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1. Introduction

1.1 A Brief Overview of the Covid-19 Pandemic and Covid Certification

The Covid-19 Pandemic has been causing enormous damage on a global level. Economically, the pandemic triggered a worldwide recession: Financial Times (Romei and Burn-Murdoch, 2020) reported that Covid-19 negatively impacts the leisure, retail, and travel industries; based on OECD's data (G20 GDP Growth - First Quarter of 2020, 2020), G20 countries' year-to-year GDP decreased by 3.4% in the first quarter of 2020. Since the occurrence of the first positive case in 2019, all countries have been designing and implementing policies that aim at mitigating the harm as much as possible.

As a potential method to recover economies, escape from lockdowns, and facilitate free movement in societies, the concept of Covid certificates (also known as Covid Passports, Vaccine Passports, Green Pass, etc.) emerged in 2020 (Reuters, 2020) when Chile started to release certificates that confirm any person who finished a quarantine after testing positive for the virus. With Israel being the first to launch a Covid immunity passport in January 2021, during the same year, this idea was gradually embraced and adopted by many countries all over the world. Although each country applies different conditions for obtaining the certificates and various details such as length of validity and the methods of use, Covid certificates are essentially proof of recent recovery from Covid-19, negative Covid test results (antigen test or RT-PCR), or doses of approved vaccine. Individuals are required to show the certificates, usually containing personal information and QR codes in digital form or on paper, when they attend events and perform activities at certain venues (especially related to health, education, entertainment, transport, and hospitality) that might trigger a large scale of coronavirus spreading. The activities and places that require Covid certificates are subject to the governments' dynamic policies dependent on the ongoing Covid situations.

1.2 Research Question

However, this policy has been causing a huge economic debate from both angles: one argument, according to researchers at Bruegel and the French Council of Economic Analysis (Oliu-barton et al., 2022), is that Covid passports may stimulate short-term economic recovery because the vaccinated groups can go back to in-person economic activities, such as working on site and consuming goods and services. But the others, for instance, nature news (Kofler and Baylis,

2020), expressed their skepticism that there should be *"too few survivors to boost the economy"* because of the limited capacity of testing and low recovery rates which are fundamental attributes to acquiring Covid certificates.

On the one hand, with increasing vaccination rates, more individuals would obtain Covid certificates, which means a lower number of existing Covid cases. Thus, it is possible that people are able to work and consume more in life, and the GDP level will be driven up by the increase in several sectors. On the other hand, from a short-term perspective, the adoption of Covid passports may deteriorate economic performance by limiting the public from further consumption in entertaining, leisure, hospitality, retail trade, and other sectors influenced. Therefore, to understand Covid certificates' impact on the economy empirically, the research question of this paper is: what are the effects of Covid certificates on GDP in the private sector?

1.3 Literature Review

Two papers should be discussed due to their relevance to this research.

Firstly, Melinda C Mills and Tobias Rüttenauer (2022) analyze the effect of compulsory Covid-19 certificates on vaccine uptake. The paper used a synthetic control model to compare the number of vaccine doses of six European countries that implemented Covid certificates with those of 19 control countries. Using daily data on cases, death, country-specific information, and vaccinations, the authors constructed a counterfactual graph that captures what the vaccine uptake would be if the certificates were not introduced. They found that Covid-19 certification led to an increase in vaccinations 20 days before implementation in anticipation, and this effect could last up to 40 days. Countries with pre-intervention uptake that was below average had a higher rise in daily vaccinations than those where uptake was already average or higher. The research applied a productive methodology, the synthetic control method, to investigate this situation with Covid certificates. This method will be used in this paper as well but to concentrate on an economic outcome variable of interest GDP data.

Another research that should be considered is the working paper from Bruegel the think tank (Oliu-barton et al., 2022). It is a working paper that analyzes the effect of Covid certificates on vaccine uptakes, public health outcomes, and economic activities. By using the data collected from OECD and G20 countries, this paper compares the estimated weekly GDP with and

without Covid certificates in France, Germany, and Italy from July 2021 to December 2021 based on the OECD's GDP tracker. This working paper found that the average effect of a 1 percentage point increase in vaccinated people would increase weekly GDP one month later by 0.052 percentage points, and compared with the counterfactual scenario, the weekly GDP of the three countries would have been lower if there was no policy intervention. The empirical methodology of Bruegel's paper is similar to this paper in the way that this research will use the synthetic control method to compare, after the implementation of the policy, the GDP in the scenario that Covid certificates exist with the GDP in the counter-factual scenario. In terms of dissimilarities, the first one is the regional scope of this paper is narrower: on a state/province level instead of countries level. Secondly, this paper would estimate a longer period with quarterly GDP data rather than weekly. These differences can add some value and may offer different results to the currently available research.

2. Policy Context & Data

2.1 Policy Background

This paper will focus on the United States, especially New York state. On 6th April 2021, Reuters (2021) reported that The White House would not introduce mandatory Covid-19 vaccination passports on a federal level, considering citizens' rights and privacy. However, the government expected the private sector to lead the verification of vaccine passports. Regarding decisions on a state level, USNEWS (Davis Jr., 2021) summarized where each state stands on this issue. The attitudes of states can be categorized into three kinds (Table 1).

In the first kind which includes only New York and Hawaii, vaccine passports have been implemented. In the second one, vaccine passports are explicitly banned to a different extent, and businesses and entities are prohibited from requiring such proof as a condition for accessing goods and services. 15 states belong to this category: Alabama, Arizona, Arkansas, Florida, Georgia, Idaho, Indiana, Iowa, Montana, North Dakota, South Carolina, South Dakota, Texas, Utah (partially banned), and Wyoming. Lastly, vaccine passports are not required in the rest of the 33 states, meaning that it depends on the willingness and choices of businesses and their establishment with individuals.

Table 1: Standpoints of States on Vaccine Passports

Have been implemented	Not required	Banned
New York Hawaii	Alaska, California, Colorado, Connecticut, Delaware, Illinois, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, Hampshire, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Vermont, Virginia, Washington, West Virginia, Wisconsin	Alabama, Arizona, Arkansas, Florida, Georgia, Idaho, Indiana, Iowa, Montana, North Dakota, South Carolina, South Dakota, Texas, Utah (partially), Wyoming

Among the only two states where the Covid certificates were implemented, New York is selected as the treatment state. 14 states where vaccine passports were banned are involved to be control states, and Utah is excluded because it only partially banned the certification. In New York State, 44% of its residents live in New York City according to 2020 Census Apportionment Results (United States Census Bureau, 2020). Based on Statista (2022), New York City's annual GDP has been very close to the total GDP of New York state. Consequently, it is reasonable to focus on both the state and the city's Covid certification policy when examining the circumstances of New York State.

The vaccine passport policy in the state and the city has been through three major stages. A statewide certification firstly appeared in March 2021, when New York state official website (2021) announced that its newly-developed digital certification called Excelsior Pass could help New Yorkers share their vaccination and Covid status voluntarily with private businesses. Although its application was not mandatory in the state, many places, especially entertaining venues, sports centers, and colleges/universities, required to check the pass or its alternatives for entry (vaccine cards or paper proof of vaccination). Entering the second stage called "Key to NYC", Mayor De Blasio (2021) stated that it would be mandatory to show vaccination proof at entertainment venues, gyms, and indoor dining in New York City. His executive order began in August 2021 with enforcement going into effect in September 2021. In the last stage, effective on 7th March 2022, NYC Health discontinued (2022) the Key to NYC vaccination requirement. However, the businesses still are able to choose to require the certification by themselves.

2.2 Data

The analysis employs several data sets, mostly economic data on a macro level. The GDP data were drawn from the website of the Bureau of Economic Analysis (BEA) (2022) of the US Department of Commerce. The quarterly state-level panel data was used for the period January 2019 (2019Q1) to March 2022 (2022Q1), with 13 quarters for each state in total. As mentioned above, the treatment state is New York. The donor pool contains 14 states shown above where Covid certificates were entirely banned. For each state, the variables used in the synthetic control match are GDP in private industries (GDP_in_Pri), the unemployment level, state tax revenues, chain-type quantity index -- both in levels and logs. Unfortunately, sector-level GDP data is not yet available for the period considered in this analysis.

Given that the federal government expected the private sector to dominate Covid certification (meaning that the private sector can choose to use the certification with autonomy and lead the development and improvement of Covid certification), the outcome variable will be GDP in private industries (GDP_in_Pri). GDP is expressed in millions of dollars and seasonally adjusted at annual rates to remove the effect or fluctuations of seasonal and calendar influences (these fluctuations normally occur at the same time and the same magnitude each year). Private industries incorporate all economic enterprises owned by individuals or groups in various sectors, namely retail trade, art entertainment recreation, health care and social assistance, construction, manufacturing, education, agriculture, etc.

The rest of the variables are used as predictor variables, which are assumed to have a steady relationship with the outcome variable both before and after the implementation of vaccine passports. These data were collected from Federal Reserve Economic Data (FRED) (2022) and also on a quarterly basis. The unit of tax revenues is millions of dollars as well, and the unemployment level is measured by the number of persons. Lastly, the chain-type quantity index (2022) represents the level of real production in the current year relative to the reference year. According to the definition given by Global Development Policy Center, the chain-type quantity index is computed by a series of year-to-year Fisher quantity indexes that measure the price level of goods and services over a given period. All of these factors are expected to be correlated with the outcome variable GDP_in_Pri.

3. Empirical Strategy

In policy analysis, the fundamental idea is, with the same group, to compare the potential outcome in the presence of policy with its counterfactual - the potential outcome in the absence of the policy. It presumes that no other policies or factors explain the observed impact during the period. However, one problem emerges: the counterfactual is unobservable – it is impossible to see what the result would be without the policy for treated units, and vice versa for untreated ones. Following this basic logic, the synthetic control method (SCM) becomes popular because it can create a hypothetic counterfactual state (the synthetic control state) that simulates the outcome of the state if it did not experience a particular policy intervention.

To effectively use the synthetic control method, a research report from Urban Institute explaining how to use SCM (Mcclelland and Gault, 2017) indicates that three fundamental assumptions must be satisfied. Firstly, only the treated state is affected by the policy change for all the periods in both the pre-treatment and post-treatment stages. This rule holds because the Covid certification policy is completely banned in the selected control states as explained in the previous part. Secondly, the policy change has no effect before it is implemented. As said in the introduction, the Covid certificate is a rather new concept that only emerges in late 2020 and early 2021. Besides, the data set includes a sufficiently long period. So, it can be assumed that this policy has no impact before its enactments. And third, the treated state's counterfactual outcome can be approximated by a combination of donor states. This rule is particularly true in the case since having Texas and Florida in the donor pool whose GDP levels are close to New York, SCM could construct a synthetic New York that should be a good approximation of the real New York State.

The synthetic New York is created using a data-driven method of choosing a weighted average of potential control states. The predictor variables shown before and the GDP outcome variable itself would determine the selection of donor states and their weights. As suggested by the research report of SCM (Mcclelland and Gault, 2017), the lagged outcome variables (for instance, GDP in previous quarters before the Covid certificate policy) are included as predictors to avoid the problem of omitting important predictors' effects. In Stata, the selected states in the donor pool and their weights assigned are optimally chosen. The resulting synthetic New York closely fits the state's GDP outcome before the implementation of Covid certification, and it plays as a control to the factual New York state after the enactment of the

policy. The first vaccine passports appeared in March 2021. Considering the time for implementation, 2021 Quarter 2 (starting from April) seems like a reasonable cutoff point representing the effective intervention of this policy. The economic impact ($\mathbf{Y_{Gap}}$) of the Covid certification policy can be estimated by calculating the difference in GDP outcome variable between New York ($\mathbf{Y_{NY}}$) and the synthetic New York ($\mathbf{Y_{SNY}}$) in the quarters after vaccine passports emerged: $\mathbf{Y_{Gap} = Y_{NY} - Y_{SNY}}$. To better capture how the GDP evolved after the enactment of the policy, the percentage gap in GDP with respect to New York (**Percent_Gap**) is also computed: $\mathbf{Percent\_Gap = (Y_{NY} - Y_{SNY}) / Y_{NY}}$.

4. Results

4.1 Main Results

As explained before, the synthetic New York is created by Stata which chose a combination of control states that can resemble the real New York state closely in the pre-Covid certification period (before 2021Q2).

Table 2 below shows the predictor balance, a comparison between pre-policy characteristics of New York state with that of the synthetic New York. In Table 2, chain-type quantity index, ln unemployment level, and ln tax collection in the treated and synthetic are relatively close. For GDP values in private industries of various quarters, on average, the difference is around 20000 million dollars (20 billion), which is approximately 1 percent - 1.5 percent of New York's GDP_in_Pri. Therefore, overall it can be seen that the synthetic New York offered comparably accurate values of predictor variables compared with that of the real New York prior to the vaccine passport policy enacted in 2021Q2.

Table 2: Predictor Balance, New York vs the Synthetic New York

	Treated	Synthetic
Index_QuantityChainType	**109.7756**	**123.9737**
lnTax_Collection	**10.02222**	**9.606291**
lnUnemployment_Level	**13.19241**	**13.39042**
GDP_in_Pri(236)	**1562360**	**1586669**
GDP_in_Pri(237)	**1597399**	**1603249**
GDP_in_Pri(238)	**1603638**	**1621456**
GDP_in_Pri(239)	**1615720**	**1635319**
GDP_in_Pri(240)	**1603996**	**1579929**
GDP_in_Pri(241)	**1439203**	**1405247**
GDP_in_Pri(242)	**1554880**	**1533828**
GDP_in_Pri(243)	**1575504**	**1568679**
GDP_in_Pri(244)	**1608039**	**1617128**

Table 3 displays the weights of each state in the synthetic New York. Capturing the GDP trend in New York before implementing the policy uses a combination of Florida (0.088) and Texas (0.912). All other states in the donor pool are assigned zero weights.

Table 3: State Weights in the Synthetic New York

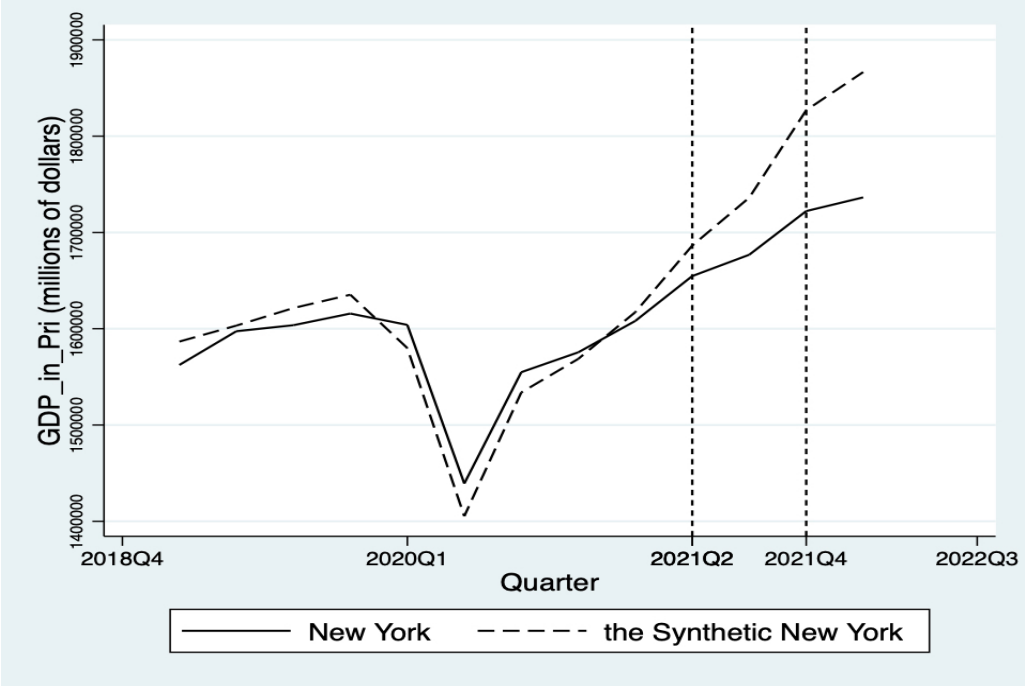
Unit Weights:

Co_No	Unit_Weight
Alabama	0
Arizona	0
Arkansas	0
Florida	.088
Georgia	0
Idaho	0
Indiana	0
Iowa	0
Montana	0
North Dakota	0
South Carolina	0
South Dakota	0
Texas	.912
Wyoming	0

Figure 1 demonstrates GDP in private industries for New York and its counterfactual, the synthetic New York, between 2019Q1 and 2022Q1. It is clear that the synthetic New York has a very close track and trend to the actual New York during the whole pretreatment period (before 2021Q2). Considering the high predictor balance shown in Table 2, it suggests that the synthetic New York provides a rational contrast that depicts what the GDP in private industries of NY would have been in 2021Q2 – 2022Q1 if the vaccine passport policy is absent. Based on the timeline of the Covid situation in the US offered by the Centers for Disease Control and Prevention (CDC) (2022), the first case of Covid-19 was found in the States in 2020 January, and later the number of cases surged. The graphs match this trend: from 2020Q1, GDP in private industries decreased rapidly, after which it gradually recovered and continued to grow.

Overall, the Covid certification policy has a negative impact on GDP in private industries. Immediately following the enactment of the policy, while GDP_in_Pri in the synthetic New York grew fast, the actual New York continued its moderate increase. The estimated GDP gap ($\mathbf{Y}_{\mathbf{Gap}}$) is negative for every quarter in the presence of Covid passport. After the appearance of the first voluntary statewide Covid certification in 2021Q2, it can be observed in Figure 1 that the gap of GDP_in_Pri between New York and the synthetic New York started to widen. As the vaccine passport became mandatory in New York City in 2021Q4, this gap has grown even wider than before.

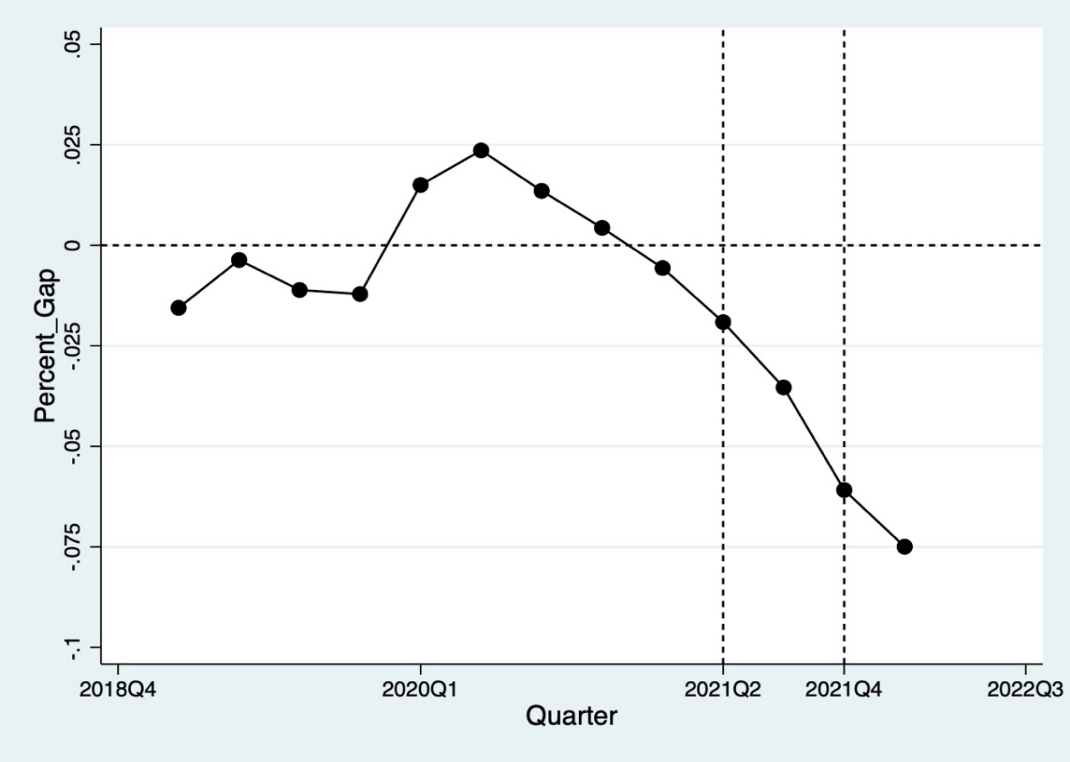
Figure 1: Trends in GDP_in_Pri, New York vs the Synthetic New York



The estimates of the economic impact of this policy can be computed by $\mathbf{Y_{Gap} = Y_{NY} - Y_{SNY}}$. During the period from 2021Q2 to 2022Q1, this policy on average reduced the GDP in private industries in New York state by approximately 81.4 billion relative to the synthetic New York. During the period when vaccine passport was voluntary (2021Q2 – 2021Q4), GDP in private industries was around 45.4 billion smaller than that of synthetic New York. When Covid certification was made compulsory (2021Q4 – 2022Q1), the magnitude of this gap was bigger than before: Figure 1 points out a loss of approximately 117.4 billion in the private sector due to the required certificate.

To have a more direct understanding of the evolution and the change of GDP_in_Pri, the percentage changes in terms of New York state (**Percent_Gap**) are also calculated and plotted as shown in Figure 2. Before the treatment, the gap in GDP between NY and the synthetic NY is stable, averaged on 0 percent and up to 2.5 percent. In the four quarters of the post-treatment period, the average percentage gap between NY and synthetic NY is 4.8 percent, and it has been increasing from around 2.5 percent (2021Q2) to a maximum of 7.5 percent (2022Q1) as the Covid certification policy became mandatory and more wide-applied.

Figure 2: Percentage Gap in GDP_in_Pri



4.2 A Placebo Test

To check the significance of the estimates, a placebo test is then performed. The idea of placebo tests is to evaluate if the results are purely accidental or driven by other factors. The central idea is to compare the economic development of a state similar to New York with the economic development of its synthetic version but with no Covid certification policy present at all. If the results are only caused by the Covid passport policy, there should not be a similar effect on the GDP_in_Pri when comparing the GDP of control states where the policy does not exist.

More specifically, the first step of running placebo tests is to apply synthetic control methods to the control states in the donor pool where the Covid certification policy is entirely banned. Afterward, if similar gaps of magnitude to the estimated results in New York are found in this placebo test, it means there is no significant evidence to support the effect of the Covid certificate policy on GDP in private industries.

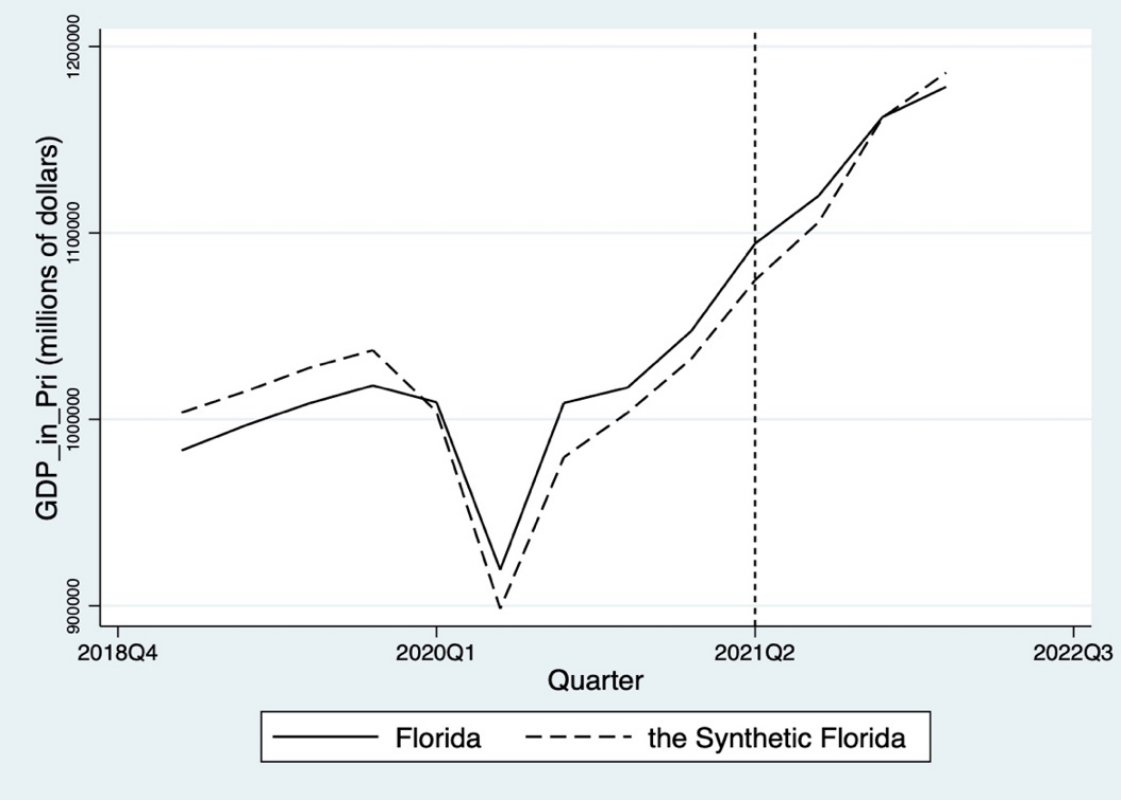
The first state chosen for the placebo test is Florida for a few reasons. Although Texas has the largest weight in the synthetic control for New York and a higher similarity as New York, it is not possible to run a synthetic control method analysis using Texas due to data limitations. The second-best option is Florida. Firstly, apart from Texas, Florida is the only other state used to construct the synthetic New York. Secondly, it has a similar GDP level as New York, according to World Population Review (2022). Last but not least, the population of the two states are resembling too, based on Tampa Bay Business Journal (2020).

Before running the placebo test, the data collected for New York is eliminated given the explanation listed above. Thus, the donor pool has 13 control states that will form a synthetic Florida. The predictor balance and the result of the placebo test are shown in Table 4 and figure 3 below respectively. The variables in the treated and synthetic Florida are relatively equal. Hence, synthetic Florida can be reckoned as an accurate counter-factual resembling the real Florida prior to the cutoff point. Regarding the results, Figure 3 shows the actual GDP_in_Pri for Florida and that of synthetic Florida during the whole period (2019Q1 – 2022Q1). It can be seen that there is no substantial gap between the two lines both before and after treatment. The percentage gap between real Florida and synthetic Florida was also computed to be compared with that of the New York case. After the cutoff point, averagely the percentage gap is 0.9 percent, which is much smaller than that of New York (4.8 percent).

Table 4: Predictor Balance, Florida vs the Synthetic Florida

	Treated	Synthetic
Index_QuantityChainType	123.32	121.6369
lnTax_Collection	9.34005	9.03749
lnUnemployment_Level	13.07436	12.84558
GDP_in_Pri(236)	983325.2	1003659
GDP_in_Pri(237)	996730.7	1014958
GDP_in_Pri(238)	1008566	1027585
GDP_in_Pri(239)	1018149	1037055
GDP_in_Pri(240)	1009196	1004115
GDP_in_Pri(241)	919296.4	898429.5
GDP_in_Pri(242)	1008788	979662.3
GDP_in_Pri(243)	1017054	1003542
GDP_in_Pri(244)	1047427	1032481

Figure 3: Placebo Test, GDP_in_Pri, Florida vs the Synthetic Florida



The second state included in the placebo test is Arizona. This selection is based on the Covid situation in the states. An American news website NPR (2022) displays a coronavirus case

tracker by state, and the data reveal that, by August 16th, 2022, the number of cases per 100K people is 29779 in New York while in Arizona this number is 30578. Given this similarity in the Covid situation, the placebo test with Arizona may help exclude the effect of Covid-19 cases on GDP_in_Pri. Seeing Table 5, the predictor balance is comparably approximate. Figure 4 does not demonstrate a similar gap of magnitude as in New York (Figure 1). In the post-treatment period (2021Q2 – 2022Q1), relative to the gap in New York (4.8 percent), the average gap of GDP_in_Pri between Arizona and synthetic Arizona is 1.0 percent.

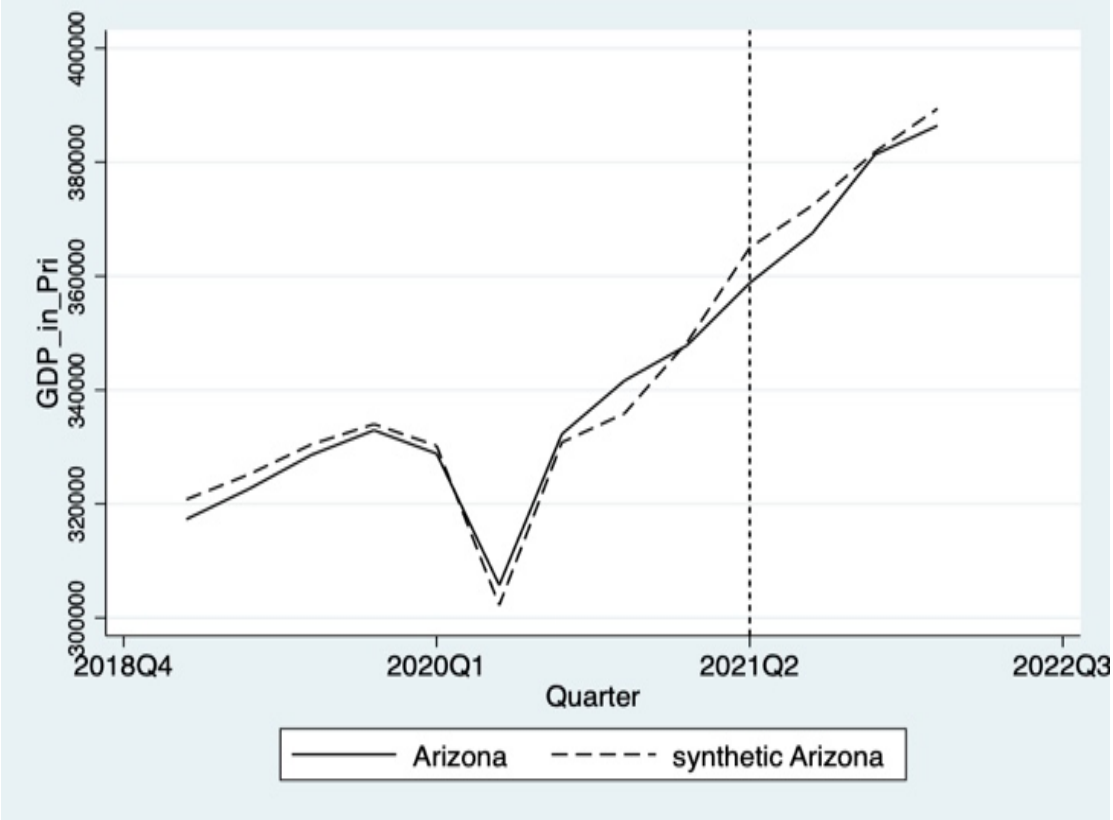
The trends of evolution of GDP_in_Pri in Florida and Arizona are not the same as in New York either. In Figure 1, after the Covid certification policy was applied (2021Q2), the gap between New York and its synthetic version was broadened. GDP in the private sector in the actual New York has a slower growth rate. However, in Figures 3 and 4, later than the cutoff point, GDP in real Florida and Arizona depicts a trend of catching up with their counterfactuals, the gaps are diminished steadily as time goes by.

In summary, no similar magnitude is detected in both Florida and Arizona. The placebo test indicates that the results found for New York are likely to capture the causal effect of the Covid passport.

Table 5: Predictor Balance, Arizona vs the Synthetic Arizona

	Treated	Synthetic
Index_QuantityChainType	**119.0681**	**111.2785**
lnTax_Collection	**8.40115**	**8.163665**
lnUnemployment_Level	**12.22974**	**11.41335**
GDP_in_Pri(236)	**317292.8**	**320778.3**
GDP_in_Pri(237)	**322612.5**	**325174.5**
GDP_in_Pri(238)	**328607.1**	**330448.9**
GDP_in_Pri(239)	**332933.5**	**333999.9**
GDP_in_Pri(240)	**328820.8**	**330208.5**
GDP_in_Pri(241)	**305744.5**	**302228.9**
GDP_in_Pri(242)	**332258.7**	**330812.8**
GDP_in_Pri(243)	**341648.7**	**335874**
GDP_in_Pri(244)	**347837.5**	**348366.6**

Figure 4: Placebo Test, GDP_in_Pri, Arizona vs the Synthetic Arizona



5. Discussion

Despite the analysis and results above being fairly clear and significant, still, some parts would be improved and might lead to different outcomes.

First of all, the data used can be more specific. In this paper, due to the availability of data, GDP numbers and all other variables collected are quarterly. For the post-treatment period, because the Covid passport policy emerged and came effective only from 2021Q2 (mandatory from 2021Q4), there are only a maximum of four quarters of GDP data available.

Furthermore, sector-specific GDP data could be used to further explore the effect of the policy more in detail. Just as mentioned earlier, GDP in private industries includes many sectors: retail trade, leisure & hospitality, art, entertainment & recreation, health & social services, etc. The implementation of vaccine passports should influence diverse sectors on different levels. One possible scenario can be the leisure and hospitality sector. Activities in this industry usually involve a large gathering of people, and, as a result, the number of businesses in this sector that adopt the Covid certificate policy would be more than that of the fishing and agriculture industry. Thus, the policy might have a stronger negative economic impact on the leisure & hospitality industry than on the fishing and agriculture industry. A more concrete comprehension of which industries are impacted severely will help the government design more flexible Covid certificate policies to mitigate the subsequent negative economic shock.

Several possible channels might explain this negative impact on GDP resulting from the Covid certification policy.

In the first place, the Covid passport policy may deter people from spending more money in the economy, at least in the short term. Concerns over the application of Covid certificates are prevalent. An article published by the health analysis journal KFF (2021) suggests that one of the major issues that need consideration is privacy and security. Storing individuals' vaccination data in a centralized database could expose the information to breaches, which raises questions about the oversight and control of these data. Individuals and organizations are less likely to participate if these concerns are not properly addressed. Hence, standing from a behavioral point of view, since not all the citizens own & advocate the certificates and, therefore, the adoption rate is unclear, this vaccine passport policy made it impossible for those who

disagree with the policy to consume or spend in their daily activities. Thus, the demand for daily social activities decreases, such as dining outside, watching movies, and company events. This could cause a reduction in GDP in the private sector.

Another potential loss of GDP in private industries could be attributed to the incoming tourism. In detail, the Covid certificate systems and their verification are not very integrated between different continents and countries, and the list of vaccines approved is not the same either. These factors would become an obstacle for people's trips. Forbes (2021) summarized the different methods of verification in the world: Europe uses EU digital Covid Certificate, Canada uses ArriveCAN App, and the United States of America relies on paper records and many various platforms. In terms of the vaccines approved in the US, the website of the US vaccine tracker (2022) shows some vaccines are not on the list, namely Sputnik V and Sinovac. Although it is hard to distinguish the effect of this divergence in Covid passport systems and vaccines from the Covid situation itself, the extent of friction in Covid certification during travel, particularly during border entry and access to tourism & hospitality venues, is assumed to play a role when individuals decide to travel or not and their intended destinations.

6. Policy Recommendations

The total number of Covid-19 cases has been decreasing globally, and the syndromes of the pandemic have evolved much less severely than before. Subsequently, many Covid control policies are lifted. Based on the updated information on Consolato Generale d'Italia in New York (2022), travelers leaving for the United States will no longer be required to show a negative Covid test or documentation of recovery from Covid before they board their flight. Although the relevant Covid certification policy is gradually disappearing, the world has learned that the situation of Covid-19 is dynamic, and similar vaccine passport policies may come back one day. For this reason, governments need to make productive amendments to the previous policy to control the spread of Covid-19 and alleviate the negative impact on GDP at the same time. According to the estimated results above and the analysis of the results, governments can balance the vaccine passport policy and GDP in two fields.

Firstly, overall, this policy brought an approximately 5 percent drop in GDP_in_Pri on average, in comparison with the case in which Covid certification is absent in New York. Considering the negative shock, Covid certificates should not be commonly applied in all industries without any selection. However, more epidemiological research ought to be conducted, targeting certain industries or venues that might promote the explosion of Covid-19, and only the chosen places will require a mandatory careful check on individuals' vaccine passports. The methodology of identifying which industries' GDP would be the most and the least impacted could be a new direction for future research. Moreover, for small businesses (family restaurants, home-own shops, etc.) that do not have the large human capital to verify the certificates and are extremely vulnerable to the shocks of the economy, the verification of Covid passports would be made optional for them after case-by-case scrutiny.

The second field is to increase the governments' capacity of protecting the public's information, integrating such certificates, and international coordination. Many possible changes and actions could be done. In the US, the administration should facilitate more standardized rules & regulations regarding vaccine passports to enhance public trust. Another focus could be to narrow the number of verification Apps/platforms among countries and states. A business travel platform TravelPerk (2022) published a summary of the Top 7 vaccine passport apps for travel. Apart from the traditional ways of showing paper vaccination proof, states and airlines have different preferences over the choice APP. For example, even though both in the US, Hawaii

uses Clear Health Pass while New York uses Excelsior Pass. British Airways, Iberia, and American airlines implement VeriFly, but JetBlue and Swiss International airlines prefer CommonPass. This separation between the verification might produce friction for people's travel and hence prevent them from going on a journey. International dialogues should be held, aiming at creating a more unified regulation system and verification system for convenience. As a consequence of these improvements, the adoption rate of the certificates may increase, which encourages more citizens to go back to the pre-Covid level of consumption in society. What's more, Covid passports from different countries will be more integrated, and it is more convenient for people to move and generate more consumption both domestically and internationally.

7. Conclusion

Does Covid certification policy bring a positive or negative effect on GDP in private industries?

Focused on the United States, by exploiting each state's autonomy in approving this policy and their divergent decisions, this paper chooses New York state as the treated state where the Covid passport policy was implemented and became mandatory later. Using the synthetic control method, the paper selected control states where this policy was entirely prohibited and then used them to establish a synthetic New York as a counterfactual case to New York to capture the GDP outcomes if no such policy exists. By comparing the differences in GDP in the private sector of the two New York states, this paper found that the vaccine passport policy decreased GDP in private industries by 81.4 billion dollars, an approximately 4.8 percent decline of New York's GDP. And the negative impact was enlarged as the policy became compulsory for certain businesses in the private industry in New York City. Afterward, a placebo test is conducted by applying the same method to Florida and Arizona. This test provides the estimated results with significance.

Covid certification is a rather new conception that appears in the era of the Covid-19 epidemic. It is evident that this is an effective way to limit the spread of Covid-19. But based on the results of this paper, it comes with a cost – a reduction in GDP in the private sector. For central governments that make essential decisions, they should be well informed about this trade-off. In developed countries, this temporary reduction in GDP may not be a primary concern. But most developing countries need to be more discreet about this trade-off and design more flexible and practical policies that develop from the fundamental Covid certificate policy, without harming the consumption levels in their economies. Exploring more about the detailed effect in various sectors of GDP can be seen as a future research direction. With more studies and empirical evidence in this field, it is highly possible to contain Covid-19 infection and maintain the GDP levels altogether.

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