Preliminary and Incomplete

Dynamic Estimates of the Multiplier from Federal Medicaid Assistance to States

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Abstract

Medicaid is a means-tested public health insurance program for low-income individuals—mainly families with children, pregnant women, elderly and the disabled. It is jointly funded by federal and state governments, with the federal government reimbursing 50-74 percent of states' Medicaid costs. There is a general perception that federal Medicaid dollars foster economic activity and generate positive multiplier effects for states. Identifying such effects remains a challenge because states' Medicaid spending and, therefore federal matching funds are likely endogenous, as they are correlated with unobserved factors driving states' economic outcomes. We circumvent this inherent endogeneity by using an instrument derived from the kink in Federal Medical Assistance Percentage (FMAP) for states and find that federal Medicaid dollars have a modest positive multiplier for state-level employment.

Keywords: Medicaid Multiplier, Regression Kink Design

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1. Introduction

Medicaid is the largest and the most rapidly growing means-tested transfer program in the U.S. constituting roughly 10 percent of the federal budget expenditure in 2018. The program accounts for an even larger of the state budget, with its share of total state spending rising sharply from 21 percent in 2009 to 29 percent in 2016. It is jointly funded by federal and state governments, with the federal government reimbursing 50-74 percent of states' Medicaid costs. The federal government sent $375 billion to states as its share of the total Medicaid spending of $605 billion in 2017.[1]

Aside from funding a lion's share of states' health-care-related spending, research as well as media reports point to significant spillovers from federal Medicaid assistance to states' overall economic activity. State-by-state economic impact studies on Medicaid suggest that federal Medicaid dollars have a large multiplier effect on states' economies, but most such estimates use Input-Output tables, which miss the employment effects in nontradable sectors (Moretti, 2010). While there exists a large literature on the general government spending multiplier, there is very little work on potential employment gains from federal Medicaid dollars.[2]

Identifying such spillovers remains a challenge because states' Medicaid spending and, therefore federal matching funds are likely endogenous, as they are correlated with unobserved factors driving states' economic activity. In an important contribution to solve this endogeneity, Chodorow-Reich et al. (2012) used state-level pre-recession Medicaid spending as an instrument for federal Medicaid payouts under the American Recovery and Reinvestment Act (ARRA) and found that every $100,000 in additional Medicaid assistance leads to creation of 3.8 job-years at a cost-per-job of $26,000.

While Chodorow-Reich et al. (2012) narrowly focused on the 2009-2010 period, we use data from 1990 to 2013, and make two contributions. First, we propose an alternative instrument that has not previously been used to estimate the federal Medicaid assistance multiplier and is plausibly more robust to problems of policy endogeneity that potentially could contaminate

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[1] See https://www.macpac.gov/subtopic/medicaids-share-of-state-budgets/ and https://www.cms.gov/Research-Statistics-Data-and-Systems/Research/ActuarialStudies/Downloads/MedicaidReport2017.pdf.

[2] Dupor and Guerrero (2017) estimate multipliers from the Government-financed health care (GFHC) expenditures including both Medicaid and Medicare.

instruments based on state-level spending.[3] And secondly, use of a much longer time-span of data from 1990-2013 allows us to present dynamic and long-term estimates of the multiplier.

Our proposed instrument is the well-known kink in the Federal Medical Assistance Percentage (FMAP) with respect to the lagged states' per-capita personal income relative to the nation (lagged state PCPI ratio). The FMAP is designed to reimburse a higher share of the Medicaid cost of lower vs. higher income states relative to the nation, but the FMAP hits a floor beyond the lagged state PCPI ratio of 1.054. Therefore, as shown in Figure 1, FMAP's slope with respect to the state PCPI ratio jumps discontinuously just as the state PCPI ratio exceeds crosses 1.054. As previously found in Leung (2016), the kink in FMAP also induces a kink in federal matching dollars states receive. Furthermore, because the kink location itself is largely driven by a long-standing formula and is not controlled by states, it should be plausibly uncorrelated with unobserved factors driving states' economic activity.

We find that per-capita federal Medicaid assistance has a significant kink around the same location as the kink in FMAP and, therefore, it can serve as an instrument. Our IV estimates indicate that federal Medicaid dollars have a modest positive multiplier—an additional $100,000 in Medicaid assistance creates about 15 jobs over five years, yielding a statistically significant employment impact of 3 job-years at a cost per job of $33,000.

Remainder of the paper is organized as follows. Section 2 describes the proposed FMAP kink instrument; section 3 discusses the data and presents summary statistics; section 4 presents the econometric specification; section 5 reports the results and section 6 concludes.

2. The FMAP Kink Instrument

FMAP for state s and year t is a formula that governs the federal share of total Medicaid cost incurred by a state to provide health services covered under the program and is given by:

$$FMAP_{st} = min\left(max\left(0.5,\ 1 - 0.45 * \left(\frac{\overline{PCPI_{st}}}{\overline{PCPI_t^{US}}}\right)^2\right),\ 0.83\right) \qquad (1)$$

$\overline{PCPI_{st}}$ and $PCPI_t^{US}$ are 3-year average PCPIs for state s in year t and U.S. in year t, respectively. For year t they are calculated based on PCPI in years $t-3,\ t-3$, and $t-4$.

[3] See Besley and Case, (2000) for a discussion of policy endogeneity.

$$\overline{PCPI_{st}} = (PCPI_{st-3} + PCPI_{st-4} + PCPI_{st-5})/3$$
$$\overline{PCPI_t^{US}} = (PCPI_{t-3}^{US} + PCPI_{t-4}^{US} + PCPI_{t-5}^{US})/3$$

The FMAP is 55 percent if the state's per capita personal income (SPCPI) equals the national average (USPCPI). It varies inversely with the state PCPI ratio, i.e., $\frac{\overline{PCPI_{st}}}{\overline{PCPI_t^{US}}}$. The FMAP has a floor of 50 percent, which induces a kink in the relationship between FMAP and state PCPI ratio when the ratio equals 1.054, so that FMAP is greater than 0.5 if state PCPI ratio is under 1.054 and FMAP equals 0.5 if the ratio exceeds 1.054. The ceiling of 83 percent on the FMAP almost never binds.

The FMAP has remained largely unchanged since its inception and states have no control over it. Therefore it is not subject to the policy or legislative endogeneity that is a potential concern in research using individual state-by-state experiences. As detailed in Mitchell (2016), there have been some instances when the FMAP has deviated from the formula. For example, the FMAP for DC is set at 70 percent regardless of its relative per capita income. Also, as part of the ACA, the FMAP increased to allow 100 percent reimbursement to states for newly eligible Medicaid enrollees in states that opted for Medicaid expansion under the ACA. The FMAP was also increased in 2003-2004 to assist states during a slow economic recovery. After the Great Recession, in 2007–09, it was allowed to deviate from the formula and was linked to the state's unemployment rate. There were also temporary adjustments for Alaska, Michigan, and Louisiana (due to Hurricane Katrina).

In addition to Medicaid funding, FMAP is also used for some other relatively smaller programs: Guardianship Assistance, Child Care and Development Block Grant, Child Care mandatory and matching funds of the Child Care and Development Fund, Foster Care- Title IV-E, Adoption Assistance, and the phased down state contribution or the *clawback* for Medicare—Part D. Additionally, the Children's Health Insurance Program (CHIP) uses enhanced FMAP (E-FMAP) which equals $FMAP + 0.3 \times (1 - FMAP)$ with a cap of 85 percent. Thus E-FMAP also has a kink with respect to state PCPI ratio at the same place as FMAP.

3. Data and Summary Statistics

Our analysis is based on state-level panel data from 1990-2012. Data on the primary dependent variable—state-level annual payroll employment—is from the monthly Current Establishment Statistics (CES) available from the Bureau of Labor Statistics (BLS). We calculate per-capital number of jobs for each state by normalizing it with the state's population from the Bureau of Economic Analysis (BEA). Data on the key variable of interest, state-level Medicaid expenditure, are obtained from State Health Expenditures by state of provider (1980-2014) data files released by the Centers for Medicare & Medicaid Services (CMS) Office of the Actuary. We then use the FMAP to compute federal assistance for state's Medicaid expenditure and convert that to per-capita basis by using annual population data from the BEA. FMAP data are from the U.S. Department of Health and Human Services (HHS) and data on per-capita personal income for the US and states are from the Bureau of Economic Analysis (BEA). Table 1 presents summary statistics of key variables. Data on demographic covariates in included in various specifications come from the Current Population Survey (CPS) of the Census Bureau.

4. Econometric Framework and Identification

To estimate dynamic impulse responses with panel data we follow the local projections (LP) approach with instrumental variables proposed in Jorda and Taylor (2015).

$$y_{s,t+h} - y_{st} = \beta_0 + \beta_1^h FMA_{s,t} + \beta_2 \Delta y_{s,t-1} + \gamma X_{st} + u_{s,t+h}\,, \qquad (1)$$

where $y_{s,t+h} - y_{st}$ is the cumulative change in the key outcome variable, per-capita jobs of state s from period t to $t+h$; $FMA_{s,t}$ is the federal share of per-capita state's Medicaid spending based on FMAP, $\Delta y_{s,t-1}$ is a measure of lagged economic activity--one-year lagged change in per-capita jobs, and X_{st} consists of a set of other controls that may be correlated with both $FMA_{s,t}$ and $y_{s,t+h} - y_{st}$. In the LP framework, β^h captures the h^{th}-period impulse response of one unit increase in $FMA_{s,t}$ on the outcome variable, $y_{s,t+h} - y_{st}$. The methodology essentially involves regressing $y_{s,t+h} - y_{st}$ on the right hand side variables of (1) for a set of time horizons, h, which we set from 1 to 5. Thus, we estimate impulse response of $FMA_{s,t}$ in year t from years $t+1$ through $t+5$.

For a variety of reasons, $FMA_{s,t}$ is potentially correlated with $u_{s,t+h}$, therefore, OLS estimates would be biased and inconsistent. Our instrument is motivated by the Fuzzy Regression

Kink Design (RKD) approach proposed in Card et al. (2012, 2015) and used in Lundqvist et al (2014). $FMA_{s,t}$ is based on FMAP, which is a kinked function of an assignment variable—state PCPI ratio, henceforth denoted as R—with a known kink in the function when R is under 1.054: FMAP is greater than 0.5 if R is under 1.054 and FMAP equals 0.5 if R exceeds 1.054. Let $D = 1(R > 1.054)$ and $\tilde{R} = R - 1.054$. Because $FMA_{s,t}$ is determined by FMAP and should have a kink at the FMAP threshold of 1.054, the first stage relationship can be written as:

$$FMA_{s,t} = \alpha_0 + \sum_{j=1}^{p} \gamma_j \tilde{R}^j + \sum_{j=1}^{p} \eta_j \left[\tilde{R}^j \times D\right] + \alpha_3 \Delta y_{s,t-1} + \delta X_{st} + v_{s,t} \qquad (2)$$

Note that $\tilde{R}$ is simply the assignment variable, $R = \frac{\overline{PCPI_{st}}}{PCPI_t^{US}}$, normalized to equal zero when $R = 1.054$; p is the order of the RKD polynomial. For a linear polynomial, the estimation collapses to a simple regression of Y on $\tilde{R}$, the interaction term $\tilde{R} \times D$, and other controls. The coefficient on the linear interaction term η_1 is an estimate of the difference in slope of $FMA_{s,t}$ with respect to R at the kink point. If $\tilde{R} \times D$ is indeed is a valid instrument, then for the linear polynomial case, the second stage becomes:

$$y_{s,t+h} - y_{st} = \beta_0 + \beta_1^h \widehat{FMA}_{s,t} + \beta_2 \Delta y_{s,t-1} + \beta_3 \tilde{R} + \gamma X_{st} + u_{s,t+h} \qquad (3)$$

The identifying assumption is that while $\tilde{R} \times D$ is correlated with $FMA_{s,t}$, it has no direct correlation with $y_{s,t+h} - y_{st}$, which will be violated if the states were able to manipulate their location around the kink. The ability to manipulate their location would imply that the kink itself is endogenous and therefore an invalid instrument. This can be informally tested by examining whether the density of the assignment variable, R, evolves continuously around the kink point.

Figure 2 plots the density of R around the kink location and, using the McCrary test for the difference between the two densities on either side of the kink, shows that the densities do not differ significantly at the kink point; there is no statistical evidence of manipulation around the kink location (McCrary, 2008). This is hardly surprising, as state PCPI ratio (R) for state s in year t is calculated using personal income data from years $t-3, t-4$, and $t-5$, that are already multiple years old when $R$for year t is calculated.

While the primary identification condition that $\tilde{R} \times D$ is uncorrelated with the error term $u_{s,t+h}$ remains fundamentally untestable in the just identified case, another informal test is based on the absence of a kinked relationship between the running variable and other covariates potentially correlated with economic activity—in particular other measures of non-Medicaid spending. Table 2 reports the coefficients from simple regressions, without any controls, of two key spending measures on $\tilde{R}$ and $\tilde{R} \times D$—state-level spending on TANF in column (1) and other non-Medicaid spending in column (2); insignificance of both coefficients indicates that there is no significant kink in non-Medicaid spending measures. Appendix Table A1 reports similarly estimated coefficients and significance levels on $\tilde{R} \times D$ for several other covariates, for different bandwidths around the kink point, and shows that the presence of a significant kink among covariates is an exception rather than the norm. To guard against potential correlations with any such covariates, we control for a large set of covariates in our main results presented next, Column (3) of Table 2 reports the first stage coefficient from a basic regression of $FMA_{s,t}$ on $\tilde{R} \times D$ without any controls and shows that the coefficient is highly significant, suggesting strong evidence of a kink. Finally, column (4) of Table 2 presents the simple reduced form coefficient from a simple regression of $\sum_h y_{s,t+h} - y_{st}$, which represents the 5-year accumulated effect. The reduced form coefficient is significant at 10 percent level.

5. Results

Table 3 reports OLS estimates from regressions of $y_{s,t+h} - y_{st}$ on $FMA_{s,t}$, $\Delta y_{s,t-1}$ and a set of controls, X_{st} for five different time horizons, i.e., $h = 1,2 \ldots,5$ in columns (1) through 5. The dependent variable is change in per-capita nonfarm payroll jobs from year t to year $t + h$. Column (6) presents the accumulated effect with the dependent variable set to $\sum_h y_{s,t+h} - y_{st}$. Guided by recent econometric specifications in Chodorow-Reich et al. (2012) and Jorda and Taylor (2015), the set of controls (X_{st}) includes—Share Age 65+, Share Female, Share White, Share Black, Share Hispanic, Share with High School, Share with Some College, Share with College+, Lagged Union Coverage, Lagged Manufacturing Share of GDP, Lagged Population, Lagged Per-Capita Real GDP.

OLS estimates indicate that federal Medicaid assistance to states has a positive and statistically significant impact on per-capita jobs. Each coefficient represents the impulse response of a \$100,000 increase in per-capita $FMA_{s,t}$ year t on per-capita number of jobs in $t + h$. The impulse response in column (1) suggests that a \$100,000 increase in per-capita federal Medicaid assistance leads to the creation of additional 0.25 jobs per-capita. The impact is highly persistent and increases over time, reaching 2.3 jobs in year 5. The total impact over 5 years adds up to 7.4 jobs—for an average impact of close to 1.5 jobs a year (job-year).

Of course, $FMA_{s,t}$ may be correlated with a variety of other unobserved shocks to state-level economic activity and therefore OLS estimates in Table 3 may be biased and consistent. If the omitted variables are mostly state-specific and time-invariant, fixed-effects estimates presented in Table 4 would address the resulting endogeneity. Unfortunately, fixed-effects do not help, as the results are highly imprecise. This could be either because $FMA_{s,t}$ has no impact on per-capita jobs, or there is still remaining endogeneity, or it could simply be due to lack of enough within-variation in $FMA_{s,t}$ and/or $y_{s,t+h} - y_{st}$.

Instrumental variable Estimates

The instrumental variable estimates are presented in Table 5. Isomorphic to Tables 3 and 4, Table 5 reports impulse responses of a \$100,000 increase in per-capita $FMA_{s,t}$ on per-capita number of jobs for time horizon, $h = 1, \dots, 5$. Presenting results for $y_{s,t+1} - y_{st}$ as the dependent variable, the estimate in column (1) suggests that a \$100,000 increase in per-capita $FMA_{s,t}$ in year t leads to a statistically significant increase of 0.66 jobs in year $t + 1$. The bottom panel of Table 5 presents the first-stage F-statistic on the instrument , $\tilde{R} \times D$, which suggests that instruments have significant explanatory power for the explanatory variable $FMA_{s,t}$ and is not weak.

IV estimates of impulse responses are larger than OLS estimates and are increasing over time horizon h, with the impact in 5 years after the \$100,000 shock to per-capita $FMA_{s,t}$ being 5.2 jobs per-capita. Figure 3 plots these impulse responses shows highly persistent effects of per-capita $FMA_{s,t}$ on jobs. The accumulated impact presented in column (6) of Table 5 indicates that 14.7

jobs per-capita are created from that $100,000 shock in per-capita $FMA_{s,t}$—for an average impact of about 3 job-years. Thus, federal Medicaid assistance to states results in job creation at a cost of $33,000 per job-year.

Tables 6 explores robustness of accumulated 5-year impulse responses over different bandwidths around the kink point, and shows that estimates from smaller bandwidths lack statistical power, although precision improves with gradual increases in bandwidth and estimates turn positive at bandwidths of 0.2 and 0.3. Use of the full sample in column (4), previous presented in column (6) Table 5, yields the largest and most significant estimates. Table 7 examines robustness across different periods and shows that the accumulated 5-year responses are significant in 1990-1994 and 2000-2006, although the point estimates are positive across all periods presented in Table 7.

6. Conclusion

Using state-level data from 1990 to 2013, we propose an alternative instrument to estimate the federal Medicaid assistance multiplier and present dynamic and long-term estimates of the multiplier. We find that per-capita federal Medicaid assistance has a significant kink around the same location as the kink in FMAP and, therefore, it can serve as an instrument. Our IV estimates indicate that federal Medicaid dollars have a modest positive multiplier—an additional $100,000 in Medicaid assistance creates about 15 jobs over five years, yielding a statistically significant employment impact of 3 job-years at a cost per job of $33,000.

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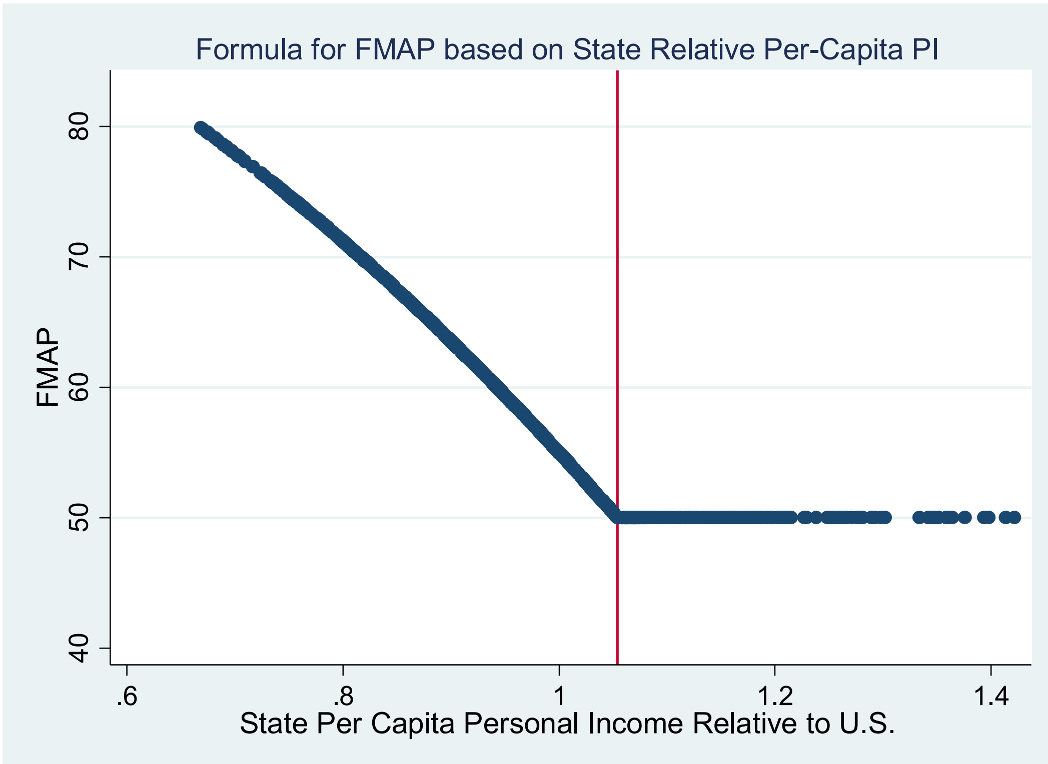
Figure 1



The figure plots the exact formula-based relationship between Federal Medical Assistance Percentage (FMAP) and the running variable—state's per-capita personal income relative to the nation (state PCPI ratio). FMAP equals $1 - 0.45 * RPCI^2$ and is a declining function of state PCPI ratio for values less than 1.054. FMAP reaches a floor of 50 percent when state PCPI ratio exceeds 1.054, inducing a kink in FMAP-state PCPI ratio relationship.

Figure 2

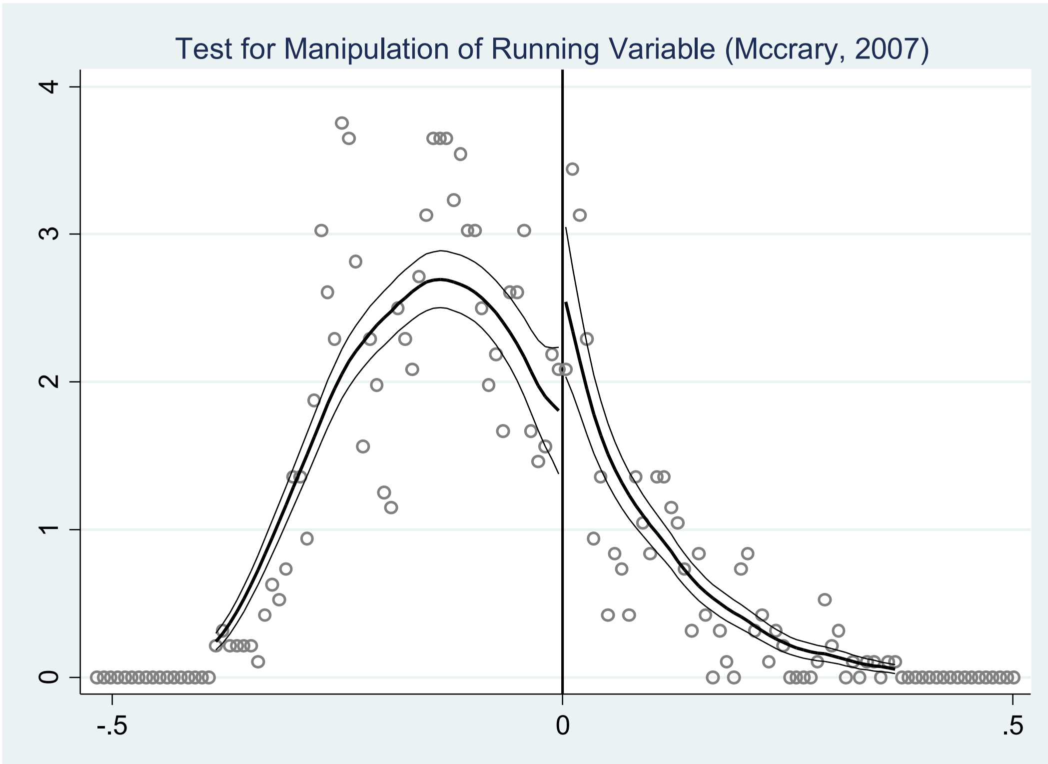
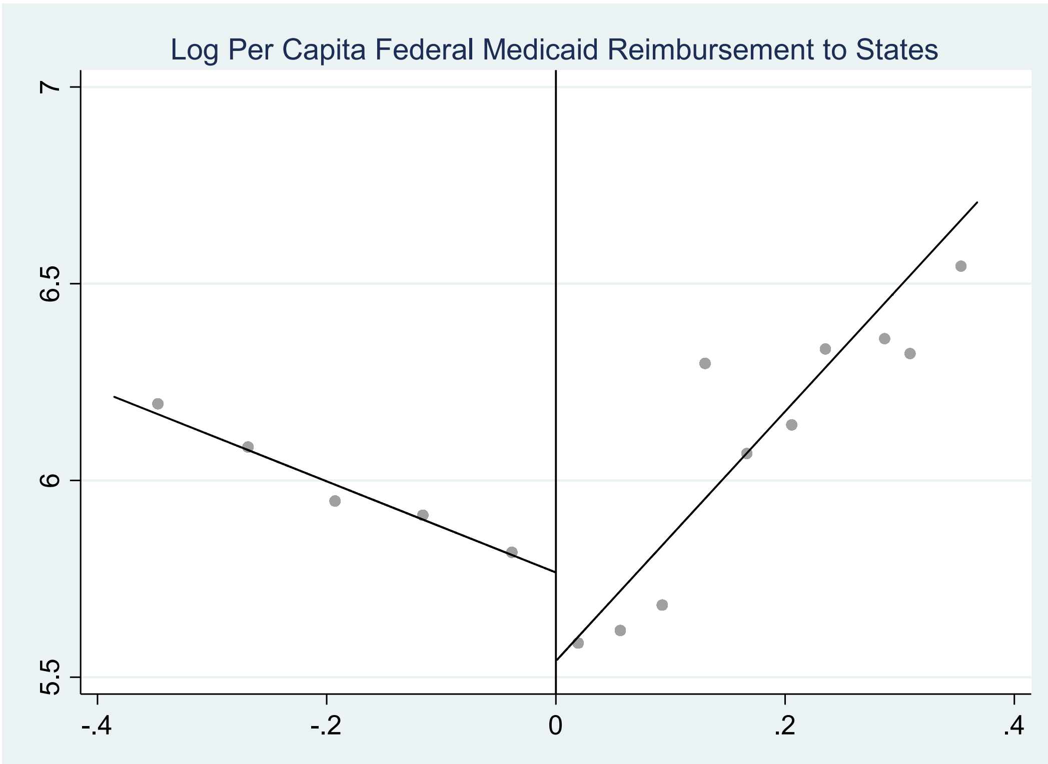

Test for Manipulation of Running Variable (Mccrary, 2007)
4
3
2
1
0
-.5
0
.5

Figure 3



Log Per Capita Federal Medicaid Reimbursement to States
7
6.5
6
5.5
-.4
-.2
0
.2
.4

Figure 4

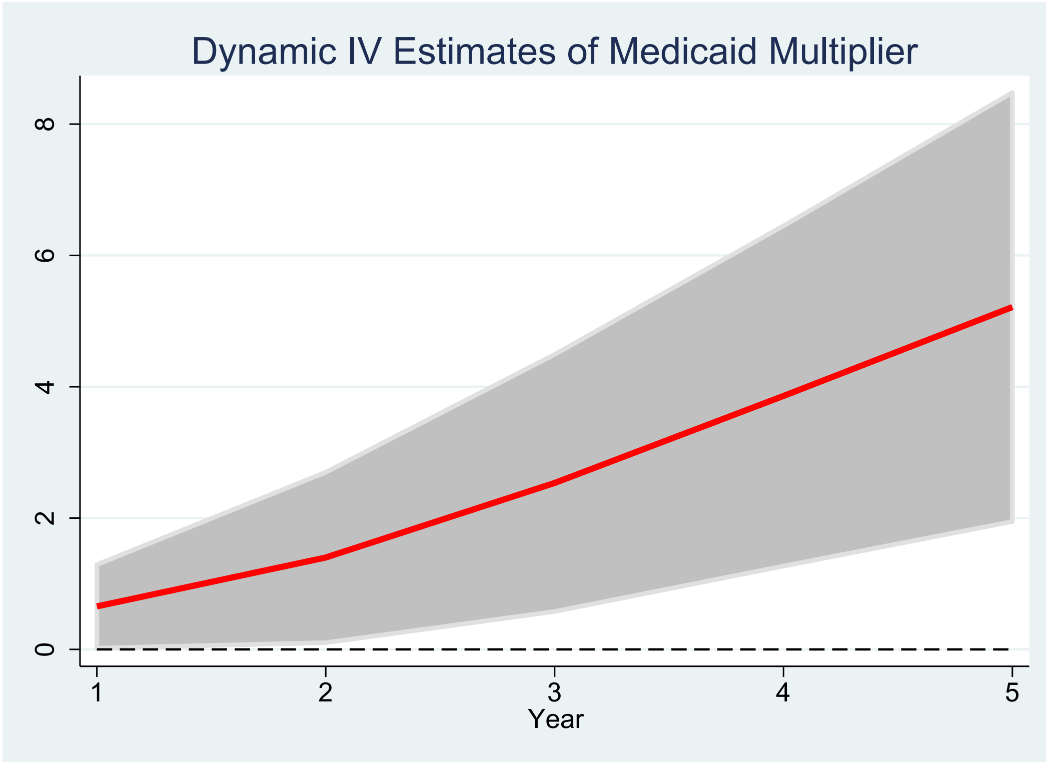

Dynamic IV Estimates of Medicaid Multiplier
0
2
4
6
8
1
2
3
4
5
Year

Table 1: Summary Statistics

	Mean	SD	Median	Min	Max
Per-Capita Jobs (per 1000)	464.33	104.19	450.54	339.49	1213.34
3-year Change in PC Jobs	1.46	19.07	5.47	-83.22	59.69
Lagged Change in PC Jobs	0.72	8.69	2.38	-48.42	44
Per-Capita Medicaid Spending	979.39	446.68	894.95	223.29	3451.25
Per-Capita Fed Medicaid Assist.	585.01	277.69	526.65	111.64	2415.88
State PCPI Raio	0.97	0.15	0.94	0.67	1.52
FMAP	60.11	8.4	60.11	50	80.18
Above FMAP Kink X SPCPI	0.03	0.08	0	0	0.47
Share Age 65+	16.04	2.21	16.16	6	21.93
Share Female	51.8	1	51.87	49.05	54.97
Share White	76.57	15.91	80.12	18.15	98.82
Share Black	10.2	11.17	6.34	0.11	67.58
Share Hispanic	7.04	8.5	3.94	0.09	43.96
Share with Highschool	29.75	8.85	31.93	2.04	43.75
Share with Some College	26.06	4.27	26.1	12.48	36.12
Share with College+	22.89	5.64	22.11	9.95	54.47
Lagged Union Coverage	14.35	5.96	13.8	3.3	31.9
Manuyf'g Share of GDP	14.43	6.66	14.38	0.2	31.47
Lagged Population (Millions)	5.53	6.17	3.77	0.45	38.06
Lagged Per-Capita Real GDP	46123.08	18767.28	43301.4	23904.34	1.84E+05

Table 2. Instrument Validity

	(1) Per Capita-TANF Spending	(2) Per Capita-Non-Medicaid Spending	(3) Per-Capita Federal Medicaid	(4) 5-yr Accumulated Jobs Impact
Instrument ($\tilde{R} \times D$)	90.218	1600.035	0.026**	0.156*
	(124.148)	(4064.452)	(0.010)	(0.085)
Observations	1150	1145	1213	969

Table 3. OLS Estimates of Medicaid Employment Multiplier

	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5	(6) 5-yr Sum
Per-Capita Federal Medicaid	0.256**	0.623**	1.132**	1.693**	2.268**	7.435**
($100,000)	(0.115)	(0.238)	(0.372)	(0.490)	(0.631)	(1.912)
Observations	1162	1111	1060	1009	958	958

Table 4. Fixed Effects Estimates of Medicaid Multiplier

	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5	(6) 5-yr Sum
Per-Capita Federal Medicaid	-0.163	-0.226	-0.242	-0.235	-0.048	1.516
($100,000)	(0.250)	(0.478)	(0.716)	(0.896)	(1.114)	(3.546)
Observations	1162	1111	1060	1009	958	958

Table 5. IV Estimates of Medicaid Multiplier

	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5	(6) 5-yr Sum
Per-Capita Federal Medicaid	0.655*	1.400*	2.534**	3.860**	5.214**	14.700**
($100,000)	(0.388)	(0.791)	(1.193)	(1.580)	(1.992)	(5.926)
Observations	1162	1111	1060	1009	958	958
R-Sq	0.731	0.737	0.726	0.711	0.702	0.729
First_Stage_F	14.676	12.872	12.252	11.998	11.998	11.998

Table 6. IV Estimates of Medicaid Multiplier (5-Year Accumulated Effect): Sensitivity to Bandwidth

	(1)	(2)	(3)	(4)
Bandwidth:	0.1	0.2	0.3	All
Per-Capita Federal Medicaid	-21.933	7.701	9.319	14.700**
($100,000)	(107.897)	(5.811)	(5.810)	(5.926)
Observations	319	657	898	958
R-Sq	0.687	0.773	0.766	0.729
First_Stage_F	0.189	13.740	8.413	11.998

Table 7. IV Estimates of Medicaid Multiplier (5-Year Accumulated Impact): by Year

	(1) 1990-1994	(2) 1995-1999	(3) 2000-2006	(4) 2007-2008
Per-Capita Federal Medicaid	10.955*	10.537	21.876**	62.788
($100,000)	(5.611)	(6.611)	(10.712)	(48.977)
Observations	250	254	352	102
R-Sq	0.759	0.732	0.536	0.013
First_Stage_F	18.614	16.880	7.157	1.019

Table A1. Kink in Covariates

Bandwidth	0.1	0.2	0.3	0.4
Share Age 65+	22.33	4.049	4.837	4.847
Share Female	6.261	9.630*	7.563**	8.099**
Share White	76.02	2.881	-24.62	-48.32
Share Black	3.255	71.3	56.55	89.7
Share Hispanic	-105.0*	-22.85	-1.692	-8.85
Share with High School	69.05*	-7.332	-6.178	-6.34
Share with Some College	-14.59	-31.57*	-28.07**	-26.99**
Share with College+	-13.65	-0.851	-0.121	9.36
Lagged Union Coverage	-40.47	-26.66	-15.2	-23.85*
Lagged Manufacturing Share of GDP	33.74	16.26	0.738	-1.028
Lagged Population	-4.4E+07	-7552553	-2.5E+07	-32177046.5*
Lagged Per-Capita Real GDP	-49680.6	-1814.7	14380.7	106617.3