

Are there Lasting Impacts of a Poor-Area Development Project?

Shaohua Chen, Ren Mu and Martin Ravallion
Development Research Group, World Bank

China: overall success against chronic poverty, but lagging areas

- Large reduction in absolute poverty over 1980-2000.
 - 53% poor in 1981; 8% in 2001
- But wide geographic disparities have emerged, notably between the coast and remote resource-poor inland.
- Southwest China: Map=>
 - Guangxi, Guizhou and Yunan: one of the poorest regions.
 - Population of 120 million and area of 800,000 square kilometers.

Stylized facts about the economy 1

Factor/risk market failures

- Restrictions on migration: *houkou* system \Rightarrow low K/L
- Administrative land allocation. Little or no (legal) market in agricultural land or land-use rights.
- Uninsured risk:
 - Poor people tend to be less well insured.
 - High precautionary savings
 - Income risk affects portfolio behavior: more liquid wealth (Jalan & Ravallion)

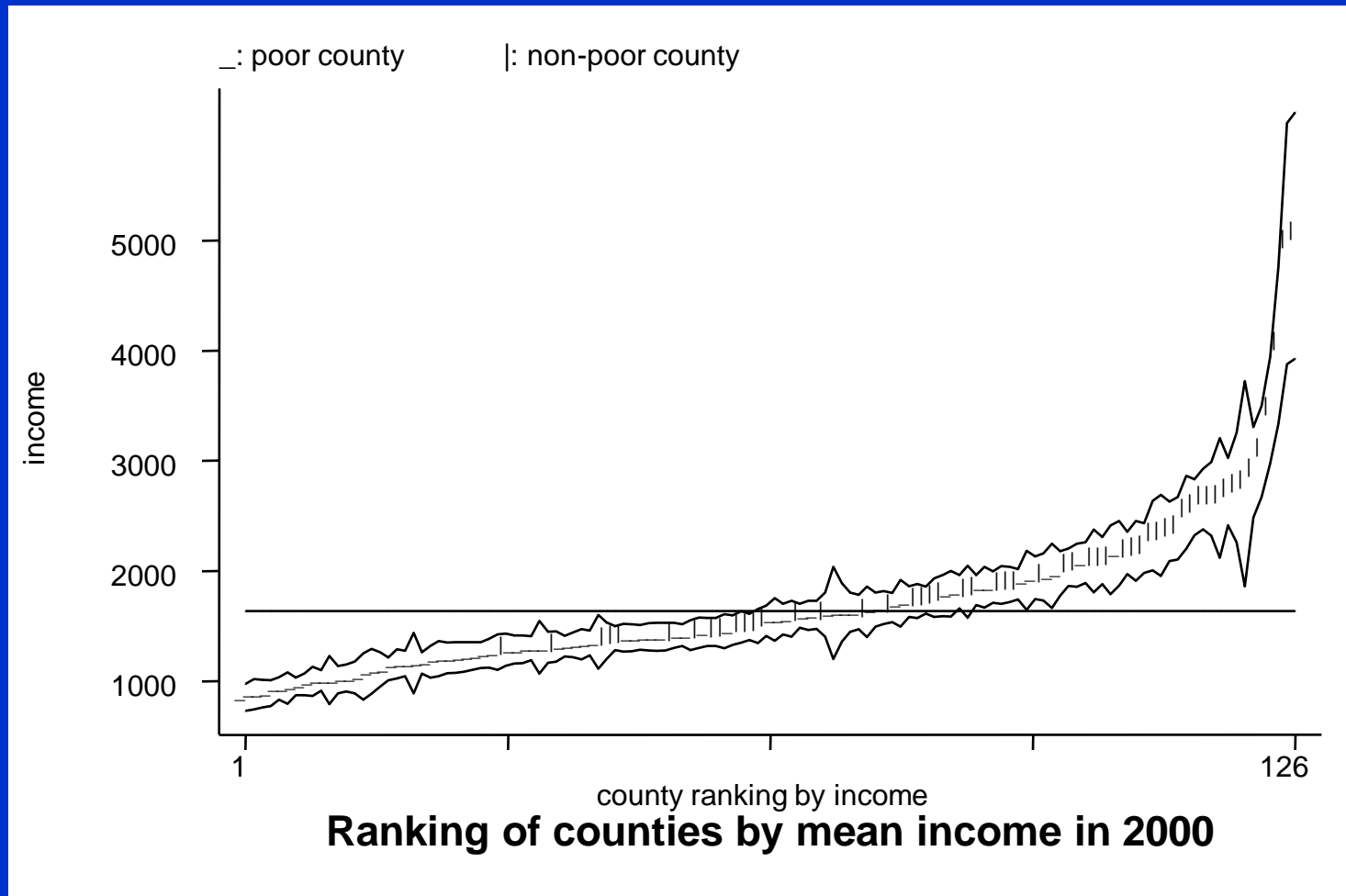
Stylized facts about the economy 2

- Externalities: local infrastructure and the composition of local economic activity appear to have impacts at the farm-household level.
- Rural under-development thought to stem (partly) from under-investment in externality generating activities, esp., agriculture and (less so) non-farm activities.
- Virtuous cycles: a well-targeted external growth stimulus in a poor area could generate positive and more widely diffused income gains over time.

Poor-area programs

- Village and small-holder investment programs have been the Government of China's main direct intervention for fighting poverty.
- Government's emphasis on agriculture makes sense given that this is a major income component and generator of positive externalities (Ravallion).
- Adequate (human and physical) infrastructure is a precondition for growth in poor areas (Jalan & Ravallion).
- Selected counties tend to be poorer
 - Evidence from probits based on RHS sample data (J&R)
 - Evidence from the Yunnan poverty map =>

Counties declared “poor” tend to be poor: Evidence from the Yunnan poverty map



小湖村扶贫开发剪影

Poor-area programs



当干部就要带头



大搞环境卫生整治



村民踊跃投工投劳



村落的变迁



植树绿化



71岁的老人刘积祥自愿修路



农民新居



调整产业

“So, did we have any lasting impact?”

World Bank's Southwest Poverty Reduction Project

- Substantial aid-financed expansion of efforts to fight poverty in lagging poor villages of Southwest China.
- Rural development program targeted to poor areas.
- Aims to reduce poverty by providing:
 - resources to poor farm-households and
 - social services and rural infrastructure.
- 35 national poor counties
- \$US 460 million from a World Bank loan and Chinese government over 1995-2001.

The key components of SWP

1. Income-generating activities: methods for raising grain yields, animal husbandry, reforestation.
2. Off-farm employment: voluntary labor mobility and support for township-village enterprises.
3. Social services and infrastructure: tuition subsidy to children from poor families, upgrading village schools and health clinics, rural roads, safe drinking water supply system etc.
4. Institution building and poverty monitoring:
 - improving the management of the project and
 - establishing a poverty monitoring system.

Composition of SWP spending

	% of total investment
Education	8.6
Health	5.4
Labor mobility	9.7
Rural infrastructure	17.2
Agriculture	43.1
Rural enterprise development	11.5
Institution building	1.7
Project & poverty monitoring	2.8
Total	100.0

What is different about the SWP (compared to the govt.'s programs)?

1. Greater integration across sectors, esp., agriculture/(physical) infrastructure + human resource development.
2. Greater community/farmer participation in deciding what is done
3. Greater resources.
4. External donor funding (M&E).

Uninsured risk remains

- In common with other development projects, the SWPRP provided the capital and technical assistance, but it did not provide insurance
 - And many of the project activities are likely to entail non-negligible income risk. The income gains will depend on a number of contingencies:
 - the vagaries of the weather (given the role of agriculture)
 - uncertain demand for the new products
 - risks associated with out migration.
- => Precautionary saving from SWP income gains

Impact evaluation: generic issues

- Impact is the difference between the relevant outcome indicator with the program and that without it.
- However, we can never simultaneously observe someone in two different states of nature.
- So, while a post-intervention indicator is observed, its value in the absence of the program is not, i.e., it is a counter-factual.

Impact evaluation: specific issues

- Time span of evaluation
 - Development projects may need longer evaluation periods than found in practice
 - Expensive longer tracking *or* more and better data?
 - How well do rapid appraisal methods work?
- Measurement of welfare impacts
 - Poor people are not myopic
 - Consumption may better reveal long-term impact
 - However, there may be great uncertainty about impact on permanent income
 - Lags in impacts on living standards cloud identification

Evaluation strategy: Matching/weighting + diff-in-diff

- Propensity score matching/weighting:
 - Matching/weighting on observed initial characteristics likely to jointly influence poor-area targeting and how incomes evolve over time.
- Difference-in-difference:
 - Difference in gains over time between participants and non-participants.
 - This eliminates any time-invariant bias due to mismatching, selection bias, omitted variables etc

Difference-in-difference

Observed changes over time for non-participants provide the counterfactual for participants.

Steps:

1. Collect baseline data on non-participants and (probable) participants before the program.
2. Compare with data after the program.
3. Subtract the two differences, or use a regression with a dummy variable for participant.

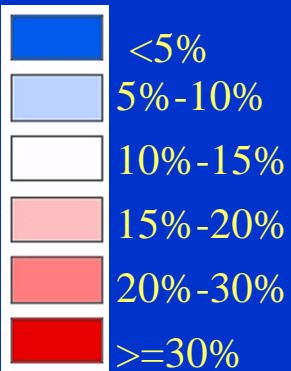
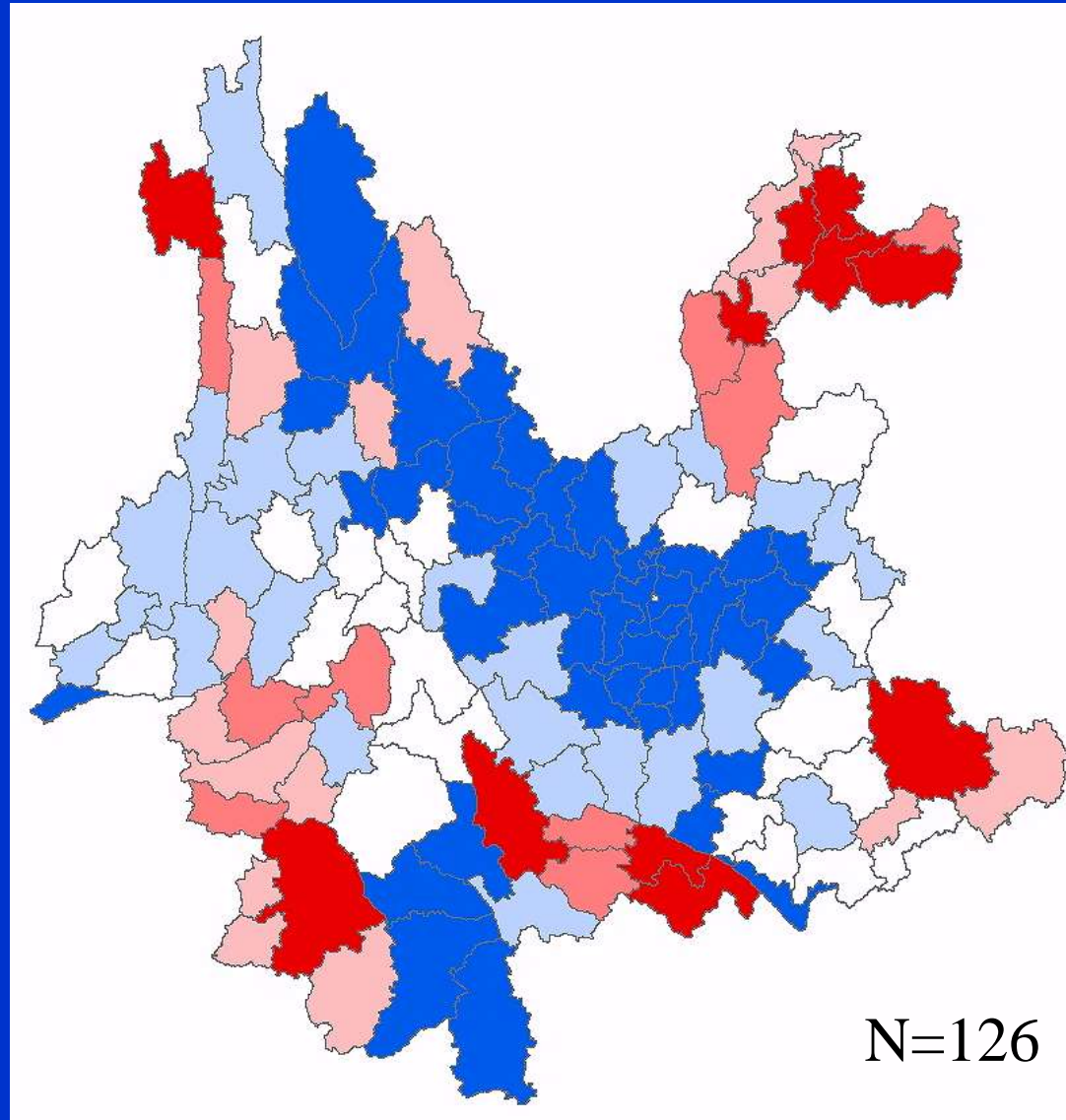
This allows for selection bias but it must be time-invariant and additive.

Sources of time-varying selection bias in diff-in-diff estimators

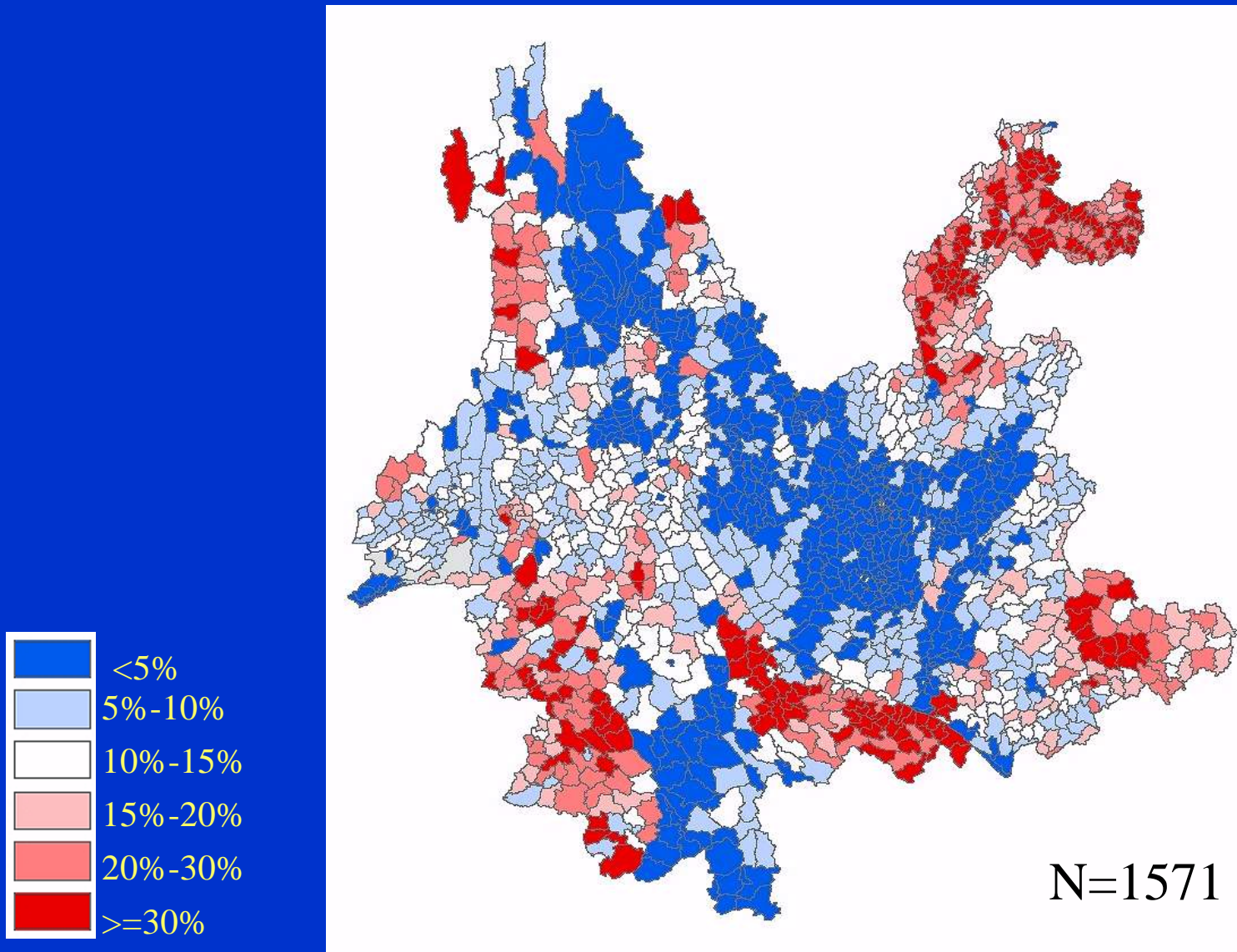
1. Interference between treatment and comparison groups.
 - Both come from poor counties. (To assess impact on top of national/provincial programs.)
 - However, there could be interference through local funding choices. Displacement.
2. Convergent or divergent growth processes:
 - If subsequent outcome changes are a function of initial conditions that influence the program assignment.
 - This is known to be a serious concern (Jalan and Ravallion; same region of rural China).
 - Heterogeneity within poor counties; Yunnan poverty map=>

Yunnan:

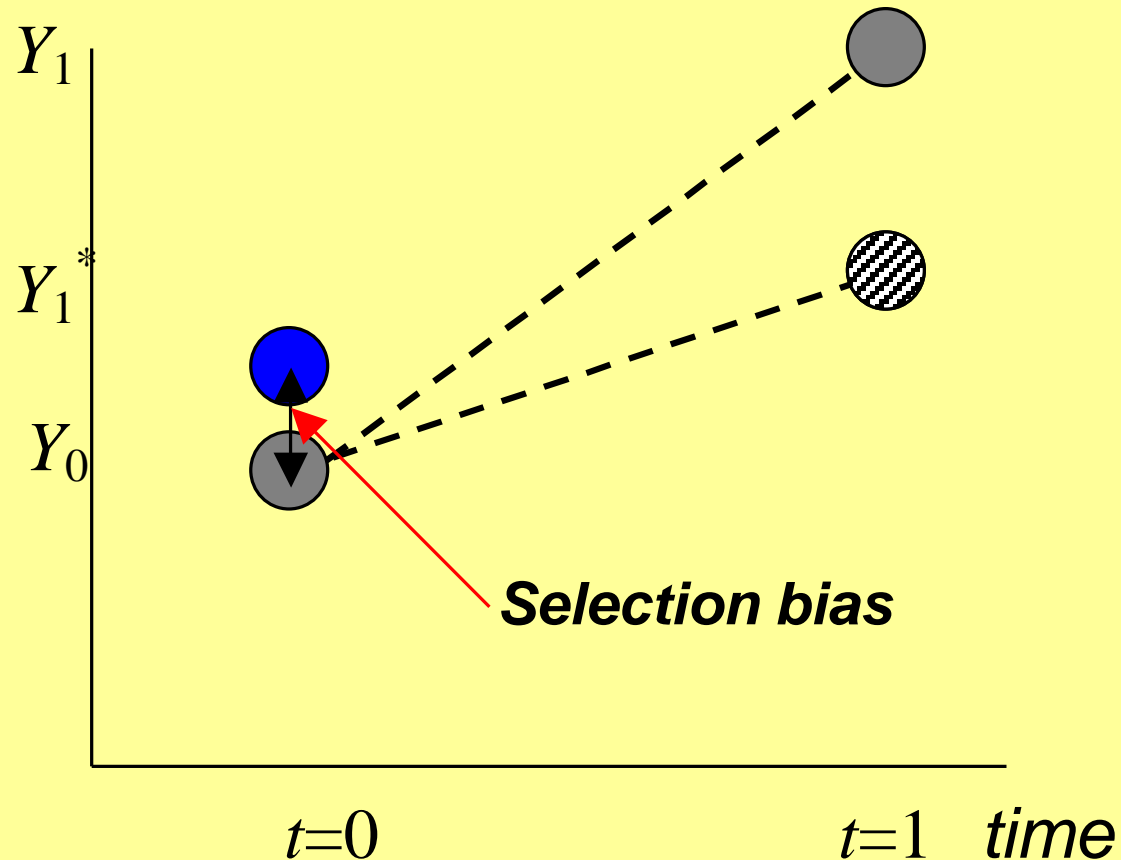
County poverty incidence



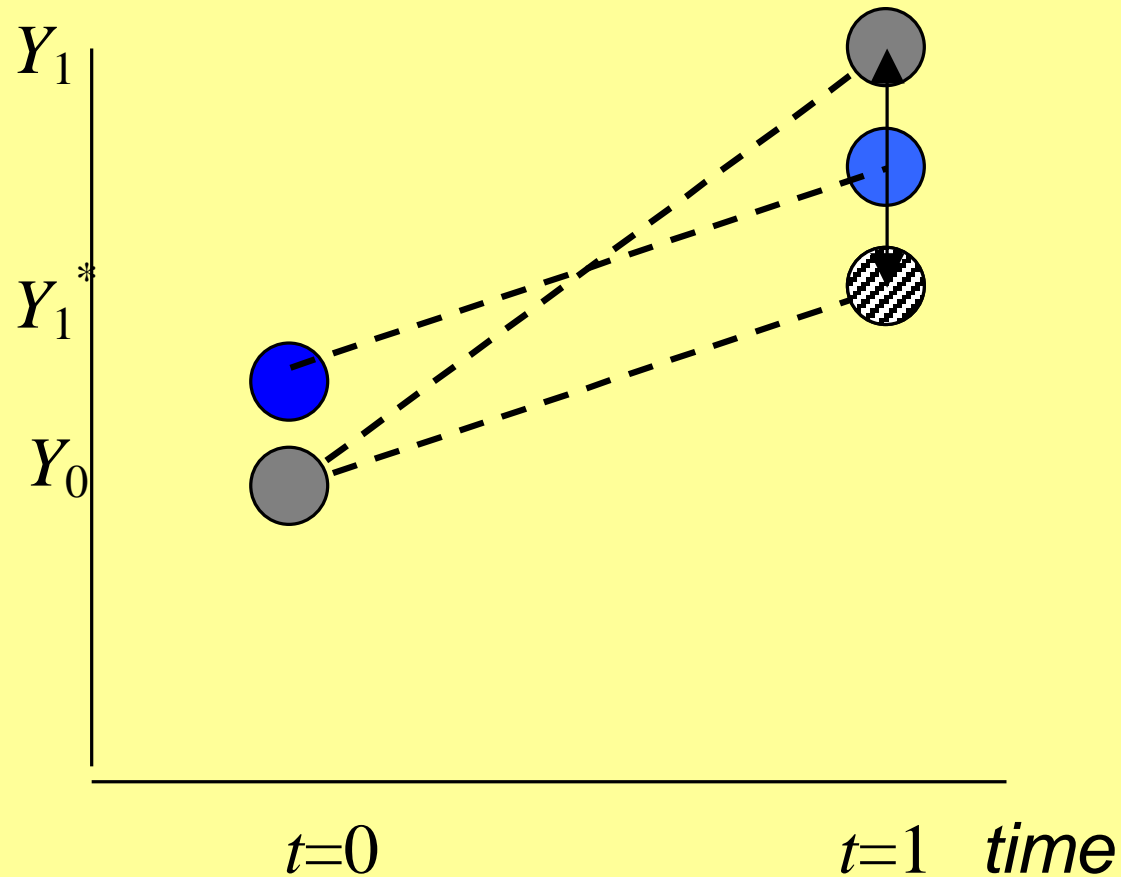
Township poverty incidence



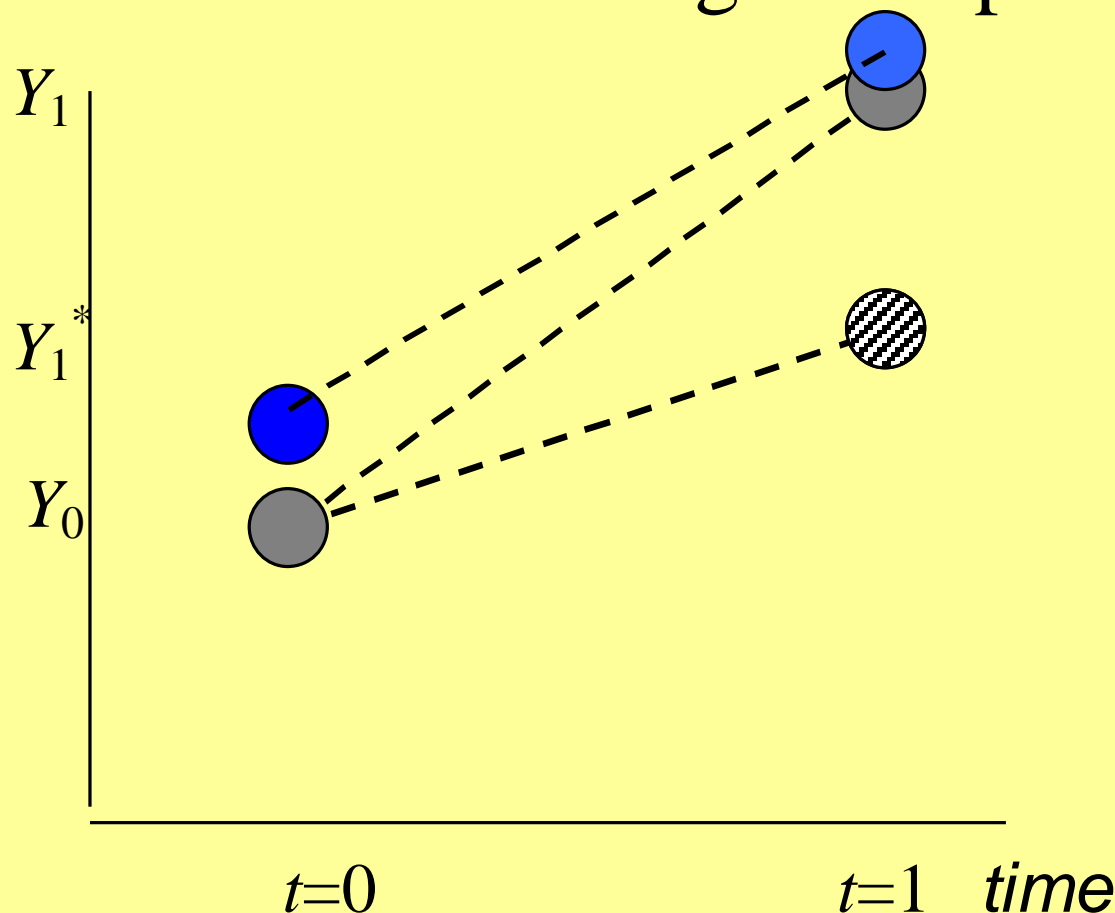
Given purposive targeting of an anti-poverty program, we can expect selection bias



As long as the bias is additive and time-invariant, diff-in-diff will work



But diff-in-diff hides true impact when targeted areas have lower growth prospects.



Targeted poor counties in China have lower growth rates in the absence of intervention (divergence) (Jalan and Ravallion)

Propensity-score weighting

- Hirano, Imbens and Ridder (2003): weighting the control observations according to their propensity score yields a fully efficient estimator.
 - easy implementation and conservative standard errors.
- Regression implementation:

$$Y_{it} = \alpha + DD.T_{i1}t + \beta T_{i1} + \delta_t + \varepsilon_{it}$$

with weights of unity for the treated units and

$\hat{P}(X)/(1-\hat{P}(X))$ for the controls where $P(X_i) = \Pr(T_i = 1|X_i)$ is the propensity score.

NBS Rural Household Survey

- Good quality budget and income survey (care in reducing both sampling and non-sampling errors).
- Sampled households maintain a daily record on all transactions + log books on production.
- Local interviewing assistants (resident in the sampled village, or nearby) visit each household at roughly two weekly intervals.
- Inconsistencies found at the local NBS office are checked with the respondents.
- Sample frame: all registered agricultural h'holds.

Consumption aggregates

- Measure of consumption based on the RHS method includes all “living expenditures:”
 - cash spending on food, clothing, housing, rents, utilities, durable consumer goods, services etc
 - imputed values of all in-kind spending
- Excludes:
 - “transfer expenditure” (remittances out, insurance, transaction costs on loans/land-use changes)
 - production costs, investments

Income aggregates

- The income variable includes
 - cash income from all sources
 - imputed values for in-kind income from various sources (household production which includes farming, forestry, animal husbandry, handicrafts etc.)
 - income received as a gift

SWPRP survey data

- Based on RHS
- Community, household and individual data
- Time period: 1995-2001; annual surveys
- 100 Project villages + 100 comparison villages
- 13 villages re-assigned
- Problem with baseline survey; 1996 instead

Descriptive statistics

- Project villages started worse off on average than non-project villages.
- By the end of the disbursement period, SWP villages had caught up in mean income, but not consumption => the project's income gains were saved.
- However, SWP villages had not caught up by 2004.
- This suggests that the project had little or no lasting impact.
- However, we need to allow for selection bias arising from the program's purposive targeting and displacement of non-SWP spending.

Covariates of participation

- SWPRP villages tend to be:
 - in more mountainous remote areas,
 - less likely to have electricity,
 - less likely to have a school in the village,
 - more likely to have a health clinic.
- The project villages tend to have:
 - higher populations,
 - lower mean income and
 - more land per capita, reflecting lower pop. density.
- Consistent with targeting poor villages within poor counties

Balancing the covariates of placement

- Standardized differences between the SWP villages and matched or weighted non-SWP villages in terms of means of each covariate (Abadie and Imbens, 2006).
- Table 3 compares village covariates with and without PS weighting and the data trimming; good balance once re-weighted.
- Also, balancing tests for the 1996 outcome measures based on the household survey data for that year.
- Even though these were not used as covariates in estimating the propensity scores in Table 2, it can be seen that quite good balance is achieved.

Impacts on mean income and consumption

2000: sizeable and statistically significant impacts on income, but not consumption; the bulk of the income gain during the project's disbursement period was saved

2004:

- much lower impacts on incomes and not statistically significant.
- Some signs of consumption gains, but with wide confidence interval, which includes zero!

Diff-in-diff estimate of the impact of SWP on household income and consumption

	1996 mean in SWP villages	Gain in SWP project	Gain in non-SWP villages	Diff-in- Diff	t-ratio
2000 income	971.4	206.8	66.0	140.8	2.02
consumption	841.7	67.1	70.5	-3.4	-0.07
saving	129.7	139.7	-4.5	144.2	2.33
2004 income	971.4	442.8	387.4	55.4	0.63
consumption	841.7	345.9	287.7	58.3	0.87
saving	129.7	96.8	99.7	-2.8	-0.03

Note: Trimmed sample

Impacts on income and consumption (alternative estimators)

		Simple		PS		Kernel	
		DD	t-ratio	weighted	t-ratio	matched	t-ratio
		DD	t-ratio	DD	t-ratio	DD	t-ratio
Trimmed sample							
2000	Income	140.817	2.021	193.162	2.751	179.657	2.512
	Consumption	-3.388	-0.067	-17.662	-0.313	-45.762	-0.751
	Saving	144.218	2.332	210.84	2.921	225.437	2.757
2004	Income	55.433	0.626	53.482	0.574	52.741	0.694
	Consumption	58.26	0.87	58.535	0.786	18.312	0.223
	Saving	-2.815	-0.034	-5.037	-0.059	34.448	0.415
Total sample							
2000	Income	208.583	3.346	213.605	3.287	199.342	3.426
	Consumption	21.84	0.510	-151.054	-1.180	-189.569	-1.427
	Saving	186.755	3.141	364.696	3.371	388.953	3.494
2004	Income	40.673	0.537	-47.159	-0.423	-38.636	-0.304
	Consumption	20.258	0.371	36.752	0.633	25.893	0.439
	Saving	20.427	0.303	-83.874	-0.705	-64.486	-0.515

Impacts on productivity, assets, prices?

Agricultural productivity?

- Crop-specific farm outputs per unit cultivated area and total farm income per unit area.
- No evidence of impacts on productivity.

Productive assets and wealth (including housing)?

- Significant livestock gains (cows)
- Otherwise, little sign of impacts in either the disbursement period and the longer-term.

Prices?

- Little impact on prices of agricultural outputs and purchase prices for inputs.

Impacts on schooling?

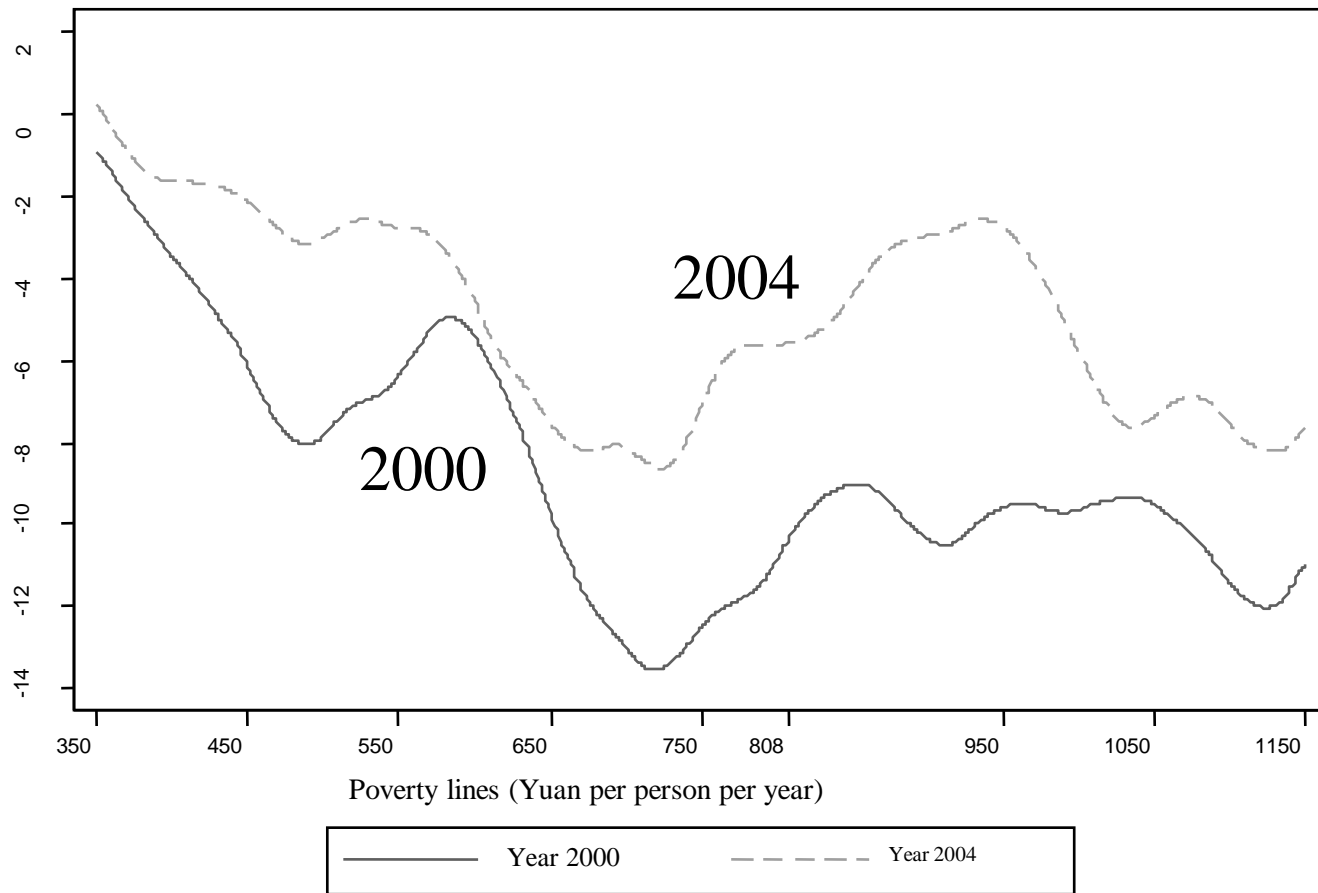
- Significant impacts on school enrolment rates during the disbursement period, under tuition subsidies
- Our PS-weighted DD estimate was 0.074 (with a t-ratio of 2.20), i.e., a 7.4% point increase in the school enrollment rate of children aged 6-11 by the year 2000 is attributed to SWP.
- However, this too had largely vanished by 2004; the corresponding DD estimate fell to 0.032 (t=1.00).

Impacts on poverty?

- Poverty impacts in the disbursement period are broadly consistent with impacts on the means.
- Non-negligible but statistically insignificant longer-term impacts on the poverty rate.
- Impacts on income poverty are greater in the disbursement period, while the impacts on consumption poverty tend to be greater in the longer time period =>

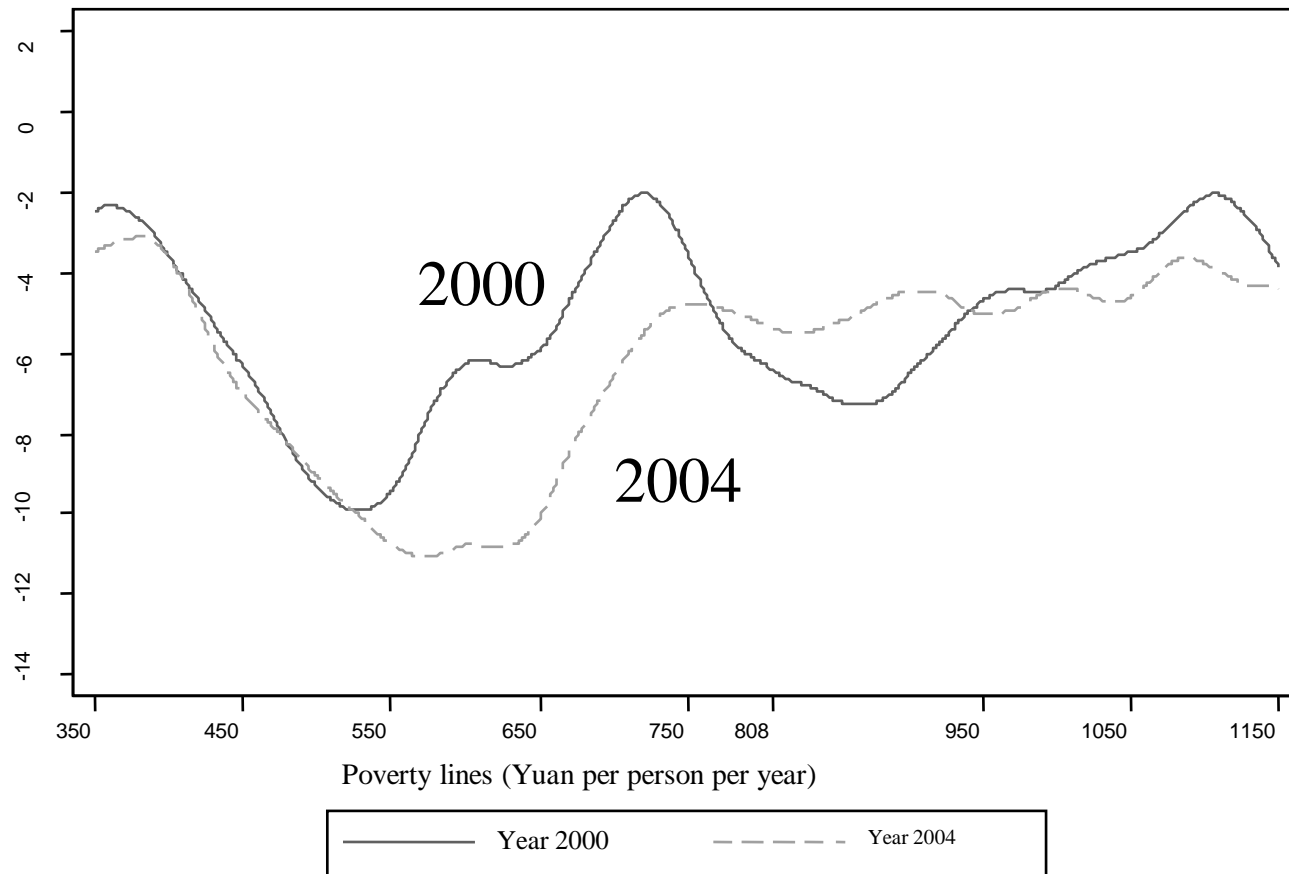
Income poverty

DD impact on headcount index



Consumption poverty

DD impact on headcount index



Rapid appraisal? No impacts on perceived satisfaction with life

- The subjective assessments by participants of whether their living standards had improved since the project began are not significantly different to those found for the non-SWP villages.
- Adding the corrections for differences in baseline characteristics between the treatment and comparison villages does not change the main conclusion from this exercise,
- although the impacts on household and village living standards are now significant at roughly the 10% level.

Impacts on self-assessed satisfaction with life

	Single difference on total sample			PS weighted and trimmed sample		
	Mean in project villages	Diff. (project-comparison)	t-ratio	Mean in project villages	Diff. (project-comparison)	t-ratio
Overall standard of living of h'hold	0.357	0.001	0.018	0.343	0.108	1.635
Income	0.328	-0.005	-0.094	0.324	0.026	0.326
Food	0.377	0.017	0.334	0.356	0.073	1.050
Clothing	0.363	0.028	0.55	0.345	0.094	1.364
Housing	0.313	-0.045	-0.952	0.292	0.006	0.089
Asset accumulation	0.173	-0.009	-0.228	0.151	-0.079	-0.974
Agriculture skill	0.101	-0.026	-0.935	0.087	0.009	0.285
Credit availability	0.190	0.011	0.251	0.190	0.035	0.589
Affordability of primary/mid. school	0.22	0.007	0.163	0.209	0.067	1.265
Health	0.302	-0.035	-0.71	0.285	0.092	1.550
School infrastructure	0.392	-0.053	-0.928	0.382	0.039	0.497
Health infrastructure	0.240	-0.059	-1.217	0.219	0.006	0.090
Knowledge of village affairs	0.170	-0.010	-0.227	0.161	0.048	0.992
Participation in decision-making	0.174	-0.017	-0.413	0.157	0.026	0.536
Democracy	0.232	0.015	0.321	0.216	0.075	1.353
Overall village standard of living	0.345	0.034	0.626	0.325	0.116	1.761
Service to village by county govt.	0.200	0.017	0.369	0.157	0.009	0.133
Service to h'hold by county govt.	0.180	0.034	0.783	0.167	0.041	0.637

Recall bias in rapid appraisal method

- Regressions of the perceived change in the household's standard of living on the change in log consumption per person, with controls for respondents' gender and age.
- Subjective recall over such a long period is evidently not reflecting well the changes in living standards as measured by consumption.
- The recall data put too high a weight on the current level of living and are affected by many idiosyncratic factors not accountable to consumption.
- By not adequately reflecting baseline outcomes, long recall has a hard time identifying impact.

Regressions for perceived change in overall standard of living

	(1)		(2)		Difference	
	Coefficient	t-ratio	coefficient	t-ratio	(1)-(2)	t-ratio
Intercept	1.971	1.248	2.217	0.903	-0.246	-0.085
Change of log consumption 2005-1996 (β_0)	0.360	2.511	0.277	1.501	0.083	0.358
Log consumption in 1996 (β_1)	0.328	1.668	0.733	2.903	-0.405	-1.269
Gender of respondent	0.200	0.850	0.339	1.520	-0.138	-0.429
age of respondent	0.082	2.089	-0.009	-0.183	0.091	1.422
age ²	-0.001	-1.62	0.000	-0.080	-0.001	-0.887
R ²	0.037		0.047			
Test $H_0 : \beta_0 = \beta_1$ (p-value)	0.8712		0.0827			

Bias due to displacement effects? Yes

- Quantitatively large displacement effects for some non-SWP activities.
 - The effects are particularly strong for farming, animal husbandry, forestry, student tuition subsidies, new school construction, and migration projects.
- For a number of items the mean in SWP villages is about half non-SWP villages, implying that about 40% of the non-SWP spending allocation to SWP villages was cut, and re-allocated to non-SWP villages.
- However, the displacement effects are much weaker for the physical infrastructure projects.
- Such large displacement effects would imply that the benefits of the SWP are likely to have spilled over to our comparison villages, leading us to under-estimate the impacts of SWP.

Testing for displacement of non-SWP development projects in SWP villages

	Mean in SWP villages	Mean in non-SWP villages	Difference	t-ratio	PS weighted diff.	t-ratio
Farming						
No. projects	0.986	2.123	-1.137	-2.296	-1.453	-1.825
No. households	21.838	406.885	-385.047	-2.223	-311.353	-2.319
Animal husbandry						
No. projects	1.282	3.215	-1.934	-2.445	-2.517	-2.142
No. households	33.471	330.885	-297.415	-1.135	-197.944	-1.138
Student subsidies: No.						
	0.986	2.385	-1.399	-2.844	-1.583	-2.596
New schools: No.						
	0.352	0.815	-0.463	-2.896	-0.546	-2.246
Migration: No.						
projects	0.746	1.554	-0.807	-2.084	-1.172	-2.477
Total						
No. projects	9.853	17.082	-7.229	-2.476	-10.469	-2.024
No. households	87.853	1046.77	-958.918	-1.537	-732.468	-1.676

How much bias in mean income impact?

- $DD^* = DD + SPILL$ be the true impact, where $SPILL$ is the income gain to the comparison group due to the spillover effect.
- I_{SW} = the level of investment per capita in the SWP villages and let I_{NSW} be the investment per capita for non-SWP projects.
- Assume that $I_{NSW}^T = I_{NSW}^C$ under the counterfactual of no SWP.

$$\Rightarrow \frac{DD^*}{DD} = 1 + \delta \frac{r_{NSW} I_{NSW}}{r_{SW} I_{SW}} \quad \text{where} \quad \delta = \frac{w(k-1)}{k - w(k-1)}$$

- The bias is small if either: (i) the project is small ($w=0$); (ii) the displacement is small ($k=1$) or (iii) the rate of return to the displaced activities is small ($r_{NSW} = 0$)

Small bias due to spillover effects

- Past estimates in the literature suggest that the rates of return to the government's poor area programs may be somewhat lower than for SWP, at least during the disbursement period, but for the present purpose it is probably reasonable to assume that $r_{SW} = r_{NSW}$
- One quarter of villages in the poor countries participate in SWP, so we can set $w = 0.25$.
- Based on our results we can take $k = 2$ to be a reasonable upper-bound.
- The level of investment per capita under the non-SWP projects is about half that under SWP.
- Thus $DD^*/DD = 1.07$.

What have we learnt?

- An evaluation that focused solely on the income gains during the disbursement period would clearly give a very deceptive picture of this project's true impacts.
 - Large and significant impact on mean household income in the participating villages during the project's disbursement period.
 - Much smaller impact on consumption during that period; the project's short-term income gains were largely saved.
- Four years after disbursements ended, we find that both project and non-project villages had seen sizeable economic gains, with only modest net gain to mean income in the project villages.
- Non-negligible impacts on poverty in the longer-term, with 5-10 percentage point reductions in the incidence of poverty attributed to the project.

Why the high savings rate?

- When interpreted in terms of the simplest Permanent Income Hypothesis, our results imply that participants felt that a large share of the income gains was likely to be transient.
- Under simple PIH, the consumption impact of the project identifies the impact on permanent income.

Does the PIH explain our results?

- 2004 consumption gain actually exceeds the increment to permanent income due to (transient) SWP income gains for plausible rates of interest.
 - More plausible for kernel-matched DD
 - However, can't reject the null that consumption gain equals permanent income gain
- 2000 consumption gains reflect high precautionary savings given uncertainty about income gains during disbursement.

Responses of local political economy

- Positive spillover effects to the comparison villages though the displacement of other development spending
 - development support from local resources switched to the villages represented by our comparison group.
- Such interference of the controls suggests that the classic impact evaluation methods will systematically underestimate the long-term impacts.
- These spillover effects are imparting about a small bias to our impact estimates, under plausible assumptions on the relevant parameters.

Knowledge spillovers?

- An aim of SWP was to serve as a demonstration of how to do integrated community-driven rural development projects.
- Positive spillover effects to the comparison villages can arise through knowledge spillovers, making it hard to identify long-term impact.
- Future work: test for knowledge spillover effects on the “production function” for poor-area development.
 - Composition of project activity (HD/labor migration)
 - Emphasis on participatory, community-driven, methods of design and implementation

Rapid appraisal methods

- ...suggest rather little longer-term impacts of the project on living standards, including various “non-economic” dimensions
 - public service quality, local democracy and participation in, and knowledge of, village affairs.
- However, this method is vulnerable to a recall error bias, whereby the respondents’ perceptions of how their living conditions have changed give too high a weight to current circumstances, and do not properly reflect actual changes since the baseline.

The most plausible interpretation

- SWP entailed a large but uncertain transient income gain during the disbursement period.
- A large share was saved, given the uncertainty.
- Modest consumption gains were spread over time.
- This was clearly not the “big push”/“virtuous cycle” growth stimulus that would yield the substantial, lasting, reduction in poverty that had been hoped for.