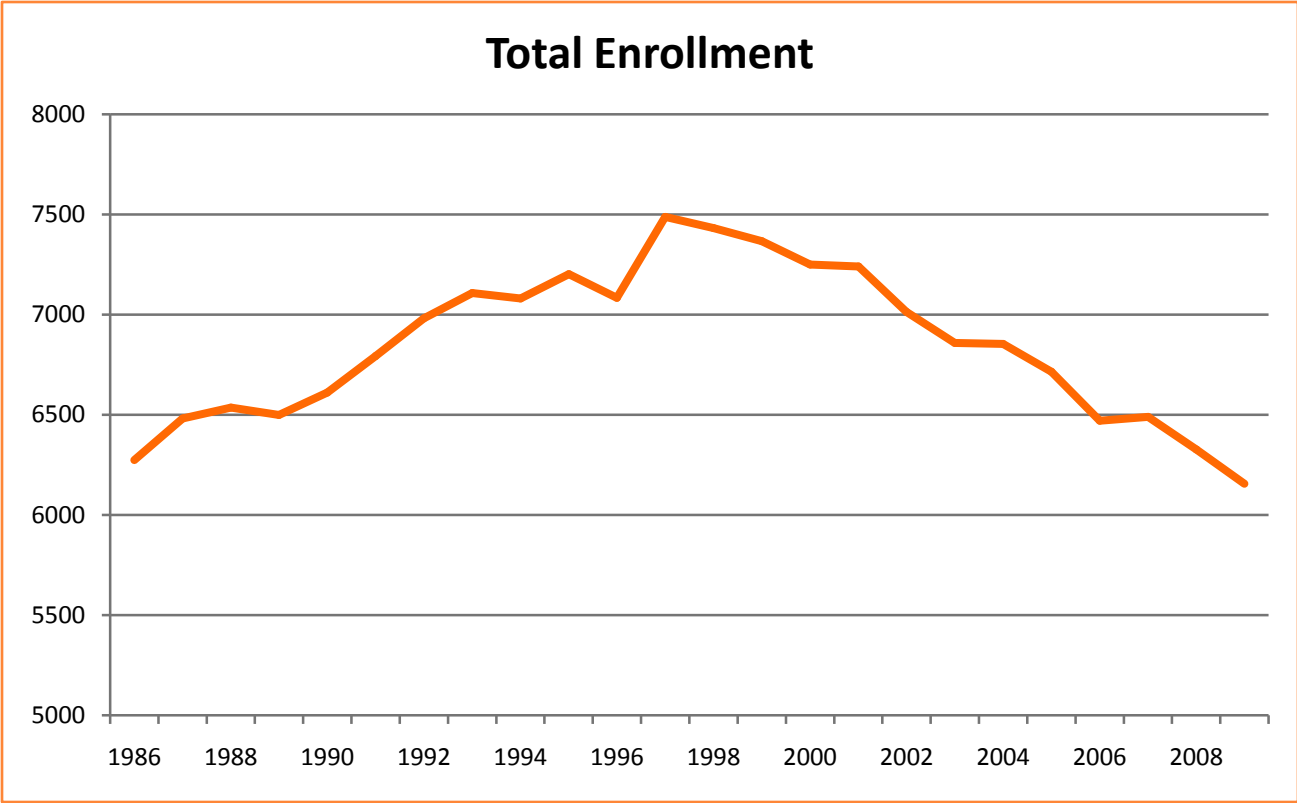
Historical and Forecasted Total School Enrollments: Clovis Municipal Schools



Central Municipal Schools Facts

- Central Consolidated Schools has 6,274 students in SY 2010-11. It serves 4 high schools, 3 middle schools, and 10 elementary schools.
- Located in San Juan County, Central District enrollment is affected migrations between San Juan and McKinley among Navajo nations.

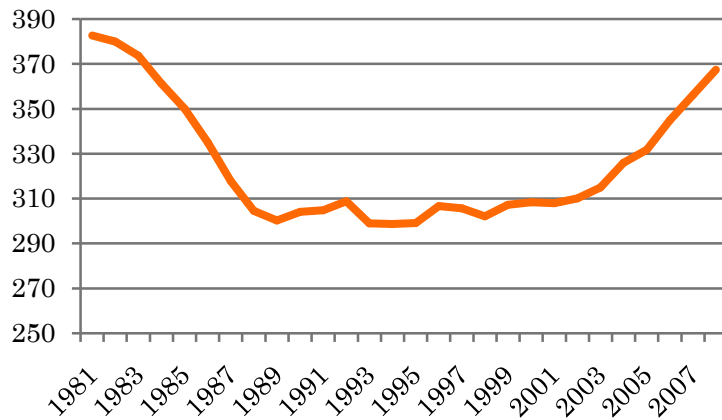
Central Municipal Schools Historical Enrollment



Data Preparation

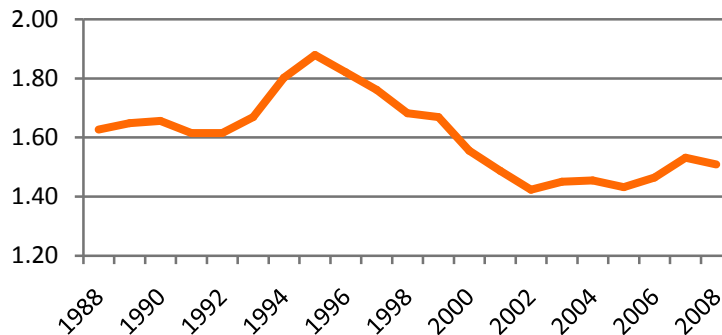
- County level live birth data were distributed to each school district according to geocoding results and birth-age mothers' shares, and then averaged by 3 years to smooth out bumps.
- Each grade enrollment at each school and school district level were averaged in 3 years.
- Actual grade progression ratios are calculated from SY1986-87 to SY2009-10, all-yr, 15-yr, 10-yr, and 5-yr averages are calculated.
- Sam cohort kg/birth, g01/birth, g06/birth, and g09/birth are calculated and pictured.

Birth_3yr

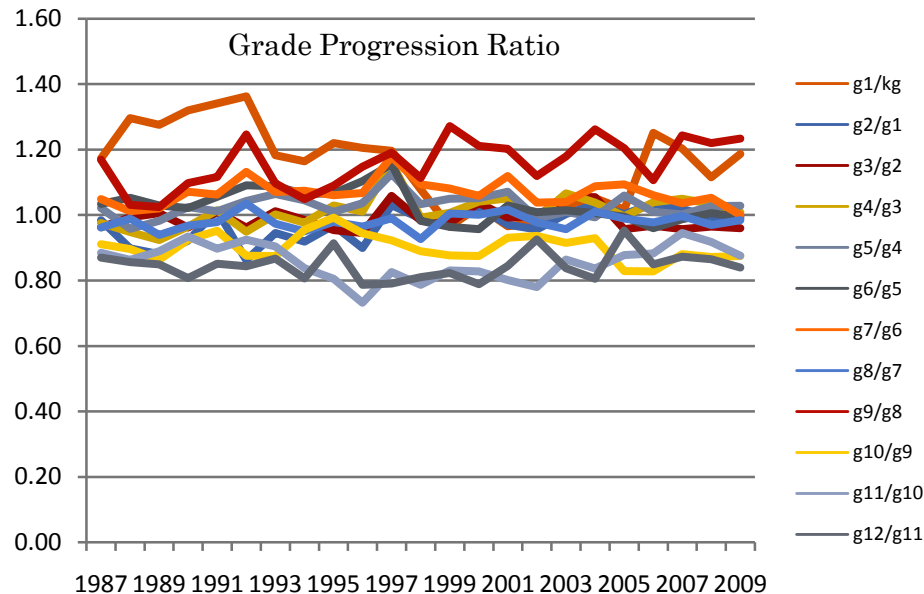


Again, neither 3-yr average birth nor kg/birth ratio showed any stable trend that might be used as the basis for forecasting.

g01/birth

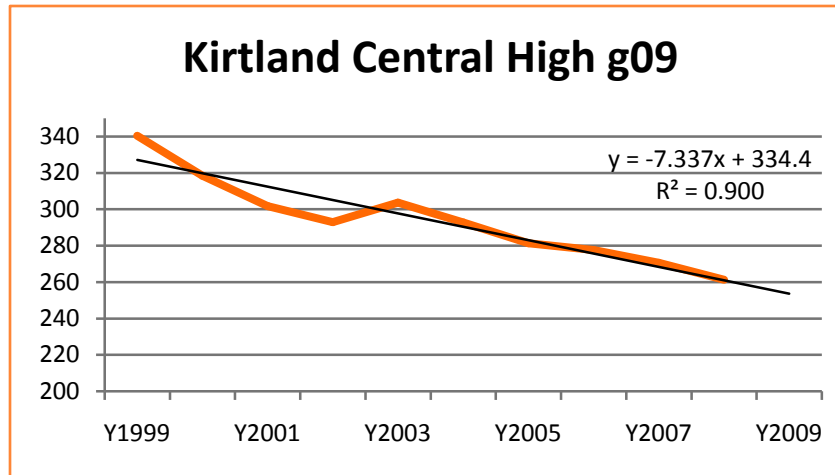
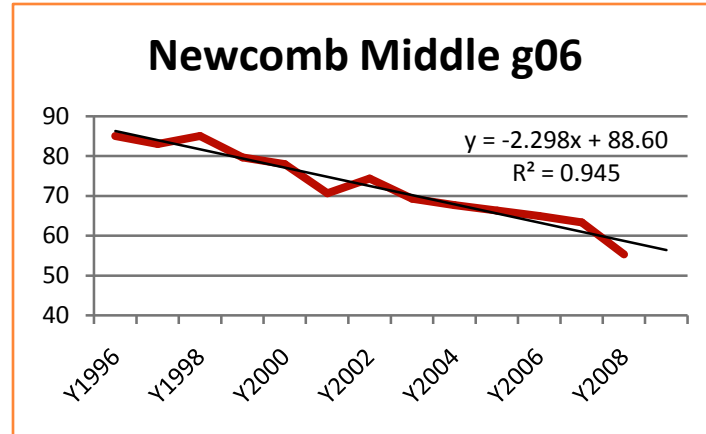
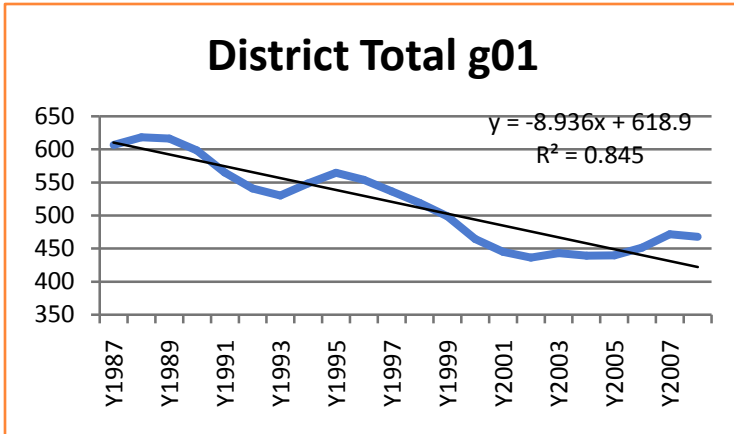


Real Grade Progression Ratios Chart for Central, 1987-2009



The grade progression ratios, however, demonstrated stable trends over time, provided a solid basis to use grade progression for higher grades.

Solution for Grade 01, Grade 06, and Grade 09, Samples





Other Grade Enrollment Projection

The averaged kindergarten or first grade enrollment forecasts are then multiplied with averaged grade progression ratio to derive the second or higher grade enrollment, both at school level and school district level.

After all grade enrollment forecasts are developed, the sum total from all schools is compared against the school district forecasts to make sure their trends are consistent.

Model Validation for Central District

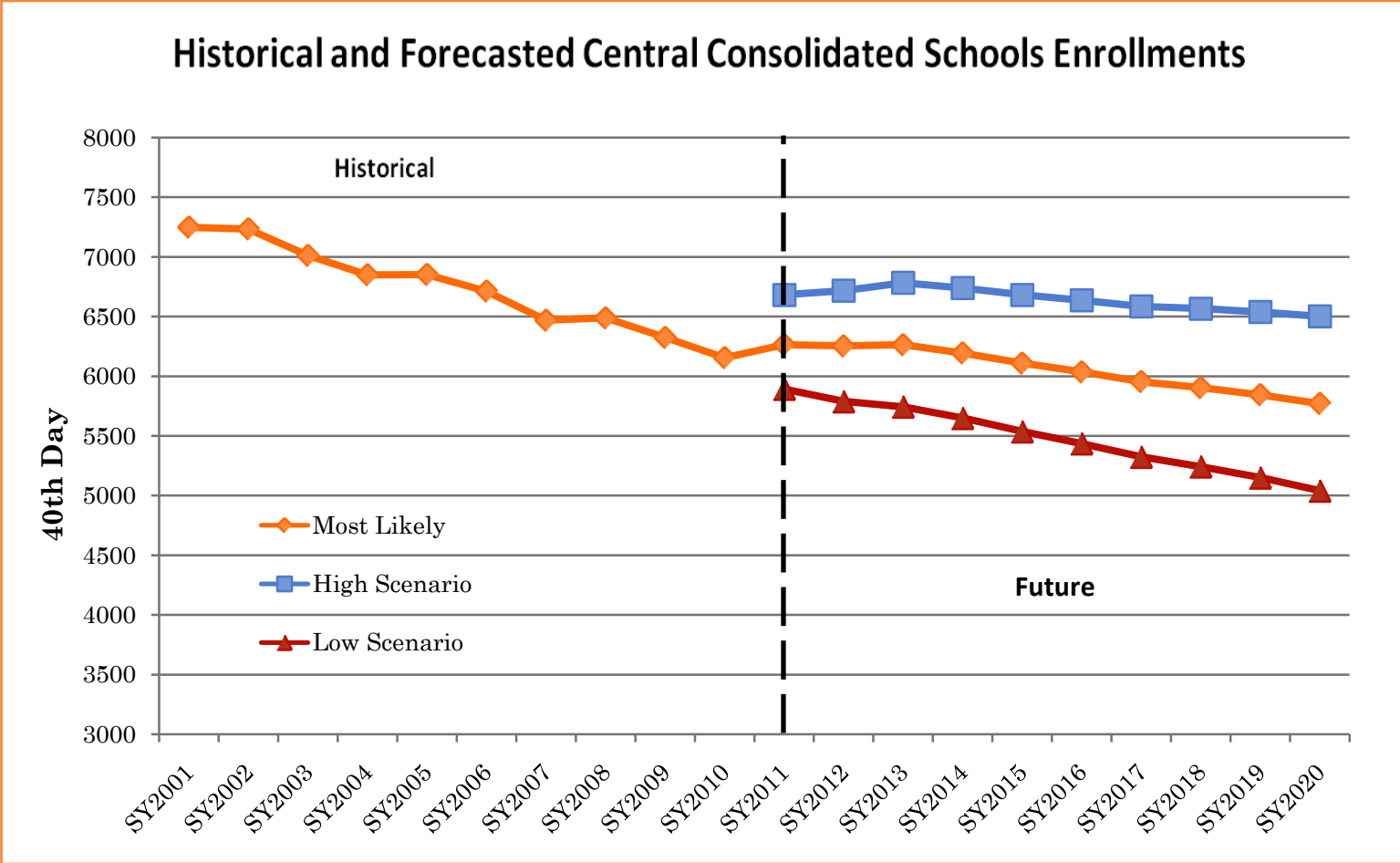
The validation data is the average of school level and district level against actual enrollments using three most recent school years.

	SY2008	SY2009	SY2010	AVE
Actual Enrollment	6,489	6,326	6,156	
Projected	6,577	6,402	6,015	
Percentage Diff.	1.36%	1.20%	-2.29%	0.09%

After SY 2010-11 enrollment data published, we compared our projections against the newly data as well.

	SY2011
Actual Enrollment	6274
Projected	6266
Percentage Diff.	-0.13%

Projection Trend



Model Validation for 28 School Districts

SD Name	Actual Enrollment			Validation from projection			Ave Validation %
	SY2008	SY2009	SY2010	SY2008	SY2009	SY2010	
Reserve	184	169	179	197	172	196	6.11%
Floyd	240	233	235	244	228	239	0.41%
Tatum	284	301	307	299	318	327	5.81%
Mesa Vista	419	401	384	394	393	406	-0.74%
Questa	509	533	513	492	517	484	-3.98%
Capitan	534	496	508	518	451	475	-6.19%
Clayton	531	586	574	505	611	600	1.30%
Eunice	566	582	582	621	654	705	14.41%
Lordsberg	663	650	600	648	616	605	-2.22%
Estancia	869	839	796	899	834	847	3.09%
Raton	1,337	1,299	1,282	1,321	1,301	1,280	-0.40%
Cobre	1,381	1,374	1,297	1,404	1,400	1,285	0.88%
Las Vegas	2,077	1,989	1,928	2,172	2,016	1,959	2.51%
Pojoaque	2,007	1,964	1,964	2,000	1,940	1,956	-0.66%
Taos	3,028	3,035	3,030	2,994	3,064	3,069	0.37%
Los Alamos	3,424	3,350	3,362	3,349	3,426	3,579	2.18%
Espanola	4,522	4,379	4,384	4,722	4,541	4,509	3.66%
Belen	4,709	5,078	5,174	4,774	5,015	5,247	0.52%
Central	6,489	6,326	6,156	6,577	6,402	6,015	0.09%
Alamogordo	6,266	6,073	6,124	6,097	6,053	5,889	-2.29%
Clovis	7,965	7,966	8,354	7,987	8,187	8,895	3.18%
Los Lunas	8,445	8,489	8,442	8,374	8,378	8,279	-1.36%
Roswell	9,297	9,484	9,780	9,245	9,530	9,995	0.71%
Gallup	12,133	12,023	11,776	12,257	12,048	11,838	0.59%
Gadsden	13,819	13,685	13,859	13,644	13,130	12,866	-4.16%
Santa Fe	13,296	13,442	13,684	12,953	13,340	13,837	-0.74%
Rio Rancho	15,502	15,828	16,320	15,074	15,793	16,513	-0.60%
Las Cruces	23,190	22,999	23,542	23,429	23,346	24,299	1.92%
Average Percentage Difference							0.87%

1.80%

1.13%

-0.27%

SY2011 Validation		
Actual	Projected	% Diff.
173	188	8.70%
226	228	0.81%
315	313	-0.76%
392	363	-7.34%
511	517	1.20%
510	491	-3.65%
550	580	5.46%
576	582	1.06%
578	584	0.95%
867	861	-0.70%
1,249	1,245	-0.32%
1,287	1,279	-0.66%
1,885	1,927	2.24%
2,035	1,997	-1.87%
2,963	2,975	0.41%
3,410	3,362	-1.40%
4,333	4,277	-1.29%
4,627	4,792	3.56%
6,274	6,266	-0.13%
6,291	5,989	-4.81%
8,391	8,415	0.28%
8,469	8,469	0.00%
9,903	9,989	0.87%
11,717	11,641	-0.64%
13,904	14,302	2.86%
13,988	13,774	-1.53%
16,530	17,332	4.85%
24,597	23,721	-3.56%
		0.16%

Model Validation for 28 School Districts, continued

Grade	Actual		Diff.	% Diff.
	Enrollment	Projected		
KG	12038	11744	-294	-2.4%
G01	12025	11958	-67	-0.6%
g02	11662	11747	85	0.7%
g03	11584	11554	-29	-0.3%
g04	11501	11424	-77	-0.7%
g05	11406	11344	-62	-0.5%
g06	11295	11350	55	0.5%
g07	11025	10880	-145	-1.3%
g08	10801	10746	-55	-0.5%
g09	12542	12690	147	1.2%
g10	11398	11478	80	0.7%
g11	9838	9887	49	0.5%
g12	9437	9657	220	2.3%
Total	146551	146459	-92	-0.1%

This table is the validation for all 28 school districts projections at each grade level using SY2010-11 actual data. Even though the total percentage error is as small as -0.1%, there are still some grades showing much larger variations than the other, like KG or grade 9 or grade 12.

QUESTIONS OR COMMENTS?

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