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Business Forecasting Center

Employment Impacts of Reduced Water Supplies to San Joaquin Valley Agriculture

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There have been conflicting estimates about the magnitude of job losses in the San Joaquin Valley stemming from reduced water exports from the Delta. Over time, new data becomes available, researchers exchange modeling ideas and forecasts become more refined. This report updates our earlier estimate in light of the latest employment information and the latest revised report from UC-Davis. We estimate the San Joaquin Valley has lost 8,500 jobs from reduced water exports in 2009 with roughly 2,000 of these attributable to the endangered Delta Smelt, and the rest to the natural drought. Our estimate is an average of two estimates derived from different source data. The results from both starting points is now converging to a much narrower range of 7,000 to 10,000 lost jobs and gives us confidence in the accuracy of the estimate.[2]

In August 2009, we released a report that included an estimate of 6,000 lost jobs from reduced water deliveries from the Delta.[3] The report also criticized much higher job loss estimates from UC-Davis and explained why the depression in the construction industry is the primary cause of rising unemployment in the San Joaquin Valley. In response, the UC-Davis team recently lowered their lost job estimate again, reporting 21,000 lost jobs with 5,000 of these because of Delta Smelt restrictions.[4] Their new report briefly admits errors in the way they calculated 80,000 lost jobs and 35,000 lost jobs in their first two attempts, scraps their original methodology, develops a new approach, and criticizes our study. Although a significant improvement over initial reports, the latest effort from UC-Davis agricultural economists and engineers continues to overstate employment impacts, and we discuss its weaknesses in the appendix of this paper.

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[1] The primary author of this report is Jeffrey Michael, Director of the Business Forecasting Center, with assistance from Andrew Padovani and Shaun Callahan. No external funding was sought or received to support this report. Researching employment trends and issues in the Central Valley is a core part of the Business Forecasting Center mission and expertise. For more information, see http://forecast.pacific.edu/.

[2] Our initial August estimate of 6,000 jobs was the midpoint of a range from 0 to 12,000 lost jobs. Although our point estimate is now higher, it is well within the range of our original forecast.

[3] http://forecast.pacific.edu/articles/PacificBFC_Fish%20or%20Foreclosure.pdf

[4] http://swap.ucdavis.edu/swapfiles/reportspapers/MeasuringEmploymentImpacts-092909.pdf.

Methodology

We use two approaches to estimating the employment effects of drought. In both cases, we use an economic impact model, IMPLAN, to estimate employment multipliers. These include indirect and induced jobs such as those created by the sale of supplies to the agriculture industry and spending on goods and services in the local community that is induced by agricultural income.[5] We also account for upstream impacts on local food manufacturing such as canneries. The difference in the approaches is the source data we use to drive the model. Our first approach begins with estimates of changes to agricultural production, and our second approach starts with the latest data on changes to direct agricultural employment. Both approaches require assumptions about the economy, and have strengths and weaknesses. In this application, multiple approaches can yield more accurate and transparent estimates, and provide a valuable reality check that helps researchers catch and correct errors. Unless there is sufficient evidence to favor one approach over another, we average the two values to generate the most accurate single estimate.

The first approach we utilize is a demand driven simulation, and it is the only technique used by the UC-Davis team. It uses estimates of reduced crop production from water restrictions to estimate employment loss using an economic impact model. The advantages of this approach include its detail and explicit link to water supply. The disadvantages include a host of unrealistic assumptions required to translate output changes into employment changes that are especially problematic in the agriculture sector. One of the most important assumptions is that jobs are entirely driven by demand from farm producers, and the number of workers freely adjusts to whatever farmers demand. In economic terminology the assumption is known as perfectly elastic labor supply, and in human terms it means that the model views farm workers as being no different than other inputs like seeds, fertilizer and fuel. Academic studies indicate that farm labor supply is actually very inelastic,[6] and the implication is that this approach will likely overestimate the employment effects of output changes. Other problematic assumptions include restricted substitution between labor and other inputs, and that labor markets are in equilibrium at the time water deliveries are reduced.

The second approach is driven by data from the most recent official employment estimates. The benefit of this approach is its grounding in current data and the fact that it reflects both supply and demand effects on the labor market. The disadvantage of this approach is timeliness, less detail in the data, and the possibility that it could underestimate some categories of indirect and induced effects that are more driven by output than farm worker income. Our August report noted that the most recent current payroll data were showing a slight increase in total farm jobs, implying that water shortages were having

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[5] The most recent UC-Davis study also uses the IMPLAN model, but their model is based on 2006 economic data. Our IMPLAN model uses more recent 2007 data to build the social accounting matrix and multipliers. This difference does not have a large effect on the results.

[6] Devadoss, S., and Luckstead, J. "Contributions of Immigrant Farmworkers to California Vegetable Production" Journal of Agricultural and Applied Economics, 40(3), December 2008: 879-894.

little or no net effect on farm employment in the San Joaquin Valley.[7] In this report, we use newly available data that shows a decrease in agricultural jobs to update our estimate.

Method 1: Agricultural Output: Labor Demand Only

As in our August report, we use the UC-Davis midpoint estimate of $627 million in reduced agricultural output to drive the results. In this report, we make a few adjustments to our earlier estimate by incorporating some of the ideas and information in the September UC-Davis report. First, we have followed the suggestion of the UC-Davis team and adjusted the production functions in the IMPLAN model to increase the use of labor contractors so that it equals the amount of directly hired labor. Second, we have adjusted the distribution of crop losses to equal the UC-Davis ratios, leading to a large reduction in vegetable losses and slightly increased losses across other crop types.[8] As in our August report, we also account for job losses in the food manufacturing sector that depend directly on these crops as inputs.[9] We did not agree with other assumptions and adjustments made by the UC-Davis researchers to the IMPLAN model, and we discuss those differences in the Appendix.

Table 1displays the estimated employment effects. The total employment effect of declining farm output is 8,252 jobs and including estimated food manufacturing impacts raises the total to slightly more than 10,000 jobs. Employment losses in the areas classified as farm jobs are 6,400 including 2,923 direct employees of farms and 3,477 indirect jobs, mostly with agricultural labor contractors. As with all impact studies, the employment levels are annual averages. Due to the seasonality of crop production, the employment losses will be larger than these estimates during the peak harvesting season from May to October, and below the average level from November to April.

Table 1. Water related employment losses estimated from output changes.

	Direct	Indirect	Induced	Total
Farm Output	2,923	4,178	1,151	8,252
Food Manufacturing	552	920	373	1,845
Total Employment Effect				**10,097**
Farm Jobs				6,400 (63.4% of total)
Farm Employment Multiplier				1.577

An informal check of the reasonableness of this estimate can be made from estimates of fallowed acres instead of dollar loss in output. As in our August report, we use an average estimate that there were 300,000 more acres of farm land fallowed in the Central Valley than usual this year and a 50 acres per job rule of thumb cited by Westlands Water District officials. This approach yields an estimate of 6,000 lost

[7] In order to give an economic explanation for this seemingly paradoxical result, our report discussed farm labor shortages reported by the industry throughout the decade and the evidence that farm employment in recent years is determined by farm labor supply more than farm labor demand.

[8] The vegetable share decreased from 40% to 15%. Recent reports that the San Joaquin Valley will have a record tomato harvest in 2009 suggest this downward adjustment is well justified, and perhaps not low enough.

[9] To model this effect, we assume a 5% decline in the output of fruit and vegetable canneries, equal to the estimated decrease in fruit and vegetable production in the San Joaquin Valley from reduced water deliveries. To avoid double counting the impacts of water on fruit and vegetable farming, we adjust the IMPLAN model for canneries to eliminate the downstream effect to farms. Thus, we account for indirect effects from other input suppliers to canneries such as cans, boxes, and professional services, but only count the farm effects once.

farm jobs, and 9,462 total jobs using the 1.577 multiplier above. Thus, an estimate of approximately 10,000 lost jobs appears very reasonable from the viewpoint that employment levels are entirely determined by agricultural output and labor demand.

Method 2: Recent Employment Data: Labor Demand and Supply

Our initial report used the official monthly payroll estimates from California Employment Development Department (EDD) produced as part of the U.S. Bureau of Labor Statistics' Current Employment Statistics (CES) program.[10] These are the official estimates of payrolls and the most current available data. Last month, additional farm payroll estimates from the California Department of Food and Agriculture (CDFA) were published by EDD.[11] These data are specific to the agricultural sector, more detailed for farm subsectors, and probably the most accurate data for agriculture in the current year.[12] The disadvantage of the agricultural sector estimates are that they lag months behind the CES data, and the data are reported at the regional rather than county level. Finally, the U.S. Department of Agriculture estimates hired farm labor on a bimonthly basis through its National Agricultural Statistics Service (NASS).[13] The latest NASS farm labor report finds that farm employment in California was higher in July 2009 than in July 2008.[14] The USDA NASS farm labor estimate is only reported on a statewide basis, and we do not use it for our estimates in this report.

Table 2 shows the change in San Joaquin Valley farm employment from each month of 2009 from the same month in the previous year, and since the drought began three years ago. These data include both direct farm employment and indirect employment in the agricultural service sector such as labor contractors. Interestingly, both data sources show 2009 farm employment is consistently higher than it was in 2006, the last year of full water deliveries before the drought began. The increase in agricultural employment since the last wet year makes it obvious that there is much more to determining farm employment than water. The change over the last year is the best place to isolate the impact of water supply, and here we see a divergence in the monthly CES data that are the official payroll jobs estimates, and the more detailed farm sector estimates produced by CDFA that lag several months behind so that current data is only available through June. CES data shows more farm jobs in most months. The CDFA data shows a different pattern, a distinct decrease in employment that begins as the peak season hits in May. The pattern in the CDFA total employment data is more consistent with the anticipated impacts of reduced water supplies. We use the CDFA data as the foundation for the estimates that follow.

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[10] http://www.labormarketinfo.edd.ca.gov/?PAGEID=166
[11] http://www.labormarketinfo.edd.ca.gov/?pageid=158
[12] Eventually, both series will be revised and benchmarked to a complete record of detailed payroll tax records. The current data is based on sample data. The estimates are considered accurate and reliable, but they are sample estimates that could be subject to future revision.
[13] http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1063
[14] http://usda.mannlib.cornell.edu/usda/current/FarmLabo/FarmLabo-08-21-2009.pdf . Interestingly, the report cites drought as a cause for increased employment. "Critically dry, deteriorating pastures in California led to increased supplemental feeding and a stronger demand for livestock workers."

Table 2: Change in Total Farm Employment in San Joaquin Valley.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
One year change										
CES	5,600	6,100	5,500	5,200	-600	600	3,000	-1,100	-900	-5,200
CDFA	-3,000	-700	300	-1,200	-10,700	-11,600				
Three year change (since drought began)										
CES	10,800	-3,000	7,400	26,600	27,800	16,100	10,300	8,800	11,900	8,400
CDFA	3,200	-9,200	2,700	20,600	17,200	5,400				

Reduced water deliveries are not the only negative impact on San Joaquin Valley agricultural production and employment in 2009. The recession has reduced prices, the financial crisis reduced the availability of credit, and most importantly, a crisis in the dairy industry is putting severe strains on the San Joaquin Valley's largest agricultural sector. The CDFA data allows us to isolate the direct employment impact losses in the dairy industry which average about 1,300 so far in 2009. Using the dairy sector production functions from IMPLAN, we estimate that the 1,300 dairy jobs would be associated with about 400 additional jobs in agricultural services for a total dairy crisis effect of 1,700 lost farm jobs. We net the dairy losses out of agricultural total, and attribute the balance of farm sector job losses to reduced water availability for crop production.

Table 3 shows our simple approach to calculating lost jobs. Because four of the six highest agricultural employment months are in the second half of the year, we weight the monthly average job losses in the first 6 months of CDFA data to produce an average loss of 6,150 farm jobs.[15] After netting out the dairy effect, we find a loss of 4,450 farm jobs. We did not enter the employment changes as inputs directly into IMPLAN to find the total change in employment, because the farm employment changes combine direct and indirect employment. Instead, we use an employment multiplier for all farm jobs that we calculated in the analysis for the first approach. The result is an estimate of slightly more than 7,000 lost jobs. Although this is a smaller impact than calculated with the first approach, it should not be interpreted as too low, because there are several reasons why one could argue this approach overstates job loss. We identified three credible, independent surveys of farm employment and utilized the only one of the three that found evidence of decreased farm employment. After conservatively estimating the dairy crisis impact, we attributed all of the remaining employment losses to water. Finally, we used a large employment multiplier that incorporates upstream food processing impacts.

Table 3. Estimated employment change in the San Joaquin Valley due to reduced water.

Estimated Average Change in 2009 Farm Jobs	-6,150
Change in Dairy Related Farm Jobs	-1,700
Non-Dairy Change in Farm Jobs (all attributed to water deliveries)	-4,450
Farm Job Multiplier	1.577
Total Employment Change from Reduced Water Delivery	**-7,018**

[15] Specifically, we assume July to October employment loss follows the pattern of May and June, and the last two months of the year are similar to the first four. Thus, our weighted monthly average of 6,150 lost jobs is higher than the January to June average of 4,466 jobs.

Summary and Conclusion

There have been many claims and competing estimates about employment losses related to water supplies this winter. Although there is evidence of employment and income loss from water reductions, we find compelling evidence that most of these claims have been greatly overstated. Total water related employment losses are in a range of 7,000 to 10,000 jobs across the San Joaquin Valley in 2009. We estimate that 63% of these jobs are in the agricultural sector with the balance in related sectors such as transportation, food processing or service industries such as retail stores. Of particular importance is that only about 2,000 of the lost jobs are attributed to Delta Smelt restrictions. Although our estimate is 95% lower than the 40,000 lost jobs because of the Delta Smelt claimed by some who are pushing for suspending the Endangered Species Act, it is similar to other assessments. UC-Berkeley economists estimated job loss from Delta Smelt restrictions as only 720 in an average water year with higher losses during drought periods like the present,[16] and even the too high UC-Davis estimate discussed in the appendix only puts the Smelt impact at 5,000 jobs. Even if this winter is wet, we believe similar employment losses are likely to persist through 2010 as reservoirs are low and environmental constraints will likely continue.

Appendix: Comments on the 3rd revision of UC-Davis employment estimates

The UC-Davis group deserves credit for quickly identifying and acknowledging the errors in their earlier employment estimates, improving their estimate, and for clearly showing that Delta Smelt pumping restrictions are responsible for only 24% of lost jobs and 16.6% of lost revenue from the current reduction in agricultural water deliveries. Unfortunately, there is not much else in the report to praise. The report misrepresents their previous errors, and the new calculations include their own errors to produce overly large employment impacts. The problems include:

- Increase output loss estimates by 60% without adequate justification.
- Only report results from the high scenario.
- Inaccurately represents their employment modeling as geographically disaggregated.
- Fails to disprove the importance of labor supply.
- Results are out of scale with the regional economy.
- Previous mistakes are incorrectly blamed on a software vendor.
- Fail to disclose other important studies that include the same error as their original report.

Increase Output Loss By 60% Without Adequate Justification

The biggest quantitative issue in the UC-Davis report is their decision to adjust their estimated dollar value of output loss into a percentage change. Rather than enter $710 million in losses into the IMPLAN model, UC-Davis researchers reduce the crop production estimated in IMPLAN by 9% of the $12.6 billion in crop output ($1.134 billion) reported by IMPLAN. Although it is not reported this way in their report, the shift to percentage changes means that they have increased the estimated crop losses by

[16] The Berkeley Economic Consulting Study was funded by water exporters and is available at http://www.berkeleyeconomics.com/BEC.FinalReport.8Dec08.pdf.

$424 million or 60%. This adjustment alone raises their estimated employment impacts from roughly 13,000 to 21,000, so it is critical that is well justified.

In our view, the adjustment is not well supported. Howitt et. al. justification comes from the 50% difference in total San Joaquin Valley crop production as estimated by their SWAP model ($8.2 billion)[17] and IMPLAN ($12.6 billion). Our investigation into this discrepancy revealed that the source of the discrepancy is inaccuracies in the UC-Davis SWAP model, not IMPLAN. Page 4 of their report states "Total value of agricultural output from SWAP for the same sector and region in the same year is valued differently than that in IMPLAN… This is because IMPLAN data is from the Department of Commerce and data from SWAP is in farm gate values, with prices and yields directly from County Agricultural Commissioners' Reports. In IMPLAN, revenue losses include outlays to all other sectors in the regional economy and value added, and reflect value to final consumers." This is an incorrect description of IMPLAN's definition of farm output and the concept of value added. IMPLAN does break down farm revenue into payments for purchased inputs and value added, otherwise known as income received by employees and owners of land and capital, because this accounting is an essential part of estimating indirect and induced effects for which IMPLAN is used. However, it does not mean that farm output is defined differently in the models and the discrepancy appears to be a problem with the UC-Davis SWAP model.

Howitt et. al. imply that the total estimates from their SWAP model matches Crop Reports from County Agricultural Commissioners because they state that the crop yields and prices in their model are directly calibrated to match the County agricultural commissioner reports. Thus, the total crop output in SWAP should be close to the total output reported by County Crop Reports. However, an inspection of the County Crop Reports reveal that the IMPLAN estimate of total crop production is closer to the values of Agricultural Commissioners and in fact it is the SWAP model total that is about $4 billion below the County Crop Reports.[18] If yields and prices are straight from the County crop reports, how can there be total crop output discrepancy of over 50%?

We received two explanations for the discrepancy from the UC-Davis team. First, they felt their yields might be too low because they are weighted averages of those reported in the Crop Reports because they group crops together in their model. This explanation is confusing to us, because it does not seem that a weighted average would bias their total estimate downward and we received no response to our request for additional explanation. Second, they revealed that the SWAP model estimates are lower because it does not include all cropland in the San Joaquin Valley, but they did not specify how much cropland is missing from the model or where it is located. Thus, their use of percentage change includes an unstated assumption that the regions of the Valley that are not included in their analysis experience the same proportional loss as regions included in their models. An informal visual inspection of a map of SWAP coverage for Kern counties reveals that most of the omitted acres are on the east side of the Valley that is less affected by Delta pumping restrictions.

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[17] SWAP stands for Statewide Agricultural Production Model, a simulation model of California agricultural production built at UC-Davis. See the SWAP webpage for more information http://swap.ucdavis.edu/.

[18] See county government websites for each County's Crop Report. The reports of the 8 counties for 2008 report total crop output at a new record of $15.1 billion in 2008. Thus, the County Crop Reports are actually higher than the IMPLAN estimates which means that IMPLAN model may actually be slightly overestimating employment per dollar of agricultural output.

It is hard for us to know exactly what to make of this information and the subsequent adjustment. It seems clear that the UC-Davis SWAP model is not nearly as precise at estimating crop losses in total or across space as it is portrayed. This discrepancy is another example of why we feel it is wise to estimate these impacts with more than one approach, and it illustrates the risk of attaching too much confidence in the precision of any single measure. We also note that in the first two UC-Davis studies that utilized the 50 per $1 million employment multiplier, there was no similar upward adjustment of SWAP estimated output losses and the authors seem quite confident in their estimates of lost revenue.

Only report high scenario results

The earlier impact studies from Howitt et. al. report two estimates of reduced agricultural production from the SWAP models: a high estimate of $710 million (90% exceedance scenario), and a more likely middle estimate of $637 million (50% exceedance scenario). The latest revision only reports results from the high scenario and does not explain why it only uses the high-range estimate.

Confuses Land and People: Inaccurately represent employment geography

Howitt et. al. correctly note that there are dramatic differences in water cutback effects on agricultural production on the west and east side of the San Joaquin Valley. One of the strengths of their SWAP model of agricultural production is that it shows the geographic variation in farm revenue effects. However, SWAP is a model of economic output from parcels of land, and thereby measures economic losses and gains incurred by the people who own the land. The owners of the land may or may not reside near the impacted properties. Many of the largest landowners are reported to live or have corporate headquarters far from their farmland. Until UC-Davis explicitly links their disaggregated land model (SWAP) to a land ownership database, the SWAP model does not provide meaningful insights for a spatial analysis of human welfare effects.

What about the workers? Howitt et. al. use the same county employment data and models we do to estimate employment impacts and their indirect effects use multipliers for the entire San Joaquin Valley. While it is reasonable to assume larger effects in communities near the fallowed fields, their jobs modeling is no more disaggregated than our own and they report results for the entire San Joaquin Valley. Furthermore, many of the workers on these west side farms typically come from outside the local community. Labor contractors are often based closer to urban centers such as Fresno and will transport workers to the farm locations. During the harvest season, the Westside communities are known to swell in population with migrant workers and temporary residents from other areas. These are the jobs that are most impacted by the water shortage, and many of them are held by non-local residents who may have found work in other locations during this harvest season. The statewide CDFA data show a significant increase in farm employment in all other regions, especially the Central Coast, South Coast and Desert regions. In our view, the UC-Davis team's criticism of our estimates as too "aggregate" and "top down" is completely baseless.

Misinterprets the Effect of Labor Supply and Shortages

The UC-Davis report criticizes our discussion of the labor shortage and misinterprets its role in our job loss estimates. The misinterpretation may be a result of an unclear presentation in our earlier report. UC-Davis implies that our original lower bound of zero job loss came from an assumption of a labor shortage, and not from data. That is not the case, our lower bound of zero job losses was not from an assumption, but is an empirical estimate that came directly from the latest official government payroll estimates. The discussion of labor shortages is to give a plausible theoretical explanation for the seemingly counterintuitive data, and show that it is in fact consistent with what farmers themselves have been reporting about the farm labor market for most of the decade.

Much of the UC-Davis criticism revolves around details about how economists' define a "shortage." Much of their discussion is beside the point which is to determine if the vast majority of farms that are not impacted by drought would increase hiring if more labor became available (whether that labor was displaced by recession or fallowed fields). We agree with their point that agricultural real wages have remained very low, and do not indicate a shortage in the economic sense of the word. However, we find their use of productivity data actually proves our point and not theirs. Gradual increases in productivity are normal as technology advances, but rapid jumps in productivity (as measured by output per worker) can be interpreted as an indicator that employers have too few workers. Their Figure 2 graphs an over 30% increase in real farm worker productivity that occurs from 2000 to 2003 and calls this gradual. 10% annual gains in real labor productivity are not normal, but are actually extremely high and are more correctly interpreted as reflecting disequilibrium in the labor market than a sudden technological shift. It is very problematic, and a sign of what ails the San Joaquin Valley economy in both wet and dry years, that real labor productivity in agricultural has improved significantly but real wages have not. Meaningful reductions in farm worker poverty will only occur when productivity growth generates wage growth, but addressing that issue is outside the scope of this report.

Results are out of scale with the regional economy.

Although much improved, both the 21,000 lost job estimate and 30 per $1 million in output labor multiplier in the revised UC-Davis still fail to pass basic tests of reasonableness. Due to seasonality, the 21,000 lost job estimate is actually equivalent to over 30,000 fewer jobs during the peak harvest months. That total is approximately equal to the total decrease in payrolls in the San Joaquin Valley across all sectors during the current severe recession. The implication is that the San Joaquin Valley would be the only region in the country that would not have experienced job loss this year if it were not for water shortages. The scale of the estimate does not make sense in the larger picture where the San Joaquin Valley has been the hardest hit region in the country by the foreclosure crisis.

Howitt et. al. also claim that their 30 to $1 million labor multiplier is not that high by comparing it to other agricultural multipliers. That is quite a stretch considering that their multiplier is double the level of most other studies. The unreasonableness of the estimate is evident when compared to employment multipliers estimated for other sectors of the economy. Keep in mind that even in the relatively labor intensive San Joaquin Valley agriculture, total labor expenditures are only about 30% of production costs whereas labor is the vast majority of costs in most service industries. Of the 440 economic sectors in the San Joaquin Valley IMPLAN model, we found only 4 sectors (less than 1%) with labor multipliers that exceeded 30 per $1 million in output. They were temporary employment agencies, child day care centers, performing arts centers, and sports and fitness centers. All four of these are labor-intensive service industries with many part-time employees and relatively low wages. Other goods producing sectors were much lower with construction around 12 and virtually all types of manufacturing are in single digits. Their agricultural employment multiplier of 30 appears implausibly high compared to these other sectors even if it is less extreme than their original multiplier of nearly 50. Our estimate of employment loss equates to an employment multiplier of 13.6 and is far more reasonable in comparison to other sectors and other studies of agriculture.

Blame previous mistakes on a software vendor

The enormously large (50 jobs per $1 million) labor multiplier in their earlier studies was a result of modeling the decline in farm revenue as a decline in farm labor contractor revenue. This is a surprisingly elementary mistake akin to modeling a change in manufacturing output as a direct loss to temporary employment agencies from which manufacturers' purchase supplemental labor. The authors imply that the source of the problem is their software vendor, because they claim that the REMI model they used did not include an agriculture sector. Even if this were true, it is still no excuse for assigning farm revenue losses directly to labor contractors, and for not catching the error when the model produced such shockingly large employment impacts. In addition, our inspection of the REMI software manual and conversations with REMI staff confirm that their claim of a missing agriculture sector is incorrect. It is true that the REMI model is different from IMPLAN and other economic impact models in the way it models the link between the farm sector and the larger economy. However, that is a reason for not selecting the REMI model for detailed agriculture studies in the first place, not an explanation for treating farm revenue and labor contractor revenue as equivalent.

Fail to disclose other important studies with the same error

The researchers should reveal that this modeling error is not confined to these jobs reports, but is also part of other important reports that are influencing current policy. Most notably, the same modeling error is part of the influential PPIC report on the Delta that endorsed the controversial peripheral canal. The endorsement of the peripheral canal in that report was based on the authors' judgment that the cost of reducing Delta water exports is too high in comparison to environmental benefits. The 50 per $1 million jobs multiplier was used in the PPIC report to exaggerate the social costs of reduced Delta water deliveries. The modeling was originally part of a major salinity study the UC-Davis group did in collaboration with the State Water Resource Control Board, thus the salinity study also overstates the economic impacts of increased salinity on the Valley. The modeling was actually done by SWRCB staff not UC-Davis, and neither the salinity report or SWRCB contribution are acknowledged in the original UC-Davis 2009 job loss estimates.