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Macroeconomic impacts of Universal Health Coverage
Synthetic control evidence from Thailand

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ABSTRACT

We study the impact of Universal Health Coverage (UHC) on various macroeconomic outcomes in Thailand using synthetic control methods.* Thailand is compared to a weighted average of control countries in terms of aggregate health and economic performance over the period 1995 to 2012. Our results suggest that financial protection in Thailand has improved relative to its synthetic counterfactual. While out-of-pocket payments as a percentage of overall health expenditures decreased by 16.9 percentage points, annual government per capita health spending increased by $78. However, we detect no impact on total health spending per capita nor the share of the government budget allocated to health. We find positive health impacts as captured by reductions in infant and child mortality. The introduction of UHC has had no discernible impact on GDP per capita. Our results complement micro evidence based on within country variation. The counterfactual design implemented here may be used to inform other countries on the causal repercussions and benefits of UHC at the macroeconomic level.

Keywords

Universal Health Coverage, macroeconomic impacts, synthetic control approach, Thailand.

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"I regard universal health coverage as the single most powerful concept that public health has to offer. It is inclusive. It unifies services and delivers them in a comprehensive and integrated way, based on primary health care." Dr Margaret Chan, WHO Director-General

1. Introduction

This paper examines the impact of universal health coverage[1] (UHC) in Thailand on aggregate health care spending, GDP per capita and child and infant mortality rates. While there are many micro studies on the effects of UHC in developing countries (Limwattananon et al., 2015; Gruber et al., 2014; Miller et al., 2013; Wagstaff and Manachotphong, 2012; Barofsky, 2011), including Thailand, there is currently little causal evidence at the aggregate level.

The WHO keenly advocates UHC as demonstrated by the 2013 World Health Report on universal health coverage. In 2009, only 58 countries were classified as having attained full UHC with Thailand being one of them (Stuckler et al., 2010). The country introduced the UHC policy, originally known as the 30 baht project, in 2001. Three different schemes are in place, including, two employment-based schemes[2] and the recently introduced, tax-financed Universal Coverage Scheme. The nationwide roll-out of the Universal Coverage Scheme was completed within a year, reaching a coverage of 71 percent. Coverage increased to 95 percent in 2003, and 98 percent by 2011 (International Health Policy Program, 2011). Health care coverage was extended to 18.5 million uninsured people out of a population of 62 million (Towse et al., 2004). The benefit package for the insured includes inpatient and outpatient care at accredited facilities as well as access to prescribed medication.

In the case of Thailand, existing micro evidence documents decreases in out-of-pocket payments and improved financial protection due to UHC. For instance, based on household data, Limwattananon et al. (2015) show that the Thai UHC reform reduced out-of-pocket expenditures by 28 percent.[3] With regard to health outcomes and health seeking behavior, previous micro studies have also reported positive impacts. For instance, the Thai UHC positively affects working age people by reducing the likelihood that they report themselves to be too sick to work (Wagstaff and Manachotphong, 2012), it further increases the demand for outpatient services (Panpiemras et al., 2011), and preventive check-ups (Ghislandi et al., 2013). At the same time, there is no evidence that ex ante moral hazard increases (Ghislandi et al., 2013). In addition, Gruber et al. (2014) show that infant mortality rates decreased due to better access to health services among poor Thai.

While these papers provide useful evidence on the impact of the UHC scheme, for policymakers it is important to know what will happen to an *entire* economy after the introduction of UHC. Capturing aggregate effects is not straightforward and the literature is often restricted to papers that rely on micro data which may not always support generalization to the aggregate level. Moreno-Serra and Smith (2015) is a notable exception. They assess the macro-economic

[1] We apply the WHO's definition of UHC. The goal of the scheme is "to ensure that all people obtain the health services they need – prevention, promotion, treatment, rehabilitation and palliation – without risk of financial ruin or impoverishment" (WHO, 2013). We use the terms universal health coverage and universal health care interchangeably. The former is often used in the context of developing countries to stress the idea of full population coverage. The latter pertains to the quality of care in developed countries (Stuckler et al., 2010).

[2] The employment based schemes are the Civil Servants Medical Benefits Scheme covering current and retired civil servants and their dependents and the Social Security Scheme providing benefits to employees of establishments with more than 10 workers.

[3] Similar evidence is reported for Mexico (Barofsky, 2011). Experiences from Taiwan and Mexico underline that UHC facilitates access to health care and financial risk protection for the poor (Lu and Hsiao, 2003; King et al., 2009).

impacts of universal health coverage at the global level. Coverage is measured by pre-paid public and private health expenditure and immunization rates. The study estimates the effects of health coverage for a large panel of 153 countries over the period 1995 to 2008 by means of an instrumental variables approach to account for reverse causality. They find that expanding health care coverage improves population health as captured by reductions in child and adult mortality.[4] Higher government health spending drives the reductions in mortality rates. In this paper, we also consider macro level effects of universal health coverage but focus on Thailand, as it is one of the few developing countries which has achieved UHC.

Evaluating the impact of UHC on just one case does not lend itself to traditional models of impact evaluation and inference. Establishing credible counterfactuals is difficult. In this paper we use synthetic control methods (Abadie et al., 2010) to compare Thailand to a plausible group of control countries without UHC. This approach offers a fully data-driven way of finding an optimal weighted average of control countries so that they closely track Thailand in terms of outcomes of interest prior to UHC. The resulting "synthetic" Thailand is then used to simulate the country's trajectory in the absence of UHC. Many other countries in the region have also shown improvements in the supply of health care. Our goal is to assess whether some of the observed changes in aggregate variables in Thailand can be attributed to the implementation of UHC, net of general trends for Thailand and its regional neighbors. At the aggregate, we carefully need to check "the ability of the control group to reproduce the counterfactual outcome trajectory that the affected units would have experienced in the absence of the intervention or event of interest." (Abadie et al., 2010).

Our assessment of the macro-economic impacts shows that between 1995 and 2012 UHC led to decreases in out-of-pocket payments and an increase in government spending. This is reflected in a 16.9 percentage point increase in government health spending as a percentage of total health expenditures. Government per capita health spending increased by about $78. At the same time, there was hardly any effect on *total* per capita health spending. We cannot document clear effects on the government budget share allocated to health. Overall, the introduction of UHC has neither harmed nor improved the economic performance of Thailand vis-à-vis the other countries in the region. There are no significant impacts on GDP per capita. While we do not have time series data on health seeking behavior, we examined mortality data at the national level. Aggregate infant and child mortality decreased by 20 percent relative to counterfactual countries in the region.

The remainder of the paper is structured as follows. Section 2 presents the data sources, indicator definitions and the synthetic control approach. Section 3 discusses the results and related robustness tests. Section 4 concludes.

2. Methods

Data sources and definition of indicators

Our analysis covers the period 1995 to 2012 and relies on data from various sources. We use data from the World Health Organization's Global Health Observatory to assess the impact of universal health coverage on several health-spending indicators. To assess the impact of the policy on financial protection as measured by out-of-pocket expenditures we use out-of-pocket expenditure as a percentage of total health expenditure. The variable does not include regular

[4] The instruments CO2 emissions and conflict deaths are used to generate exogenous variation in population health. The relationship between the instrumented mortality rates and the health coverage indicators is taken as yielding causal results.

insurance payments. Existing evidence indicates that high out-of-pocket payments are strongly related with catastrophic health spending and impoverishment (Chuma and Maina, 2012; Ghosh, 2011; Yardim et al., 2010; Xu et al., 2007). A complementary expenditure category is government expenditure on health as a percentage of total health expenditure. To achieve financial protection against catastrophic health spending, government spending needs to increase correspondingly. In many developing countries, including Thailand, there is an almost mechanical relationship between out-of-pocket payments and government health expenditure as a share of total health expenditure as these two sources constitute the two major components of total expenditure on health. The residual category includes private insurance programs and contributions to health care financing from charities. We also consider total health expenditures per capita and government health expenditure per capita. Finally, we consider another core indicator of health financing systems which is government expenditure on health as a percentage of the total budget.

In addition to the effect of UHC on health spending we examine its effect on GDP per capita (PPP, constant $2005) and on infant and child (under-five) mortality. These data were obtained from the World Bank's World Development Indicators and the UN Inter-Agency Group for Child Mortality Estimation, respectively. The mortality data is in part based on simulations and estimates have to be interpreted with this caveat on mind.[5] However these mortality estimates are widely used and have already been analyzed in panel settings (Moreno-Serra and Smith, 2015), as well as with the synthetic control method (Pieters et al., 2014).

It would have been interesting to investigate the impact of UHC on a set of additional indicators such as health care utilization to capture demand for health services, government expenditure on education or other heads to expenditure in order to examine budgetary shifts, and on overall budget deficits to gauge fiscal sustainability. However, we were unable to find systematic and consistent time-series information for these indicators.

Statistical analysis and composition of control group

To analyse the effect of UHC on the evolution of annual health spending, the overall performance of the economy and child mortality rates, we compare Thailand's performance with those of a synthetic control group, which is composed of a weighted average of other countries in the Asia and Pacific region without universal health care coverage.

The synthetic control method is a fully data-driven way of determining a counterfactual for Thailand and allows for causal estimates in contexts with only one treated unit and a few control units. The pool of countries considered to create the synthetic control consists of 17 countries[6], for which health and macroeconomic data are available for a period of six years before and 12 years after the UHC reform in Thailand, that is, 1995 till 2012.[7]

The method searches for an optimal combination of weights for the set of control countries to minimize pre-treatment differences between outcomes of interest. The applied weights result

[5] Infant mortality is defined as the number of infants dying before reaching one year of age, per 1,000 live births in a given year. Child mortality refers to the death of infants and children before reaching the age of five per 1,000 live births.

[6] The countries included in the analysis are Bangladesh, Cambodia, Fiji, Indonesia, Kiribati, Lao People's Democratic Republic, Marshall Islands, Micronesia, Nepal, Pakistan, Papua New Guinea, the Philippines, Samoa, Solomon Islands, Tuvalu, Vanuatu, and Vietnam.

[7] Unfortunately, no data are available on health expenditures for the years before 1995. Consequently, we cannot examine longer-term trends prior to UHC implementation.

from a recursive algorithm (quasi Newton method), sum up to one, are non-negative and range from zero to one. The computed sample weights are then applied to post-treatment outcomes to simulate Thailand's path in the absence of UHC. If a good pre-treatment fit between Thailand and its synthetic control (i.e. the weighted average of control countries) is achieved, then differences in post-treatment outcomes may plausibly be attributed to the universal health care policy of the country.[8] Other than matching Thailand to the pool of countries in terms of pre-treatment outcome variables, we also include additional matching variables that describe the economic potential and the size of the country (log GDP per capita in the years 1995, 2000, 2005 and 2010 and the total size of the population in 1995 and 2000). We also consider GDP per capita as an outcome variable and for this outcome we match on GDP in all years prior to treatment and population size in 1995 and 2000.

We carefully constructed the pool of control countries in the region and excluded outliers or contaminated controls as advised by Abadie et al. (2010). We excluded developed countries (Japan and Australia). Two countries leave the sample due to missing data (Myanmar and Timor-Leste). We also dropped countries with health financing systems that are (nearly) universal or are moving towards universal health coverage[9] (Minh et al., 2014; Asian Development Bank, 2011; Somanathan and Hafez, 2010; Rannan-Eliya and Sikurajapathy, 2009). Finally, we exclude the special cases of India and China from the analysis, as they are considerably larger in geographical size[10], have populations that are about 18 times larger than Thailand, and generate a volume of GDP (in 2005 PPP) that is at least 7.5 times higher. Especially the considerable differences in these economies lead us to exclude the two countries from the study: The total volume of GDP is crucial for tax revenues and thus the financing of government interventions such as universal health coverage. By restricting our samples to developing, non-UHC countries we ensure that our findings are based on a pool of countries that constitute reasonable counterfactual matches.

3. Results

The impact of universal health coverage using the synthetic control method

To preview our results we find that UHC has led to substantial shifts in Thailand's health spending relative to its synthetic control. We detect no impacts on GDP per capita and find some evidence of reductions in infant and child mortality which is consistent with existing micro evidence (Gruber et al., 2014).

Figure 1 presents trends in outcomes in Thailand and its synthetic control before and after the introduction of the UHC policy. In the same Figure, we also plot a simple average of control countries. Across panels the synthetic control group provides a much tighter pre-policy fit than a simple average, corroborating the choice of synthetic control methods. To judge exact magnitudes, Table 1 presents the corresponding average treatment effects, i.e. differences in means before and after the introduction of UHC. Note that pre-treatment means across outcomes are well balanced (Table 1). That is to say, the synthetic control closely mimics the Thai situation before the introduction of UHC.

How swiftly and strongly have expenditure patterns at the aggregate reacted relative to the synthetic control. That is, what would have happened in the absence of UHC? The analysis shows that out of-pocket-spending decreased following the introduction of UHC (Figure 1,

[8] For further information about this technique see Abadie and Gardeazabal (2003), Abadie et al. (2010), Abadie et al. (2011), Donohue and Aneja (2012), Billmeier and Nanncini (2013), and Fremeth et al. (2013).
[9] These countries are Malaysia, Palau, Sri Lanka, and Tonga.
[10] India is six times and China is 19 times larger than Thailand in geographical size.

Panel A). The mean reduction in out-of-pocket-spending between Thailand and its synthetic control, i.e. difference in means post-policy, is 16.9 percentage points (Table 1). Government health spending as a percentage of total health expenditures perfectly offsets this fall (Figure 1, Panel B). This substitution arises due to the small residual categories (expenses for private insurance programs and contribution to health care financing from charities). The Thai government thus managed to protect its people against the economic hardships associated with (catastrophic) health care expenses. Note that almost full coverage was only obtained in 2003 (International Health Policy Program, 2011), which may explain some of the sluggish, or lagged effects.

With regard to per capita government health spending (in logs), we see a steady upward trend following UHC (Figure 1, Panel C). The mean difference in per capita government health spending between Thailand and its synthetic control amounts to about 39 percent. Does this considerable increase in government expenditure affect total per capita health expenditure? We present the results in Figure 1, Panel D. While there is an upward trend in per capita total health costs experienced in Thailand and across the region, we do not find that total health care costs increased due to UHC. If there is an increase at all it occurs after 2007 which raises the possibility that total health costs may have become burdensome. However, we are unable to document a steady increase in the share of the government budget that is allocated to health care (Figure 1, Panel E). In part this may be due to poor model fit as we are unable to establish a good pre-treatment trend for this variable. Notwithstanding this concern, we observe that after 2008, the share of the Thai government budget used for health actually declines. On average, over this period the share of the government budget allocated to health rose by 1.54 percent (see Table 1) suggesting that a modest increase in the share of the budget allocated to health care expenditure was sufficient to reach UHC.

Next we consider the impact on GDP per capita. Panel F in Figure 1 suggests that Thailand closely tracked its synthetic counterfactual before the introduction of UHC. Thereafter, we see a small positive impact on GDP, yet this effect is not "statistically significant" as we discuss later. Clearly, UHC has neither boosted nor harmed GDP per capita. To get a more complete picture of the macroeconomic effects, it would have been interesting to examine budget deficits and other items in the government budget (e.g. education). However to the best of our knowledge there are no consistent annual time series datasets on education expenditures and deficit for the period and region at hand.

Turning to the effect of UHC on health outcome, we see in Panel G in Figure 1 that there is a decline in infant mortality due to UHC, averaging a reduction of more than three children per 1,000 after the introduction of the policy. For child mortality a reduction of four children per 1,000 can be observed (Figure 1, Panel H). Again, there is some indication of a lagged effect.

Falsification tests and pseudo p-values

While we have presented evidence that the impacts of UHC are "economically" important, i.e. sizeable, it is also important to judge the statistical significance of the observed impacts. Due to the small sample, classical tests of statistical significance cannot be applied to the synthetic control method. However we can gauge significance using pseudo p-values based on exact inference or permutation (Fremeth et al., 2013; Rosenbaum 2002a, 2002b). In Figure 2, we falsely assign the policy one-by-one to all the other countries in the pool of control countries resulting in 17 pseudo-treatments. The pseudo-treatments are presented in grey, the Thai impact is taken from Figure 1 and presented in black. The lines represent the difference between the falsely attributed country and the synthetic control. Thus, for a good fit prior to the treatment in 2001, we expect the lines to be tightly aligned around zero. For an economically important difference after 2001, we expect the line to deviate considerably from zero.

Figure 2 illustrates that prior to the policy all eight Thai indicators closely track their synthetic counterpart. After the policy, a number of variables clearly stand out relative to the placebos: out-of-pocket payments and government health expenditures as percentage of total health expenditures, per capita government health expenditures and the mortality indicators. We do not find similar changes for the falsely assigned control countries, that is, they do not exhibit a similarly tight pre-treatment trend. The pre-treatment trend for the control countries is best for government health expenditures as a percentage of total health expenditures (Figure 2, Panel B). But for all the other indicators that changed in response to the UHC policy we cannot establish similarly good pre-treatment trends for the falsely assigned control countries prior to 2001.

Figure 2, Panel A shows that the impact on out-of-pocket expenditures is most pronounced for Thailand. No other county has managed a similar decrease. In fact some countries even experienced an increase. Similarly, no country has augmented its government contribution to total health costs by as much as Thailand (Figure 2, Panel B). Turning to per capita government expenditures on health we observe that Thailand ranks among the two countries with highest expenditures (Figure 2, Panel C) whereas for total health expenditures Thailand ranks somewhere in the middle (Figure 2, Panel D). The picture looks similar for government health expenditures as a percentage of total government spending (Figure 2, Panel E). Thailand does not seem to disproportionately favor the health sector. In fact, a couple of other countries in the region allocate higher budget shares to the health sector. Similarly, we do not find that the change in Thailand's GDP per capita post-UHC is very different from those of other countries in the region (Figure 2, Panel F). In terms of its achievements in reducing infant and child mortality Thailand outperforms the other countries as shown in the bottom two panels of Figure 2. Note that the mortality indicators for many of the falsely attributed countries do not have a good fit prior to the policy. Furthermore, many of the placebo models feature increases in mortality.

We used the information displayed in the graphs to calculate ratios of post to pre-intervention root mean square prediction errors[11] (RMSPE) for all placebos and Thailand. The logic behind the ratio is that a relatively large difference between treatment and control post-UHC as compared to prior UHC would indicate statistical significance. We also need to take into account the sign of the impact. To this end we multiply the RMSPE by minus 1 if the average impact was negative (Fremeth et al., 2013). We then rank the 18 RMSPEs and calculate pseudo *p*-values. For example, say Thailand is ranked first. The chance of this is 1/18 or 5.5 percent. While the *p*-values can be interpreted in the usual fashion, it is important to note that classical critical values can be misleading. Clearly, the smallest possible *p*-value is 5.5 percent. Moving down just one rank, already yields 2/18 or 11 percent. Figure 3 presents this more nuanced picture of "statistical significance" by relating pre and post-UHC differences between treatment and control and taking into account the sign of the impacts. The RMSPE ratios of out-of-pocket payments, infant and child mortality rank lowest indicating a "statistically significant" reduction due to UHC (Figure 3, Panels A, G, H); the RMSPE ratio of per capita government health expenditures ranks highest pointing to a "statistically significant" increase (Figure 3, Panel C). In other words we can assign pseudo *p*-values of 5.5 percent to all these impacts. The

[11] The RMSPE is calculated by taking the root of the average square difference between Thailand and the weighted average of control countries. We calculate this measure of prediction error for the period before and after UHC implementation.

p-value for government health expenditures as percentage of total health expenditures is 2/18 or 11 percent (Figure 3, Panel B). For the three remaining variables - per capita total health expenditures, government health expenditures as percentage of total government spending and GDP per capita - we observe increases but they are not statistically significant (Figure 3, Panels D, E, F). Overall, we conclude that based on the synthetic control approach we find economically and "statistically significant" effects of UHC on financial protection working through increases in government health care spending and improved health as captured by reduced infant and child mortality.

Robustness checks using linear regression models
To verify the robustness of our completely flexible and data driven synthetic control evidence, we also estimated the average impact of UHC on all outcomes using linear regression models. In these simple regression models we account for country-specific and year-specific effects and estimated the impact on all outcomes jointly using a seemingly unrelated regression system to account for error correlations across models. It is re-assuring that estimates in Table 3 point in the same direction. Of course standard errors have to be taken with a grain of salt given that only one country is "treated." Unlike the synthetic control models, it is hard to gauge the dynamics before and after UHC implementation. Note that the linear regression models underestimate the average increase in log government health expenditures per capita and the reduction in child mortality.

4. Conclusion
By providing macroeconomic evidence on the effect of UHC this paper complements the existing microeconomic evidence on universal health coverage in the case of Thailand. Evidence on the aggregate effects of UHC are important from a policy perspective. The synthetic control approach adopted in this paper showed that the UHC policy has led to a reduction in out-of-pocket expenditure which was matched by a corresponding increase in government expenditure on health without any increases in *total* per capita spending on health. Increases in the share of the government budget allocated to health were modest and statistically insignificant. Similarly, we did not find any effect of UHC on GDP per capita but did find that the policy has worked towards reducing infant and child mortality. The results presented in this paper yield useful information for Thailand as well as for other lower and middle income countries as they strive to introduce policies to reach UHC. The approach presented here may be fruitfully applied to detect the aggregate consequences of such policies.

By design the macro approach used here cannot be used to identity effects by income groups or by regions. The approach presented here should be viewed as a complement to micro approaches and an arguably credible way of carrying out rigorous macro-economic assessments of policies such as UHC.

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Tables and Figures

Table 1: Outcome variables before and after universal health coverage

	Pre-Treatment		Post-Treatment	
	Thailand	Synthetic Control	Thailand	Synthetic Control
Out-of-pocket as % of total health expenditures	37.600	37.522	20.183	37.105
Government health expenditures as % of total health expenditures	52.350	52.427	70.067	50.494
Log total health expenditures per capita (PPP $)	5.165	5.165	5.595	5.458
Total health expenditures per capita (PPP $)	175.567	175.529	277.775	223.644
Log government health expenditures per capita (PPP $)	4.515	4.510	5.234	4.848
Government health expenditures per capita (PPP $)	91.767	91.719	198.867	120.939
Government health expenditures as % of total government spending	10.167	10.157	13.350	11.809
Log GDP per capita (constant $)	7.710	7.710	7.933	7.850
GDP per capita (constant $)	2,233.881	2,233.119	2,809.253	2,540.717
Log infant mortality (per 1,000)	3.061	3.061	2.668	2.854
Infant mortality (per 1,000)	21.400	21.434	14.558	17.957
Log child mortality (per 1,000)	3.230	3.234	2.821	3.022
Child mortality (per 1,000)	25.367	25.404	16.983	21.147

Note: These are outcome averages for Thailand and synthetic control corresponding to the weights in Table 2 and models in Figure 1.

Table 2: Country weights for the construction of the synthetic control group

	Out-of-pocket as % of total health expenditures	Government health expenditures as % of total health expenditures	Log total health expenditures per capita (PPP $)	Log government health expenditures per capita (PPP $)	Government health expenditures as % of total government spending	Log GDP per capita (constant $)	Log infant mortality (per 1,000)	Log child mortality (per 1,000)
Bangladesh	0.000	0.000	0.000	0.000	0.000	**0.001**	0.000	0.000
Cambodia	0.000	0.000	0.000	0.000	0.000	**0.001**	0.000	0.000
Fiji	**0.547**	**0.349**	**0.113**	**0.315**	**0.450**	**0.642**	**0.009**	**0.064**
Indonesia	**0.004**	**0.508**	**0.261**	**0.268**	**0.276**	**0.295**	**0.073**	**0.066**
Kiribati	0.000	0.000	0.000	0.000	0.000	**0.004**	0.000	0.000
Lao People's Democratic Republic	0.000	0.000	0.000	0.000	0.000	**0.002**	0.000	0.000
Marshall Islands	0.000	0.000	**0.626**	**0.416**	**0.273**	**0.009**	0.000	0.000
Micronesia	0.000	0.000	0.000	0.000	0.000	**0.008**	0.000	0.000
Nepal	0.000	0.000	0.000	0.000	0.000	**0.001**	0.000	0.000
Pakistan	**0.449**	0.000	0.000	0.000	0.000	**0.001**	0.000	0.000
Papua New Guinea	0.000	0.000	0.000	0.000	0.000	**0.004**	0.000	0.000
The Philippines	0.000	**0.143**	0.000	0.000	0.000	**0.003**	0.000	0.000
Samoa	0.000	0.000	0.000	0.000	0.000	**0.007**	**0.918**	**0.871**
Solomon Islands	0.000	0.000	0.000	0.000	0.000	**0.005**	0.000	0.000
Tuvalu	0.000	0.000	0.000	0.000	0.000	**0.008**	0.000	0.000
Vanuatu	0.000	0.000	0.000	0.000	0.000	**0.007**	0.000	0.000
Vietnam	0.000	0.000	0.000	0.000	0.000	**0.002**	0.000	0.000

Table 3: The impact of universal health care coverage in Thailand using panel regressions

	Out-of-pocket as % of total health expenditures	Government health expenditures as % of total health expenditures	Log government health expenditures per capita (PPP $)	Log total health expenditures per capita (PPP $)	Government health expenditures as % of total government spending	Log GDP per capita (constant $)	Log infant mortality (per 1,000)	Log child mortality (per 1,000)
Universal Health Coverage	-15.99*	18.24*	0.22*	-0.07	1.40+	0.04	-0.16*	-0.14*
(1= for Thailand after 2001)	(1.24)	(1.44)	(0.06)	(0.05)	(0.84)	(0.05)	(0.04)	(0.05)

Note: N=324, all countries in table 2 are used as (equally weighted) controls. All regressions include time and country dummies. Models are jointly estimated in a system of seemingly unrelated regression models (SUR). Standard errors are clustered at the country level. * p-value 0.05, + p-value 0.10.

Figure 1: The impact of universal health care coverage in Thailand on aggregate variables

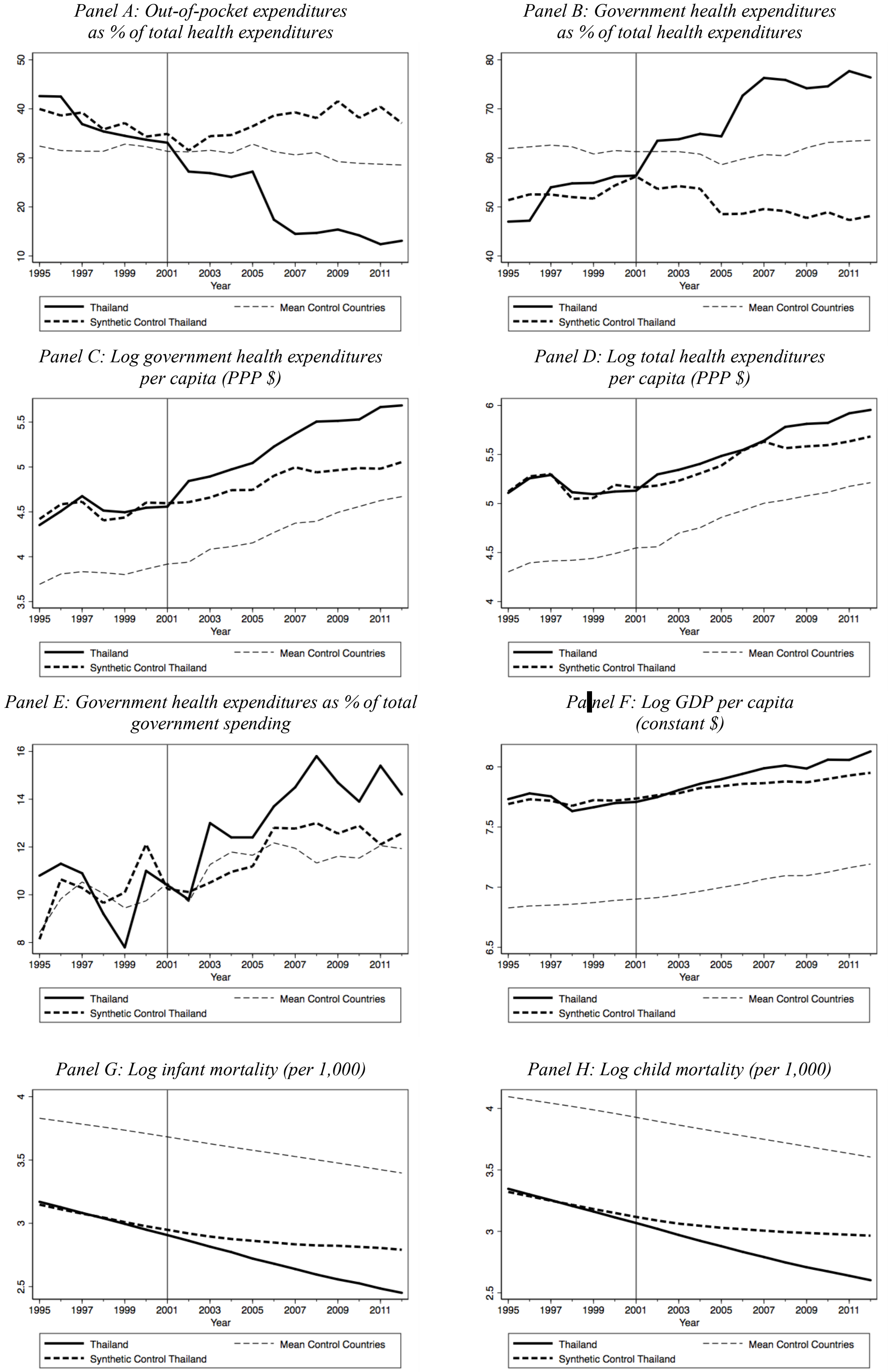

Figure 2: Placebo tests of falsely attributing the policy to other countries in the pool of control countries **(Impact on Thailand in black)**

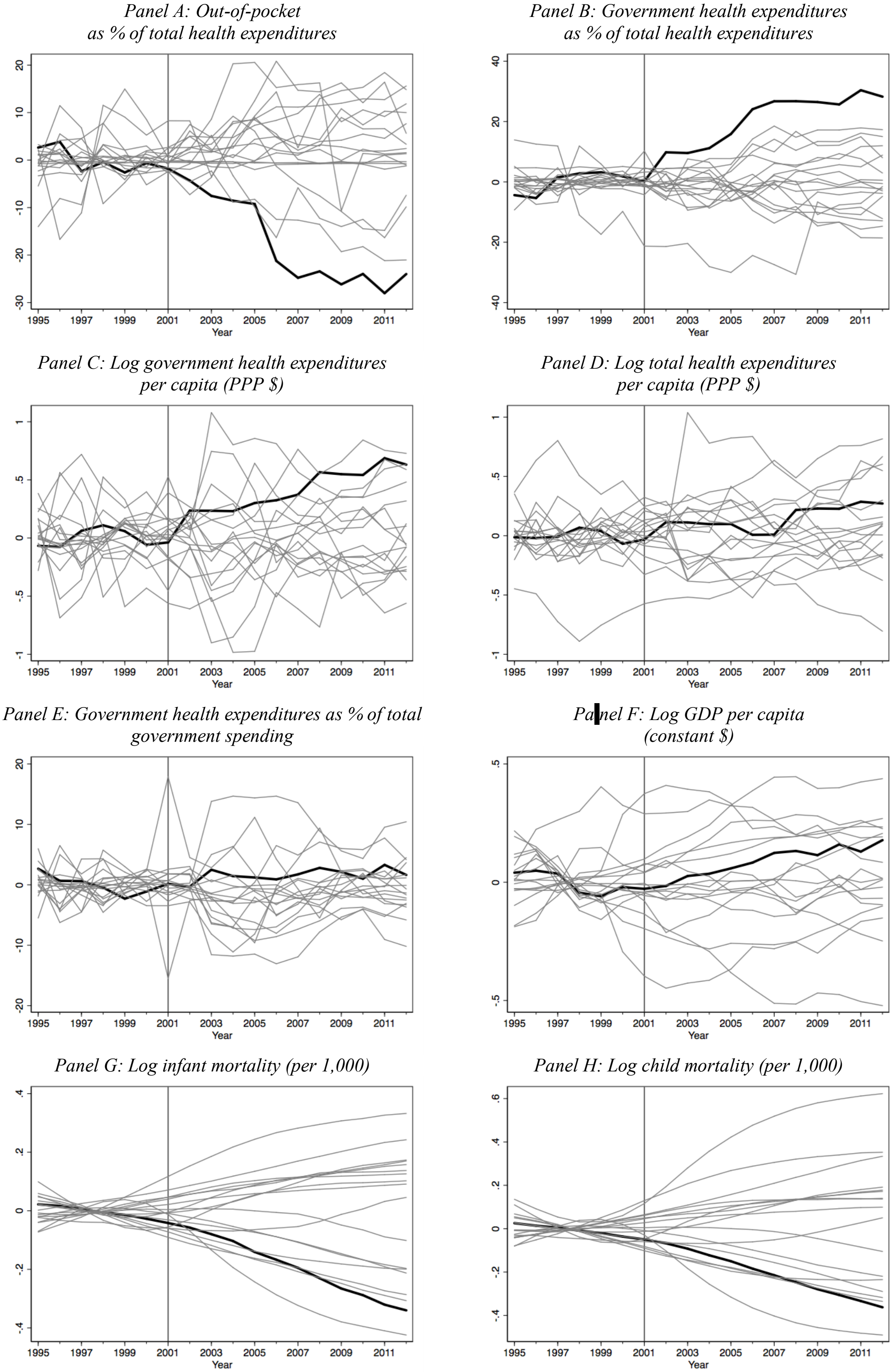

Figure 3: Ratios of pre- and post-intervention root mean square error **(RMSPE)**