

Rural Research Report



Jan, 2021
Volume 31, Issue 1

By
Adee Athiyaman, Professor,
Illinois Institute for Rural Affairs

David Boulay, President,
Illinois Manufacturing
Excellence Center

Co-Editors
Adee Athiyaman, PhD
Chris Merrett, PhD

Editorial Review Board

Christopher Connor PhD
Tim Collins PhD
Kim Pierce
Andrea Runge

Published by Illinois Institute
for Rural Affairs

Stipes Hall 518
Western Illinois University
Macomb, IL 61455-1390
309.298.2237

www.IIRA.org

Some Empirical Aspects of Manufacturing Sector During the Covid-19 Pandemic

1.0 Introduction

The Covid-19 pandemic has resulted in 315,000 deaths nationally, as at December 18, 2020; Illinois has reported 16,326 fatalities. The economic cost of the virus has been steep; the US economy shrank by more than 9% in the June quarter, the worst in record since 1947¹. Economic impact on Illinois is no less, the state is classified as “worst affected” by Moody’s analytics².

Academic and business interests on the economic impacts of the pandemic have been plenty. For example, a title search on ProQuest’s ABI/Inform database on “covid-19 impacts” resulted in 271 publications, equally distributed between scholarly journals and trade journals³. The trade publications focused mostly on services such as banking and finance; manufacturing, which accounts for 12% of the nation’s GDP⁴ was seldom discussed⁵. This paper fills this gap in knowledge. Using a combination of primary and secondary data on firms, the paper addresses questions such as:

¹ Simon, R. (2020). Covid-19 shuttered more than 1 million small businesses. Wall Street Journal (online), August.

² Athiyaman, A. (2020). The economic impact of Covid-19 on Illinois Counties, Research Brief, 2(9), May 20, available online at: <http://www.iira.org/2020-2021-publications/>

³ The search was for scholarly journal / trade journal publications during the period January 2020-December 2020.

⁴ Ramaswamy, S. et al (2017). Making it in America: Revitalizing US Manufacturing. McKinsey Global Institute.

⁵ IBISWorld predicts a 17.3% decline in revenue for manufacturing during 2020 because of Covid-19; see Savaskan, D. (2020). Manufacturing in the US, available online at: <https://www.ibisworld.com/>

1. Did Covid-19 shutter proportionally more small businesses (including manufacturing businesses) in the metro or the nonmetro?
2. How do rural manufacturers in Illinois adapt to and cope with the threats of Covid-19?
3. Is variability in adapting to Covid-19 workplace health and safety measures correlated with the characteristics of the business and the sociodemographic of the business location?

The focus on small business stems from the fact that 99.9% of the nation's businesses are small, firms that employ fewer than 500 employees⁶. The results of this research should be of interest to decision makers in both business and government.

2.0 Findings

Small Business Closure in the Metro and the Nonmetro

To address the question on small business closures, microdata from the Current Population Survey (CPS) were used. The CPS is fielded monthly by the US Census Bureau and the Bureau of Labor Statistics. It's primarily used to gain information about the nation's labor force. Sixty thousand households spread across the 50 states and the District of Columbia are polled using a 4-8-4 sampling

⁶ US Small Business Administration (2019). 2019 Small Business Profile; see <https://cdn.advocacy.sba.gov/wp-content/uploads/2019/04/23142719/2019-Small-Business-Profiles-US.pdf>.

scheme⁷; data are collected during the calendar week that includes the 19th of the month. Results are often released for public use within two weeks of data collection⁸.

In CPS, the variable "class of worker" contains information about self-employed in incorporated businesses and unincorporated businesses. These two categories were combined, statistically weighted to be representative of the civilian noninstitutional population 16 and over in the metro and the nonmetro⁹, and the results used to estimate the rate of small business addition / attrition, an estimate of Covid-19 impacts (Table 1).

As shown in Table 1, the number of small businesses during the peak of the pandemic, April 2020, reduced by 25% in the metro and 15% in the nonmetro, compared to March 2020. Overall, from January 2020 to October 2020, number of small businesses declined in the metro (ACGR = -0.34%), but increased in the nonmetro (ACGR = 1.36%). Appendix 1 provides estimates for the state of Illinois.

⁷ A household is in the survey for four consecutive months, left out for eight months, and then polled again for four consecutive months.

⁸ For more information about CPS methodology, see the publication Design and Methodology: *Current Population Survey – America's Source for Labor Force Data*; available online at <https://www.bls.gov/cps/>.

⁹ The numbers are conditional, the variable PEHRACT1, actual hours worked during the week, was set to 15 or more to estimate the number of small businesses; this is to ensure that only active businesses are considered in the data analysis

Table 1: Impacts of Covid-19 on Small Business

2020 Time Period	No. of Small Businesses, Metro	Monthly Rate of % Change, Metro	No. of Small Businesses, Nonmetro	Monthly Rate of % Change, Nonmetro
January	10,869,549		2,375,322	
February	11,194,761	2.99	2,354,851	-0.86
March	10,461,154	-6.55	2,289,719	-2.77
April	7,824,501	-25.2	1,943,714	-15.11
May	8,667,346	10.77	2,295,286	18.09
June	9,366,308	8.06	2,570,860	12.01
July	9,738,369	3.97	2,433,883	-5.33
August	10,087,903	3.59	2,756,097	13.24
September	10,251,840	1.63	2,645,754	-4
October	10,539,123	2.8	2,684,884	1.48

Table 2 shows Covid-19 impacts on small businesses in each of the 12 major industry sectors during March-April 2020. As shown in the table, more manufacturing businesses were lost in the nonmetro (see the April 2020 numbers)¹⁰. If we group or cluster the sectors into three categories:

production and manufacturing, distribution, and services, it is the service industries, from information to leisure & hospitality, that posted the most decline in business numbers¹¹.

¹⁰ Statistically, small business activities (entry and exit) do not differ by rural, urban categories; the presentation is for policy purposes only, for example, to ensure that local governments in metro and nonmetro learn about the actual number of entry / exits into an industry.

¹¹ Production and manufacturing sectors include: agriculture, mining, manufacturing, and construction. Distribution sectors include: wholesale, retail, and transportation; all other sectors are classified as services. The median rate of decline in business activities for services during April 2020 was 29%; for manufacturing, 11%, and for distribution, -8.5%.

Table 2: Covid-19 Impacts by Industry Sector: Changes in Number of Active Small Businesses during March 2020 and April 2020

	Industry Sector	Metro	Nonmetro	Metro Rate of Change (%)	Nonmetro Rate of Change (%)
Mar-20	1. Agriculture, forestry, fishing, and hunting	310981	425873	9	-1
	2. Mining	14337	2100	-48	-35
	3. Construction	1854191	368754	-1	-13
	4. Manufacturing	413607	102187	-6	5
	5. Wholesale & retail	979549	238965	-1	11
	6. Transportation & util.	548142	141211	-14	24
	7. Information	186763	18996	-6	-16
	8. Financial activities	907462	144648	-5	-21
	9. Prof.& bus. serv.	2480621	275783	-8	-6
	10. Educational & health serv.	1134555	214540	-2	11
	11. Leisure & hospitality	684979	134590	-19	-8
	12. Other services	945968	222071	-14	-4
Apr-20	1. Agriculture, forestry, fishing, and hunting	337891	473146	9	11
	2. Mining	17483	4272	22	103
	3. Construction	1307817	289970	-29	-21
	4. Manufacturing	381119	74543	-8	-27
	5. Wholesale & retail	766291	192724	-22	-19
	6. Transportation & util.	428313	144530	-22	2
	7. Information	162560	5825	-13	-69
	8. Financial activities	840712	96824	-7	-33
	9. Prof.& bus. serv.	1997845	239568	-19	-13
	10. Educational & health serv.	788221	161416	-31	-25
	11. Leisure & hospitality	475310	141735	-31	5
	12. Other services	320938	119162	-66	-46

Figure 1 expands manufacturing to 15 subsectors and explores changes to number of businesses in each of the subsectors¹². Other than chemical and computer and electronic product manufacturing, all sectors posted declines in business activities during April 2020; electrical equipment and appliance manufacturing posted the most decline (-65% from March to April).

Further analysis suggests that 50+ year old females with high school education and 50+ year old, college-educated males, contributed to the spike in business numbers in the chemical sector; pharmaceutical and medicine

¹² Rate of change is the variable shown in Figure 1.

manufacturing and soap and disinfectant manufacturing spiked during April 2020; college educated men, in the 30+ age group ventured into computer and electronic product manufacturing. The decline in number of businesses in electrical equipment and appliance

manufacturing was caused by male business owners; both high school and college educated business owners shuttered their electrical and appliance business (Table 3).

Figure 1: Rate of Change in Number of Businesses: Manufacturing Subsectors, Jan-Oct 2020

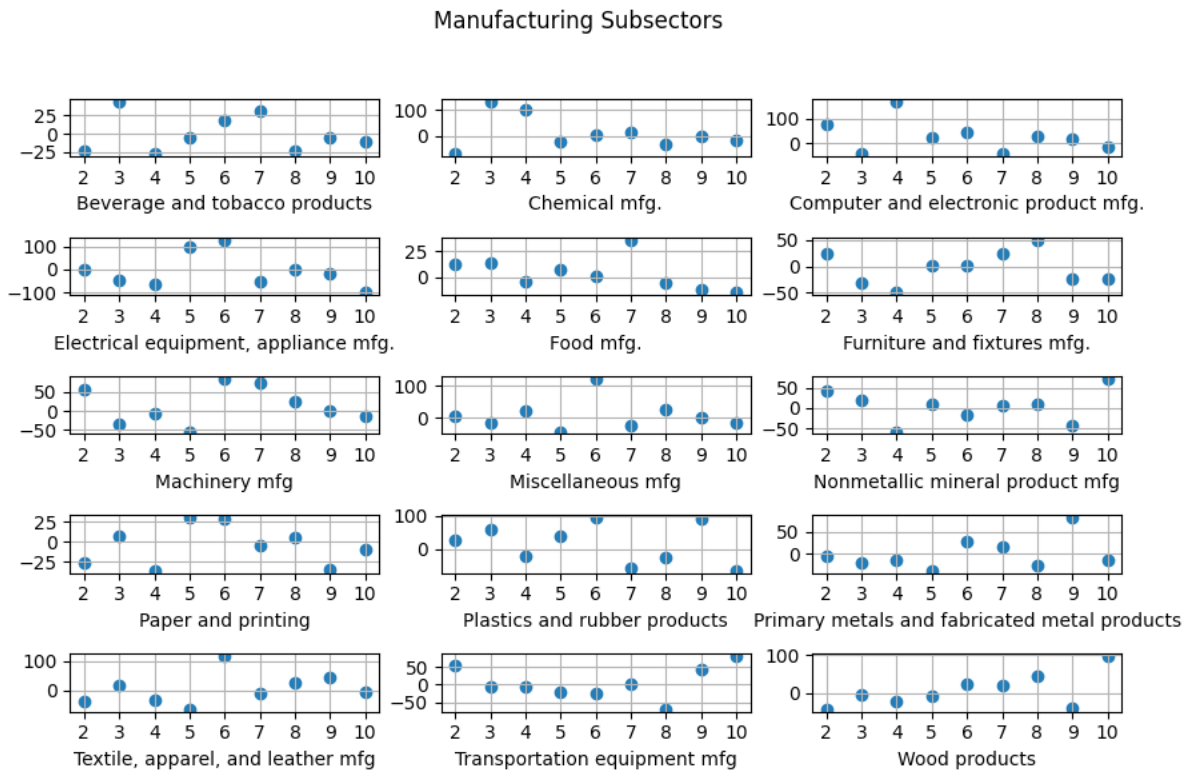


Table 3: Covid-19 Impacts on Manufacturing: Changes in Number of Active Businesses

Chemical Manufacturing

Gender	Age	Education	Jan 2020	Apr 2020	Change	% of Total Change
Male	<= 29	College	5539	5549	11	< 1%
Female	30 - 49	LT High School	3375		-3375	-19%
		College	3693	6522	2829	16%
Male		High school	4455		-4455	-25%
		College	4737	2680	-2057	-12%
Female	>= 50	High school	3843	14160 ¹³	10317	59%
		College		1605	1605	9%
Male		High school	3142	4019	877	5%
		College	5239	17100	11860	67%
All			34023	51635	17612	100%

Computer and Electronic Product Manufacturing

Gender	Age	Education	Jan 2020	Apr 2020	Change	% of Total Change
Male	30 - 49	College	3752	9437	5685	44%
Female	>= 50	High school	2598		-2598	-20%
		College		3463	3463	27%
Male		College	418	6773	6354	49%
All			6768	19673	12905	100%

Electrical Equipment and Appliance Manufacturing

Gender	Age	Education	Jan 2020	Apr 2020	Change	% of Total Change
Female	30 - 49	High school	906	871	-35	0%
Male		College	4728	811	-3917	50%
Male	>= 50	High school	3066		-3066	39%
		College	868		-868	11%
All			9568	1682	-7886	100%

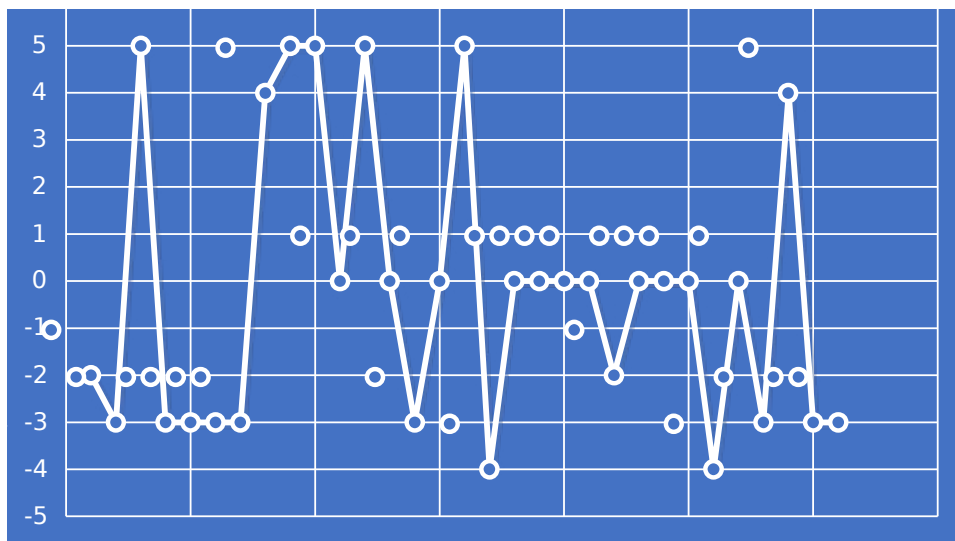
¹³ The industry-wise breakdowns are: Pharmaceutical and medicine manufacturing = 6450; Soap, cleaning compound, and cosmetics = 3761; and Industrial & miscellaneous chemicals = 3948.

Adaptation to and Coping with Covid-19, Illinois Manufacturers

Manufacturers were asked to rate on a 11-point, bipolar numerical scale the threat of Covid-19 for their businesses¹³. As shown in Figure 2, the modal and the median responses were zero; for 50% of the respondents, the threat from Covid-19 was

neither high nor low for their business. For more than 1 in 3 (35%), the threat from Covid-19 was “high”, they assigned a numerical score of -3 or higher; (The numerical scale had -5, +5 anchors.) these businesses deal with consumers directly and are predominantly furniture and printing businesses.

Figure 2: Threat Appraisal Responses



Note: A negative score imply high risk; the 11-point scale ranged from -5 to +5.

Coping Responses

The CDC recommends that manufacturing facilities adapt strategies such as screening employees for potential Covid-19 symptoms before they enter the workplace. As shown in Figure 3, half of the respondents

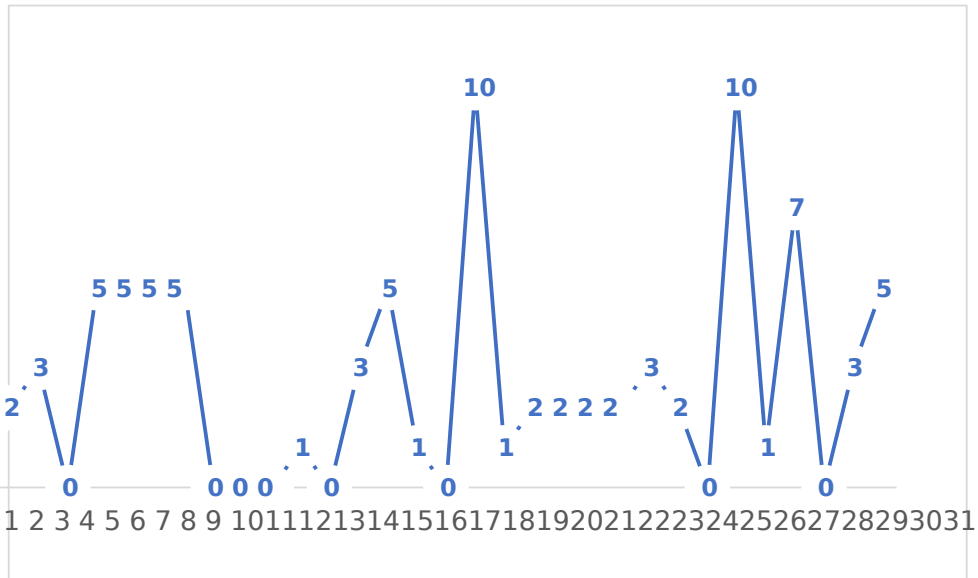
implement only two of the ten strategies prescribed by the CDC¹⁴ and there is no difference between the behavior of metro and nonmetro firms¹⁵.

¹³ During October-November, 2020, the IIRA conducted a telephone / email survey about Covid-19 practices among 31 Illinois manufacturing firms; more information about the survey can be obtained by writing to the first author.

¹⁴ It could be that the respondents are unaware of the firm's Covid-19 prevention / mitigation practices; another reason could be the voluntary nature of CDC's recommendations; Covid-19 prevention / mitigation strategies are not mandated by law.

¹⁵ *t*-test did not reveal differences in Covid-19 prevention behavior between the two groups, the mean difference was zero.

Figure 3: Overt Responses to Prevent Covid-19 Infection



Variability in Adapting to Covid-19 Health & Safety Measures

Finally, the relationship between coping responses, firmographics, and the sociodemographic of the business location were examined; the objective is to learn about business decisions at the community level. The variables selected for statistical analysis included Covid-19 prevention behavior (y), threat appraisal (x1), business size (x2), and growth rate of infection in the community (x3); behavior was the criterion variable.

Three forms of relationships between the criterion and the predictors were examined; (i) linear form, it has been extensively used by economists to assess relationships

between business conduct and structure $y = \alpha + \sum bx + e_1$; (ii) the logarithm of the predictors, common among psychological studies $y = C \log X$, and (iii) the coefficient of elasticity specification, to assess percentage changes in the criterion and the predictors $y = ax^b$.

Table 4 presents the results of model estimation. The equations are presented in the rank order of the amount of variance explained by each. As shown in the table, the nonlinear, elasticity conceptualization of the model explains the most variance in the criterion variable, behavior; a one percent change in the growth rate of the virus in the community results in 13.64% increase in the dependent variable. Put another way, businesses tend to adhere more to the CDC guidelines for Covid-19 prevention, if the community experiences growth in Covid-19 infections.

Table 4: Determinants of Covid-19 Prevention Strategies

Linear equation

$$Y = \frac{-24.87}{(12.7)} - \frac{0.79}{(0.12)} X_1 + \frac{1153.7}{(502.21)} X_3 \quad \text{Adj. } R^2 = 0.62$$

Nonlinear equations

Logarithm of the predictors

$$Y = \frac{67.86}{(86.6)} - \frac{3.72}{(0.36)} X_3 \quad \text{Adj. } R^2 = 0.81$$

Elasticity

$$Y = \frac{63.79}{(23.01)} - \frac{3.74}{(0.31)} X_1 + \frac{13.64}{(5.4)} X_3 \quad \text{Adj. } R^2 = 0.83$$

3.0 Summary and Conclusions

This paper explores business responses to Covid-19, the focus is on the manufacturing sector. To establish the context of the study, the paper begins with estimating the number of small businesses that were active during the beginning of the pandemic in January 2020, during the “stay at place” order implemented by most states during March-April 2020, and monthly for the period January-October 2020. Since the spread of Covid-19 in nonmetro was delayed by a few months, it was hypothesized that Covid-19 impacts in the nonmetro would be less than that of the metro regions; both secondary data (CPS, monthly, micro data for 2019 and Jan-Oct 2020) and primary data (telephone interviews with 31 manufacturing businesses in Illinois) were used to test the hypotheses.

Results reveal, that:

- the number of active small businesses during the peak of the pandemic (March-April 2020) reduced by 25% in the metro and 15% in the nonmetro;
- the mean rates of changes in business activities were similar for metro and nonmetro;
- service businesses such as leisure & hospitality posted the most decline in business numbers, -29% was the median rate of decline across the service industries;
- other than chemical and computer and electronic product manufacturing,

all other manufacturing sectors registered decline in business activities; electrical equipment and appliance manufacturing declined -65%;

- 50+ year old females with high school education contributed to growth in business numbers in soap and disinfectant manufacturing;
- one-in-three manufacturers appraise the threat from Covid-19 as “high”, and
- the higher the fear of Covid-19 (threat appraisal), the higher is the number of CDC recommended, Covid-19 prevention strategies implemented by the manufacturers.

The impact of Covid-19 is decreasing; businesses have started to function at the pre-pandemic level. To keep this momentum, it is essential that local governments maintain a strong vigil to detect and deter the spread of Covid-19 in their communities.

Appendix 1: Number of Active Small Businesses in Illinois, Jan-Oct 2020

Industry	January	February	March	April	May	June	July	August	September	October
1. Agriculture, forestry, fishing, and hunting	6,096			3,650	9,269	9,691	17,257	29,417	29,014	55,942
3. Construction	75,377	74,005	86,626	43,403	49,815	76,126	46,109	42,914	46,875	51,303
4. Manufacturing	14644	16434	8919	10981	4923	4854	6838	12463	19759	22970
5. Wholesale & retail	34,306	27,395	23,831	7,488	28,897	13,509	47,839	21,978	39,217	41,142
6. Transportation & util.	25,127	36,769	28,528	23,812	41,146	23,061	36,184	21,173	49,253	34,234
7. Information	3,303	7,847			4,948	4,364	3,999	7,835		
8. Financial activities	31,332	54,653	50,622	49,756	70,614	55,137	46,122	56,459	59,505	32,949
9. Prof. & bus. serv.	99,089	102,284	100,053	92,639	83,734	59,768	59,947	65,750	84,498	84,216
10. Educational & health serv.	49,908	58,639	84,193	40,499	65,527	47,072	49,683	44,639	45,455	49,041
11. Leisure & hospitality	17,593	33,895	45,175	28,920	39,521	32,483	13,226	32,670	19,957	10,910
12. Other services	47,684	71,893	52,380	14,825	23,080	54,424	42,727	38,968	17,601	31,945
All Industries	404,461	483,814	480,328	315,972	421,473	380,488	369,931	374,267	411,133	414,652

Note: Empty spaces signify nil observations; Illinois implemented "stay at place" order in March 2020; other than manufacturing, all sectors had decreases in number of small businesses during April '20.



**Western Illinois
University**

**ILLINOIS INSTITUTE FOR
RURAL AFFAIRS**

The Rural Research Report is a series published by the Illinois Institute for Rural Affairs to provide brief updates on innovative best practices and applied research on rural issues. Rural Research Reports are peer-reviewed and are made available to elected officials, public libraries, the general public, and other rural development stakeholders. Publication of this report is funded, in part, with USDA-RD dollars.