How Has the COVID-19 Pandemic Impacted the Consumer Price Index? Evidence from China

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Abstract

This paper provides empirical insight into the impact of the COVID-19 pandemic on the consumer price index (CPI) using a difference-in-difference approach. Using monthly panel data for eight CPI categories for China and considering two specifications (i.e., the average effect and month-by-month effect), we reveal that the pandemic had a persistent negative impact on housing and daily consumables, whereas no evidence was found for a strong effect on health care. Regarding education, culture, and recreation, the pandemic mainly had a persistent positive effect over the initial months of the pandemic and then a negative effect for several months. In addition, the pandemic could have a positive effect on food, tobacco, and liquor, while it may have a persistent negative impact on clothing, transport, and communications. Furthermore, there could be a positive effect, which has increased slightly since the pandemic outbreak, on other articles and services.

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1 Introduction

The consumer price index (CPI) recently became one of the most important macroeconomic indicators to measure changes over time in the price level of consumer goods and services purchased by a country's residents. As we know, the unexpected disaster of the COVID-19 pandemic fundamentally impacts every facet of our existence by wreaking havoc in health-care systems, leading to a massive death toll and causing profound socioeconomic disruption. Unsurprisingly, the prices of a broad range of commodities are also affected.

There is no doubt that consumer prices affect people's livelihoods and that fluctuations in prices directly affect residential consumption and manufacturers' production. Hence, it is imperative to explore the impact of the pandemic on the prices of goods and services systematically, which will offer policymakers new insights into how to best combat the deleterious effects of the pandemic.

A large number of studies explore this topic. Specifically, quite a few studies focus on how COVID-19 affected the general price level of goods and services in different countries (e.g., Reinsdorf, 2020; Kouvavas et al., 2020; Cavallo, 2020; Yan and Qian, 2020; Mohsin et al., 2021; Mendez-Carbajo, 2021; CEPAL, 2021; Laskowski et al., 2022). Furthermore, some studies only focus on the impact of the pandemic on the prices of food (e.g., Mead et al., 2020; Leone et al., 2020; Coluccia et al., 2021), alcohol (e.g., Castaldelli-Maia et al., 2021), and agriculture (e.g., Ramakumar, 2020; Pu and Zhong, 2020; Siche, 2020). However, these studies are primarily descriptive in nature. In addition, there are some studies that analyze the impact of the pandemic on prices by statistical modeling. For example, Ho et al. (2021) and Aliefendioğlu et al. (2021) analyze the impact of the pandemic on housing and transport prices using a multivariate linear regression model and nonlinear autoregressive distributed lag model, respectively. Liu and Rabinowitz (2021) applies a regression discontinuity design to characterize the immediate impacts of the pandemic on retail prices of dairy products in the United States. Lusk et al. (2021) uses a multivariate linear regression model to analyze beef and pork marketing margins and price spreads during the pandemic. Hillen (2021) and Bairagi et al. (2022) analyze the impact of the COVID-19 on food prices using a logit model and a reduced-form of inverse demand function, respectively. However, these studies do not separate out other factors that also affect the CPI, such as holidays or festivals. Although Amare et al. (2020), Akter (2020), Çakır et al. (2021), Clair (2021), among others, separate other factors that also affect the CPI of food, health-care, and housing prices, but they do not consider the dynamic features of the impact of the pandemic on prices.

Hence, we empirically analyze the impact of the COVID-19 pandemic on the different subindices of the CPI to address the limitations mentioned above. Note that three studies are similar to ours (i.e., Zhang et al., 2020, Chen et al., 2021 and Uche et al., 2021), but they only focus on health-care services and food supplies, whereas we also consider other commodities and services.

Specifically, the innovations of our paper are threefold. First, our data are comprehensive. We collected a monthly CPI dataset of 31 provinces in China over a 24-month span between September 2018 and August 2020. This dataset comprises eight CPI categories: food, tobacco, and liquor; clothing; housing; daily consumables; transport and communications; education, culture, and recreation; health care; and other articles and services.

Second, the assessment of the consequences of the COVID-19 pandemic presents an empirical challenge because a simple pre- versus postpandemic comparison of CPI values, for example, will not adequately capture the effect of the pandemic when CPI changes are subject to inherent temporal trends. Therefore, we adopt the difference-in-difference (DID) method to capture the impact of the pandemic on the CPI. We regard the dataset from September 2019 to August 2020, which is a 12-month span and includes the onset of the COVID-19 pandemic, as the experiment group. To construct the missing counterfactuals depicting the CPI changes in the absence of the pandemic, we rely on the changes in the outcomes of the same set of the CPI categories observed during a 12-month span that closely resembles the experiment group from one year earlier. This feature renders the same set of the CPI that is observed from September 2018 to August 2019 as a suitable control group for the purposes of our analysis. For more details, see Section 2.

Third, to measure the impact of the pandemic on the eight CPI categories, we consider two specifications. We first consider the average effect of the pandemic on the CPI, that is, the impact on the CPI because of the outbreak of COVID-19. We then measure the dynamics of the effect on the CPI over a period of time. The pace of the spread of the virus has varied over time and, moreover, after the onset of the pandemic, some shops and restaurants introduced certain measures, such as socially distanced dining and measuring temperatures, to cope with the pandemic. Hence, the effect of the pandemic may vary from month to month.

The contribution of our paper is that we provide a more in-depth analysis of the impact of the COVID-19 pandemic on the CPI, obtain more definitive conclusions, and offer a deeper insight into policymaking using the monthly panel data of the eight CPI categories in China. In addition, our empirical framework provides a valuable reference for other similar studies. The empirical results indicate that from January to August 2020, the pandemic had a persistent negative impact on housing and daily consumables, whereas no evidence was found for a strong effect on health care prices. Regarding education, culture, and recreation, the pandemic mainly had a persistent positive effect on the price from January to June and then a negative effect for the next two months. In addition, the pandemic could have a persistent positive effect on the price of food, tobacco, and liquor from January to March and then a negative effect over the following several months, while it may have a persistent negative impact on clothing and transport and communications prices after January. Moreover, there could be a mild strengthening of the positive effect on the price of other articles and services following the outbreak of the pandemic.

The rest of the paper is organized as follows. Section 2 provides a detailed description of our data. Section 3 develops our empirical approach. Section 4 presents and discusses the results. The final section concludes.

2 Data

The source of our data is the China Economic Information Network Statistics Database[1)]. We select the monthly CPI dataset for 31 provinces in China over a 24-month span between September 2018 and August 2020. This dataset comprises eight CPI categories: food, tobacco, and liquor; clothing; housing; daily consumables; transport and communications; education, culture, and recreation; health care; and other articles and services.

The first instance of pneumonia of unknown cause in China was officially

1) See https://db.cei.cn/

registered on December 8, 2019. The first virus strain was successfully isolated on January 7, 2020 and medical professionals confirmed that the pathogen was a new type of coronavirus. On January 23, 2020, China's central government imposed a lockdown in Wuhan and other cities in Hubei Province in an effort to put the center of the COVID-19 outbreak into quarantine. This was an extremely critical point in time. In addition, although the first case was reported on December 8, 2019, most people did not realize the seriousness of this unknown virus during this month. Considering these points, we regard January 2020 as when the COVID-19 pandemic began in China.

We split this dataset into two contiguous, nonoverlapping 12-month subperiods. The first subperiod from September 2019 to August 2020 includes the onset of the COVID-19 pandemic in January 2020. We refer to this subperiod as the experiment group. The second subperiod from September 2018 and August 2019 covers the exact same number of months as the experiment group but begins one year earlier when the CPI of each province was not subject to any noteworthy shocks or legislative changes. We refer to this second subperiod as the control group. As we clarify in the next section, the two-group structure of our data allows the estimation of the effect of the COVID-19 pandemic on CPI.

Table 1 presents the basic descriptive statistics for the CPI data that we use in the analysis for both the experiment group (part A) and control group (part B). In the experiment group, from September 2019 to December 2019 (part A 1), the mean price and standard deviation of food, tobacco, and liquor are clearly much higher than those for the other CPI categories; therefore, food, tobacco, and liquor prices experienced large fluctuations over this time, which continued from January 2020 to August 2020 (part A 2). Moreover, the standard deviations of some CPI categories, such as transport

Table 1: Descriptive statistics

	Part A: Experiment Group (Sep. 2019 – Aug. 2020)					
	Part A1: Sep. 2019 – Dec. 2019			Part A2: Jan. 2020 – Aug. 2020		
CPI	Obs.	Mean	SD	Obs.	Mean	SD
Food, tobacco, and liquor	124	112.84	3.83	248	116.35	4.24
Clothing	124	102.04	1.67	248	101.16	1.98
Housing	124	102.77	1.17	248	102.30	1.32
Daily consumables	124	101.82	1.32	248	101.78	1.46
Transport and communications	124	98.65	1.12	248	96.29	2.21
Education, culture, and recreation	124	104.22	1.79	248	105.11	1.91
Health care	124	104.36	2.57	248	105.58	2.86
Other articles and services	124	106.28	1.58	248	108.51	2.83
	Part B: Control Group (Sep. 2018 – Aug. 2019)					
	Part B1: Sep. 2018 – Dec. 2018			Part B2: Jan. 2019 – Aug. 2019		
	Obs.	Mean	SD	Obs.	Mean	SD
Food, tobacco, and liquor	124	101.97	1.25	248	105.26	1.78
Clothing	124	101.09	1.30	248	101.35	1.61
Housing	124	102.10	1.12	248	102.43	1.18
Daily consumables	124	101.24	0.72	248	101.65	1.03
Transport and communications	124	101.10	1.40	248	99.59	1.22
Education, culture, and recreation	124	102.60	1.46	248	103.51	1.61
Health care	124	102.20	0.93	248	103.36	1.78
Other articles and services	124	101.29	0.71	248	103.39	1.62

and communications, increased after the outbreak of the pandemic outbreak, which suggests that the pandemic could affect the prices of these items. Nevertheless, in the control group, the means and standard deviations of the eight CPI categories are all similar in the pre-January and post-January periods. In addition, the results for part B1 are similar to that of part B2.

3 Empirical approach

Two simple approaches can be used to examine the consequences of the pandemic on the different CPI categories. One approach is to compare the value of the CPI after January with the value prior to January in the experiment group, that is, by contrasting the means in part A2 with part A1 of Table 1. However, this approach does not separate out other factors that also affect the CPI. For instance, the post-January period subsumes the holiday season in January and February, when the CPI naturally rises every year. Therefore, a post-January versus pre-January comparison alone would unlikely yield a compelling estimate for the effect of the pandemic. Alternatively, one might contrast the post-January outcomes in the experiment group with the post-January outcomes in the control group, that is, by comparing the mean for the outcomes in part A2 and part B2 of Table 1. However, the comparison of the post-January outcomes in the experiment group with the post-January outcomes in the control group does not address the concern that the experiment and control groups differ in unobserved ways, which confounds the estimate of the effect of the pandemic (see Castelliano et al., 2021).

To address the deficiencies inherent in the two simple approaches described above, we use a DID approach and exploit the exogenous nature of the pandemic to analyze its impact on the CPI. First, we posit the following general model:

$$y_{group,it} = \beta_0 + \beta_1 post \times group + \beta_2 group + u_i + \lambda_t + \epsilon_{group,it}, \qquad (1)$$

where ***group*** is equal to 1 if the observation is from the experiment group and 0 if it is from the control group, i refers to the i-th province, t means the month (from September to August in the following year), $y_{group,it}$ represents the eight CPI categories, which are listed in the first column in Table 1, *post* is a dummy variable equal to 1 if the observation is from January or later, u_i is the individual fixed effect, which absorbs the time-invariant impact on explained variables, λ_t is the month fixed effect, which absorbs the time-varying common trend of all units over time, $\epsilon_{group,it}$ denotes the error term.

The coefficient of interest in the regression equation (1) is β_1 and it denotes a DID estimate of the impact of the COVID-19 pandemic on the CPI. Table 2 presents the rationale of the DID estimation by (1). Specifically, the expected value of the CPI before January in the experiment group is $\beta_0+\beta_2+u_i+\lambda_{pre}$ in accordance with (1), whereas after January it becomes $\beta_0+\beta_1+\beta_2+u_i+\lambda_{post}$. Hence, the difference, $\beta_1+(\lambda_{post}-\lambda_{pre})$, captures the difference between the post-January and pre-January changes in the CPI in the experiment group. However, we can not observe the post-January CPI for the case where no pandemic began in 2020. To construct a pertinent counterfactual, we use the changes, $\lambda_{post}-\lambda_{pre}$, between the post- and pre-January CPI in the control group. By subtracting $\lambda_{post}-\lambda_{pre}$ from $\beta_1+\lambda_{post}-\lambda_{pre}$, that is, β_1, provides a DID estimate of the effect of the pandemic on the CPI.

Table 2: DID estimate of the COVID-19 pandemic

	pre-Jan.	post-Jan.	difference
Experiment group (Sep.2019–Aug.2020)	$\beta_0+\beta_2+u_i+\lambda_{pre}$	$\beta_0+\beta_1+\beta_2+u_i+\lambda_{post}$	$\beta_1+\lambda_{post}-\lambda_{pre}$
Control group (Sep.2018–Aug.2019)	$\beta_0+u_i+\lambda_{pre}$	$\beta_0+u_i+\lambda_{post}$	$\lambda_{post}-\lambda_{pre}$
difference	β_2	$\beta_1+\beta_2$	β_1

The estimate of β_1 based on (1) is informative of the average effect of the pandemic on the eight CPI categories. To gain further insight into whether, and if so how, the effect of the pandemic has varied over time, we estimate the following specification:

$$y_{group,it}=\theta_0+\sum_t \theta_t month_t \times group+\theta_2 group+u_i+\lambda_t+e_{group,it}, \quad (2)$$

where $month_t$ is a dummy equal to 1 if the observation is from a specific month t from the 9 months from December to August in the following year. We omit December and use this month to compare all the month-by-month effects. $e_{group,it}$ is the error term. The remaining elements of the equation (2) are as defined in (1).

Note that in this study we estimate all models using OLS. Considering there could be a serial correlation in the error terms, then the cluster-robust standard errors (i.e., the robust standard errors clustered at the level of provinces, see Cameron and Miller, 2015) could be an alternative. But this standard errors, as Cameron and Miller (2015) and Greene (2018) mentioned, have a downward bias when the number of clusters (i.e., the number of provinces) is small. Since there are only 31 provinces in this study, which means that the number of clusters is small, it is hard to say that the cluster-robust standard errors are better than usual standrad errors. In this study we base inference on a larger one of two standard errors for a conservative inference and these two standard errors are presented in all tables.

If the CPI in the control group we chose can serve as a good control group for the CPI in the experiment group, then the change in CPI should be the same for both groups in the absence of the pandemic (i.e., two groups have parallel trends). We present the temporal evolution of the cross-sectional mean of the monthly CPI of 31 provinces from September 2019 to August 2020 (experiment group) and from September 2018 to August 2019 (control group) in Figure 1. In the figure, some CPI categories prior to January in the experiment and control groups exhibit comovement, which seems to indicate that the parallel trends assumption could be apt. To judge this better, we carry out two simple DID regressions as placebo tests. Specifically, for the first regression, we divide the dataset from September to December in the experiment and control groups into two subperiods. The first subperiod is from September to October and the second is from November to December. Then for these two subperiods, we use the equation (3) to estimate b_1.

$$y_{group,it} = b_0 + b_1 post^* \times group + b_2 group + u_i + \lambda_t + \xi_{group,it}, \tag{3}$$

where $post^*$ is equal to 1 if the observation is from the second subperiod (i.e., November and December) and 0 if it is from the first subperiod (i.e., September and October), $\xi_{group,it}$ is the error term, and the remaining elements are as defined in (1). The estimate of b_1 for each CPI is listed in Table 3. As for housing, daily consumables, education, culture, and recreation, and health care, the point estimates of b_1 are statistically non-significant, which means that the parallel trends assumption probably hold in our context for these four CPI categories. However, the results of the other CPI are statistically significant, which indicates that the control group we selected for these CPI categories could not serve as a good control group (i.e., the parallel trends assumption could not be apposite).

Now we consider the second DID regression as follows:

$$y_{group,it} = \phi_0 + \sum_t \phi_t month_t^* \times group + \phi_2 group + u_i + \lambda_t + \eta_{group,it}, \quad (4)$$

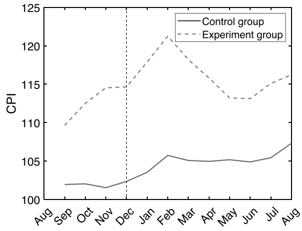
where $month_t^*$ is a dummy equal to 1 if the observation is from a specific month t from the 12 months from September to August in the following year. We omit December and use this month to compare the results of the other months. $\eta_{group,it}$ is the error term. The remaining explanatory variables of expression (4) are as defined in (1). Figure 2 shows the point estimates of ϕ_t and corresponding 95% confidence intervals based on a larger one of two standard errors for the eight CPI categories. For housing, daily consumables, education, culture, and recreation, and health care, all piont estimates prior to December are statistically non-significant, which means that the parallel trends assumption probably hold for these four CPI; in addition, there are some statistically significant results after December for housing, daily consumables, education, culture, and recreation, which indicates that the pandemic is likely to have an evident impact on these CPI. As for the remaining CPI, some estimation results prior to December are statistically significant, which means that the parallel trends assumption could not hold for these CPI.

Combining the results of two placebo tests, we believe that the parallel trends assumption seems an apposite one to make for housing, daily consumables, education, culture, and recreation, and health care. Hence, the results of the subsequent analysis for these four CPI categories are likely to be more convincing than for the remaining CPI. However, the reader should keep in mind that the parallel trends assumption is inherently untestable.

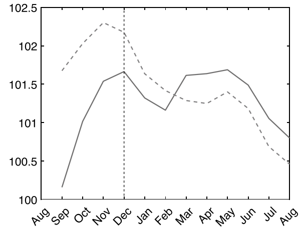
Table 3: The point estimates of b_1 for the eight CPI categories

CPI	Food, tobacco, and liquor	Clothing	Housing	Daily consumables
b_1	3.5623***	−0.6274***	−0.1226	−0.1733
	(0.4473)	(0.1991)	(0.1244)	(0.1242)
	(0.2192)	(0.1556)	(0.0839)	(0.0488)
CPI	Transport and communications	Education, culture, and recreation	Health care	Other articles and services
b_1	1.4585***	0.0697	−0.0972	−1.1540***
	(0.1484)	(0.1858)	(0.3187)	(0.1816)
	(0.1053)	(0.1389)	(0.0746)	(0.1203)

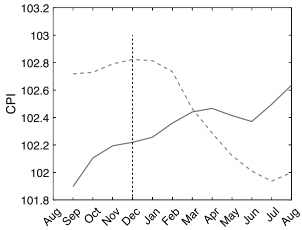
Notes: (a) we estimate b_1 in the regression equation, $y_{group,it} = b_0 + b_1 post^* \times group + b_2 group + u_i + \lambda_t + \xi_{group,it}$, using 248 observations for each CPI. (b) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The usual standard errors and the cluster-robust standard errors of b_1 are in the first and second parenthesis, respectively. We base inference on a larger one of two standard errors for a conservative inference.



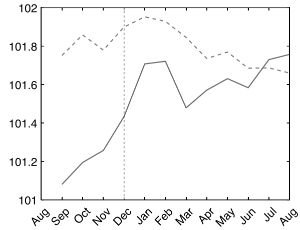
(a) Food, tobacco, and liquor



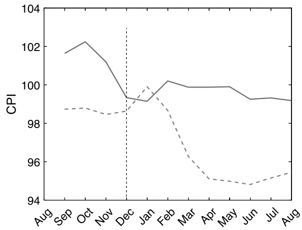
(b) Clothing



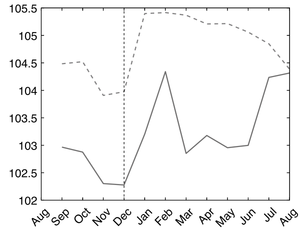
(c) Housing



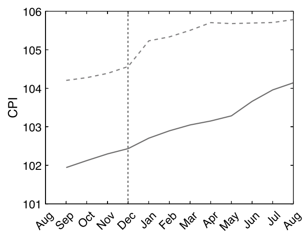
(d) Daily consumables



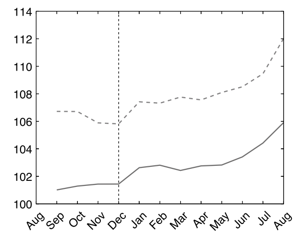
(e) Transport and communications



(f) Education, culture, and recreation

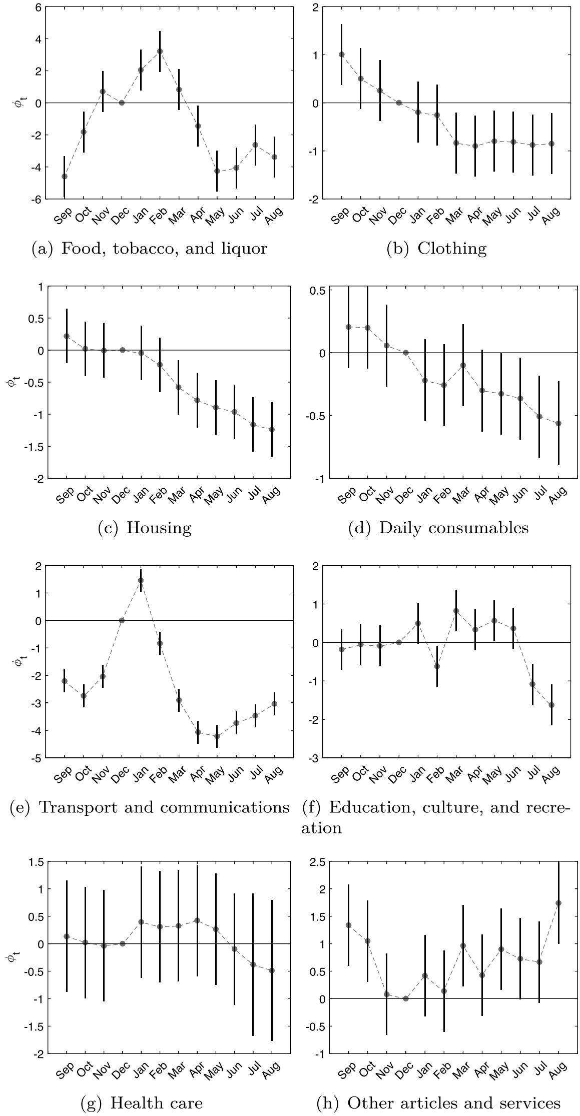


(g) Health care



(h) Other articles and services

Figure 1: Temporal evolution of the cross-sectional mean of the monthly CPI of 31 provinces in the experiment group (Sep.2019-Aug.2020) and control group (Sep.2018-Aug.2019).



(a) Food, tobacco, and liquor

(b) Clothing

(c) Housing

(d) Daily consumables

(e) Transport and communications

(f) Education, culture, and recreation

(g) Health care

(h) Other articles and services

Figure 2: (1) The point estimates and corresponding 95% confidence intervals (based on a larger one of two standard errors) of ϕ_t for the eight CPI categories. (2) We estimate ϕ_t in the regression, $y_{group,it} = \phi_0 + \sum_t \phi_t month_t^* \times group + \phi_2 group + u_i + \lambda_t + \eta_{group,it}$, using 744 observations for each CPI.

4 Results

In this section, we present the average and month-by-month effects of the COVID-19 pandemic on the eight CPI categories and provide some possible explanations for this.

The second column in Table 4 presents the estimation results of the average effect (β_1) of the pandemic on different CPI categories. The pandemic has a negative impact that is statistically significant on clothing, housing, daily consumables, transport and communications prices, while it does not have a significant effect on the remaining CPI categories.

The results from the third column to the last column in Table 4 show the estimates of the month-by-month effect (θ_t) from January 2020 to August 2020. For each CPI, apart from health care, most of the estimation results of β_t are statistically significant, which indicates that the pandemic has a significant effect on these CPI. To better show the dynamic trend of the month-by-month effect, each part of Figure 3 summarizes the results for a specific CPI category. Note that the omitted (comparison) month is December, which is the month immediately preceding the onset of the pandemic.

For food, tobacco, and liquor, part (a) shows that the pandemic has a persistent positive effect on the price in January, February, and March and then has a negative effect over the following several months. The offset positive and negative effects of the pandemic during different periods could explain the statistical non-significance of the estimation result of the average effect. These commodities, generally speaking, are necessities, hence the pandemic can not significantly affect people's demands. However, the supply of these goods can be affected by the pandemic because many stores and manufacturers are asked to be closed during the initial months of the pandemic. Hence, the demand can exceed the supply, which means that the price probably increases. But the supply recovers gradually as the pandemic eases, which means that the price could decrease. This provides a possible explanation for the dynamic effect of the pandemic.

Parts (b), (c), and (d) present that the pandemic has had a persistent negative effect on clothing, housing, and daily consumables prices since January and this negative effect is also reflected by the negative estimation results of the average effect. We believe that these commodities can not be purchased frequently for a short period of time except for some necessary expenses (e.g., water or electricity bills). In addition, people are likely to reduce the consumption of these goods because of falling incomes and rising unemployment risks. Hence, declining demand for these goods during the pandemic is a possible reason for falling prices.

Part (e) traces out the month-by-month effect of the pandemic on transport and communications prices. There is a positive effect in January and then a persistent negative effect over the following several months. The persistent negative effect from February to August exceeds the positive effect in January such that on the whole the pandemic has a negative effect on the prices, which is the same as the negative estimation result of the average effect. Many people are eager to return home because of the panic caused by the pandemic outbreak, which is likely to be responsible for a temporary rise in the price in January. Then the government asked people not to go out or travel unless necessary in order to prevent the spread of the pandemic, which could be a factor for a persistent drop in the price after February. As the pandemic eases gradually, people can go outside or travel freely, which provides a possible explanation for a persistent drop in the negative effect after May.

For education, culture, and recreation, part (f) presents that the pandemic mainly has a positive effect on the price of these commodities from January to June and then has a persistent negative effect over the following two months. The offset positive and negative effects of the pandemic during different periods could explain the statistical non-significance of the estimation result of the average effect. The decreased supply of these goods because many stores are asked to stop operations or shorten business hours could be responsible for the price increase during the initial months of the pandemic. The supply recovers gradually as the pandemic eases, which could lead to a drop in the price.

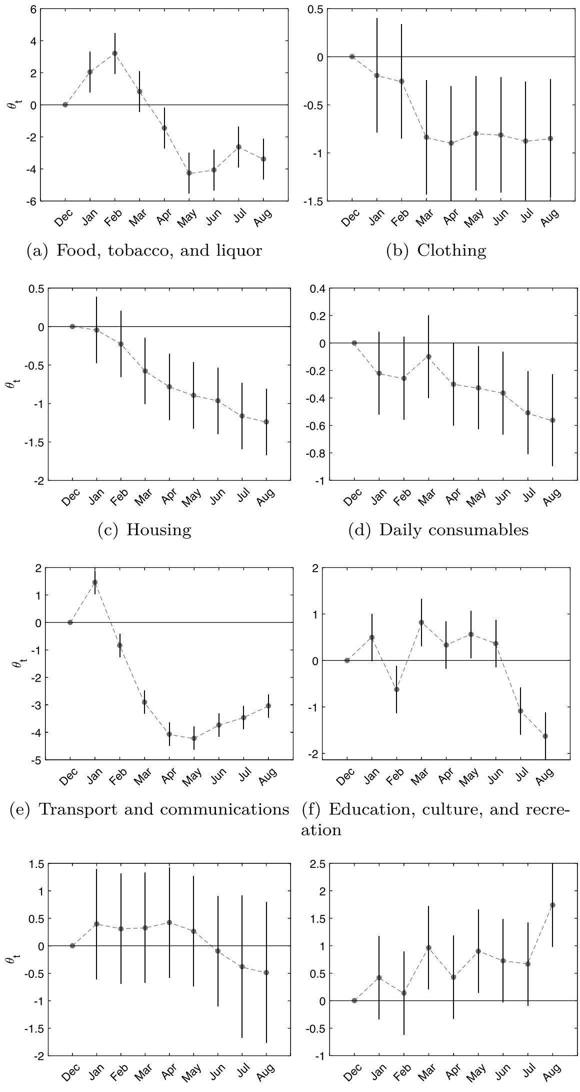
Part (g) shows that the month-by-month effect of the pandemic on health care is statistically non-significant, which is the same as that of the average effect. A possible reason is that, in China, the government controls the prices of most drugs and medical facilities, which means that the pandemic could not have a significant impact on their prices.

Part (h) reveals that the pandemic has had a persistent positive effect on other articles and services since January and this positive effect is also reflected by the positive estimation result of the average effect. Considering other articles and services mainly include insurance, beauty salons, jewelry, watches, and bags, we believe that people are likely to increase the demand for insurance out of concern for the uncertainty in the future caused by the pandemic, which is a possible factor for the price rise.

Table 4: Average effect (β_1) and month-by-month effect (θ_t) of the pandemic on the eight CPI categories

		θ_t							
CPI	β_1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Food, tobacco, and liquor	0.2180	2.0505***	3.2114***	0.8199	−1.4525**	−4.2624***	−4.0685***	−2.6332***	−3.3895***
	(0.3404)	(0.6508)	(0.6508)	(0.6508)	(0.6508)	(0.6508)	(0.6508)	(0.6508)	(0.6508)
	(0.2259)	(0.2038)	(0.3462)	(0.2829)	(0.2200)	(0.2847)	(0.3391)	(0.4251)	(0.5505)
Clothing	−1.1318***	−0.1965	−0.2563	−0.8384***	−0.8998***	−0.7996***	−0.8154***	−0.8780***	−0.8520***
	(0.1405)	(0.3039)	(0.3039)	(0.3039)	(0.3039)	(0.3039)	(0.3039)	(0.3039)	(0.3039)
	(0.1992)	(0.0870)	(0.1437)	(0.2385)	(0.2764)	(0.2958)	(0.3056)	(0.3142)	(0.3144)
Housing	−0.7953***	−0.0465	−0.2282	−0.5789***	−0.7836***	−0.8954***	−0.9648***	−1.1638***	−1.2399***
	(0.0967)	(0.2195)	(0.2195)	(0.2195)	(0.2195)	(0.2195)	(0.2195)	(0.2195)	(0.2195)
	(0.1088)	(0.0463)	(0.0678)	(0.1044)	(0.1256)	(0.1448)	(0.1594)	(0.1470)	(0.1496)
Daily consumables	−0.4452***	−0.2206	−0.2580*	−0.0997	−0.3013*	−0.3273**	−0.3644**	−0.5087***	−0.5629***
	(0.0723)	(0.1537)	(0.1537)	(0.1537)	(0.1537)	(0.1537)	(0.1537)	(0.1537)	(0.1537)
	(0.0937)	(0.0622)	(0.1023)	(0.1208)	(0.1154)	(0.1256)	(0.1301)	(0.1449)	(0.1704)
Transport and communications	−0.8533***	1.4609***	−0.8354***	−2.9054***	−4.0716***	−4.2210***	−3.7379***	−3.4682***	−3.0381***
	(0.1552)	(0.2171)	(0.2171)	(0.2171)	(0.2171)	(0.2171)	(0.2171)	(0.2171)	(0.2171)
	(0.1076)	(0.1099)	(0.1080)	(0.1911)	(0.1882)	(0.1580)	(0.1593)	(0.1879)	(0.1845)
Education, culture, and recreation	−0.0141	0.4972*	−0.6229**	0.8189***	0.3329	0.5621**	0.3642	−1.0869***	−1.6288***
	(0.1280)	(0.2582)	(0.2582)	(0.2582)	(0.2582)	(0.2582)	(0.2582)	(0.2582)	(0.2582)
	(0.1955)	(0.1618)	(0.1628)	(0.2233)	(0.2139)	(0.2389)	(0.2270)	(0.2225)	(0.2352)
Health care	0.0647	0.3960	0.3076	0.3253	0.4230	0.2638	−0.0969	−0.3816	−0.4900
	(0.2238)	(0.5118)	(0.5118)	(0.5118)	(0.5118)	(0.5118)	(0.5118)	(0.5118)	(0.5118)
	(0.4308)	(0.3274)	(0.3503)	(0.3557)	(0.3812)	(0.4124)	(0.5031)	(0.6612)	(0.6534)
Other articles and services	0.1312	0.4169	0.1368	0.9634**	0.4257	0.8996**	0.7252*	0.6665*	1.7398***
	(0.1667)	(0.3874)	(0.3874)	(0.3874)	(0.3874)	(0.3874)	(0.3874)	(0.3874)	(0.3874)
	(0.1828)	(0.1338)	(0.2217)	(0.2081)	(0.2028)	(0.2548)	(0.2154)	(0.1968)	(0.2757)

Notes: (a) β_1 in the regression equation, $y_{group,it} = \beta_0 + \beta_1 post \times group + \beta_2 group + u_i + \lambda_t + \epsilon_{group,it}$, means the average effect of the pandemic and the sample size is 744. (b) θ_t in the regression equation, $y_{group,it} = \theta_0 + \sum_t \theta_t month_t \times group + \theta_2 group + u_i + \lambda_t + e_{group,it}$, means the month-by-month effect of the pandemic and the sample size is 558. (c) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The usual standard errors and the cluster-robust standard errors of β_1 and θ_t are in the first and second parenthesis, respectively. We base inference on a larger one of two standard errors for a conservative inference.



(a) Food, tobacco, and liquor　(b) Clothing

(c) Housing　(d) Daily consumables

(e) Transport and communications　(f) Education, culture, and recreation

(g) Health care　(h) Other articles and services

Figure 3: (1) The point estimates and corresponding 95% confidence intervals (based on a larger one of two standard errors) of θ_t for the eight CPI categories. (2) We estimate θ_t in the regression, $y_{group,it} = \theta_0 + \sum_t \theta_t month_t \times group + \theta_2 group + u_i + \lambda_t + e_{group,it}$, using 558 observations for each CPI.

5 Conclusion

In this paper, we used a DID approach and a monthly panel for eight CPI categories in 31 provinces of China over a 24-month period between September 2018 and August 2020 to provide empirical insights into the consequences of the COVID-19 pandemic for the CPI.

The empirical results indicated that from January to August 2020, the pandemic had a persistent negative impact on housing and daily consumables, whereas no evidence was found for a strong effect on health care prices. Regarding education, culture, and recreation, the pandemic mainly had a persistent positive effect on the price from January to June and then a negative effect for the next two months. In addition, the pandemic could have a persistent positive effect on the price of food, tobacco, and liquor from January to March and then a negative effect over the following several months, while it may have a persistent negative impact on clothing and transport and communications prices after January. Moreover, there could be a mild strengthening of the positive effect on the price of other articles and services following the outbreak of the pandemic. Therefore, the government should implement certain measures, such as some type of fiscal stimulus, to increase the demand for housing and daily consumables so that their prices can recover to normal levels. Furthermore, it may be appropriate for the government to stimulate consumer demand for clothing and to allow more stores or manufacturers to open to increase the supply of other articles and services.

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