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Research on the Impact of Epidemic on Financial Markets in Terms of Two Basic Evaluation Methods

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Abstract: The COVID-19 epidemic has influenced many aspects of financial market, and NPV and IRR are the most important and popular measurements for financial asset (investments) traded in financial market. It is foreseeable that the NPV and IRR are also influenced by the COVID 19 epidemic. The previous researchers have made deep and concise research of them, and this study compares the NPV and IRR from three aspects, including uniqueness, compatibility and assumptions, and use data of companies from North American since 2016 to explore how those aspects have been affected by the epidemic. The exploration process involves the data PIVOT, some statistics skills and data visualization. The conclusion is that the IRR becomes to some extent more reliable because of its higher uniqueness and increased effectiveness within compatibility, but rational investors might not use IRR as an unexceptionable benchmark because of its more unreliable assumption.

Keywords: NPV, IRR, comparison, COVID-19

1. Introduction

During the epidemic, the financial market has been severely influenced by the broken out of COVID-19. The financial market has become more fluctuate and susceptive. For instance, within just one month, March in 2020, the stock market in U.S.A. has hit the mechanism of circuit breaker for 4 times, which just been triggered once in the past decades since the setup of the mechanism. In addition, the COVID 19 pandemic significantly boosted the risk among the global financial market with the uncertainty and numerous economic loss [1].

The financial assets or investment projects are the most important goods traded in the financial markets. And it is foreseeable that the NPV and IRR, as the most important and popular measurement and criteria for financial assets, are also be influenced by epidemic.

There had been intense researches about the NPV and IRR, the most popular in-vestment measurement, in previous decades, including excavating the functional relationship [2], introducing new approaches to the debate between them [3] or just achieve the conditions of consistent NPV-IRR rank [4]. The previous researchers have made a consensus that NPV is generally better while IRR is more useful in some special case such as capital budgeting. Besides, some researchers also develop some advanced measurement based on them to remedy the gap and combine their advantages [5].

However, the influence of epidemic to the measurement of financial as-set/investments are still remain unexplored, and this paper aims to compare the NPV and IRR within in a new context-

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epidemic-from three aspects and to examine the difference between the traditional circumstances and special epidemic circumstances.

2. Comparison on Uniqueness of NPV and IRR

2.1. Data and Variable

The data used by this paper involves all the company from the North American from 2016 to 2022. The broken out of the COVID-19 is not at the same time around world, and NIH has claimed that in 2019 the COVID had existed in five states of America [6]. Thus, the 2019 can be seen as the beginning year of the epidemic. The data is queried from the Compustat, involving the 'Fundamental Annual' and 'Security Monthly' category.

2.2. The Uniqueness in Traditional Situation

In traditional situations, for each investment project, there is only one NPV, but may have multiple IRRs, for example, zero, one or more IRRs. This difference is due to the identification and computation methods of those measurements. The NPV is discounted future cash flow calculated by a formular, while the IRR is the possible hurdle rate which make the NPV to be zero and is calculated by the equation of higher degree. It means that as long as the rate can make the NPV to be zero, the rate can be an IRR no matter whether it is meaningful or not. In addition, if we use the software to get the IRR, we may get different IRR values based on the guess value input in the EXCEL formular, without knowing the situation aside from the IRR value. As table 1 and 2 shows, according to the changes of input of guess value, the corresponding output value of IRR changes. Further, if we want to know what happen at the real cost of capital or how the NPV changes between the points , we discounted at COC again, which means we are actually return to the NPV method for decision, like figure 1.

Table 1: The IRR value with 'guess' input of 10.

Yr	CF	COC
0	-10	1.08
1	550	
2	-7200	
3	3600	
4	0	
5	0	
IRR	1914%	

Table 2: The IRR value with 'guess' input of 30.

Yr	CF	COC
0	-10	1.08
1	550	
2	-7200	
3	3600	
4	0	
5	0	
IRR	3334%	

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Figure 1: The actual NPV situation of the investment in figure 1 and 2.

2.3. The Uniqueness During the Epidemic

According to the data collected by Compustat, we can get total income from investment of all the company in North American during the period from 2016 to 2022, and by using the data pivot function of excel, we can calculate the average total income for each year.

Table 3: The average income for each year and variance of average income before and after epidemic.

Year	2016	2017	2018	2019	2020	2021
Avg Income	1879	1942	1454	2755	2432	2590
	Var16-18	70456				
	Var19-21	26086				

The COVID-19 epidemic begun from 2019, so we can consider the period from 2016 to 2018 as traditional and normal circumstance, while treating the period after 2019 as epidemic period. During the epidemic, according to ta-ble 1, the variance of the total income is smaller than that in normal period. According to the Descartes' rule of signs, the less the times of signs change, the less real root an equation has[7]. Here the equation is the computation process of the IRR and the less fluctuate income can lead to less chance for signs of cash flow to change. If take further look into the capital expenditure for those company, table 2 shows that the capital expenditure is also reduced in the beginning of COVID-19, which directly means a cash out-flow or a negative cash flow.

Table 4: The average income for each year and variance of average income before and after epidemic.

Year	2016	2017	2018	2019	2020	2021
Invt. Exp.	74	80	89	98	92	101

In conclusion, the uniqueness of IRR might be better, in other words, there is larger chance for an investment to have a single IRR during the epidemic.

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3. Comparison on Compatibility of NPV and IRR

3.1. The Compatibility in Traditional Circumstances

The compatibility aspect is developed from the uniqueness aspect. NPV works well for most of investments because of its uniqueness. And as IRR is initially designed for a kind of 'classical asset', it mainly works well for those investment projects with initial capital expenditure and following cash inflow.

Only in some very specific situation the IRR is better, such as capital rationing. In such situation we should use every dollar efficiently, so rational investors prefer a relative measurement to an absolute value. Thus, IRR is better in capital rationing, as a relative number like PI (profitability index) mentioned in Principles of Corporate Finance by Breally in 2011[8], which is the so-called BMA book. Intuitively, high IRR create more margin for error, because it exceeds hurdle rate significantly. In most of other situation NPV is better.

3.2. The Compatibility in Epidemic

Given that the definition and computation method of the two measurements remain unchanged, the compatibility of them didn't change a lot during the past several years under the pressure from COVID-19. However, as mentioned above, the IRR works well when there is limited access to capital and investors have to utilize every dollar efficiently.

Table 5: The cash and short term investment, real estate investment and insurance investment for each year.

Year	2016	2017	2018	2019	2020	2021
Cash and short term Invt	12796718.3	14711996	14447314	14727650	19748175	20518851
Real Estate Invt	62858	64451	64505	66456	67527	65494
Insurance Invt	7148	7520	7773	8299	7687	7931

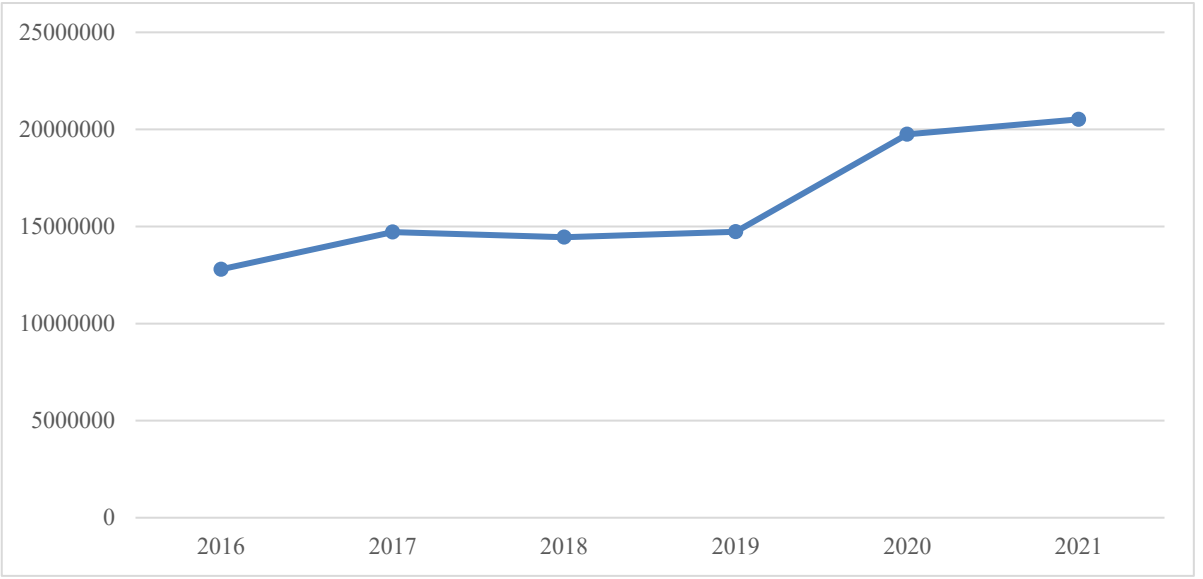

Figure 2: The trend of cash and short term investment from 2016 to 2021.

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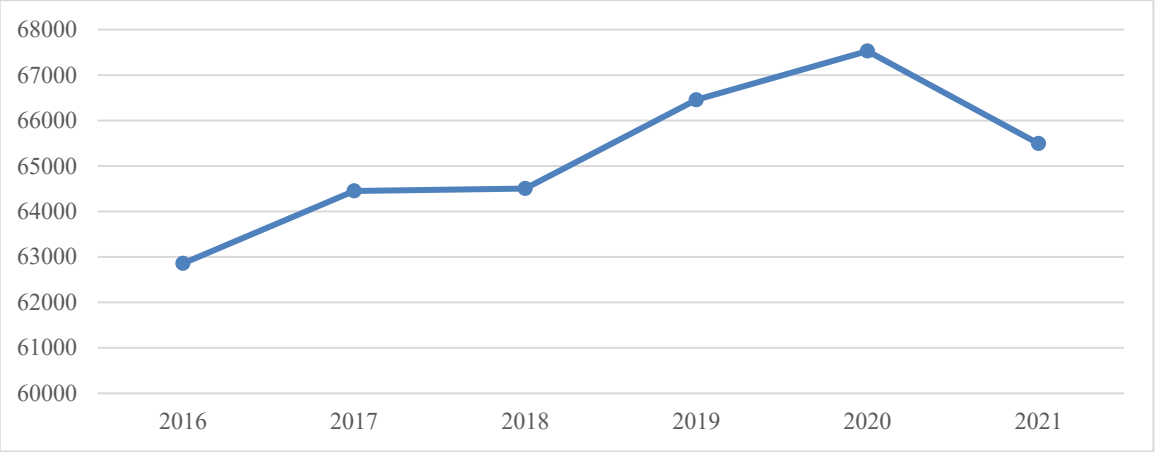

Figure 3: The trend of real estate investment.

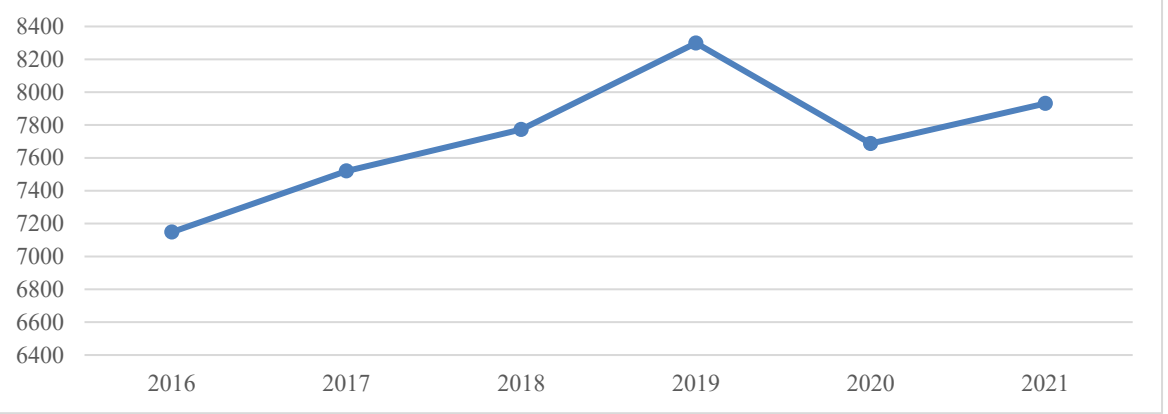

Figure 4: The trend of insurance investment.

From the figures 4-6, it can be found that corporations are spending more money into the short-term investment. In addition, during the epidemic after 2019, the real estate investment increasing trend lasted till the 2020, but it increased at a lower rate and then transmit to a downward trend. Besides, the upward trend of insurance investment stopped between 2019 and 2020 with a slide in investment expense and then increased at a much slower rate. One possible interpretation of those changes above is that investors (here refers to companies in North American) are more focus on short term payback, has less confident in long term real estate investment and are also cutting back spending in insurance to take a negative and reactive investment decision. To be more specific, the COVID-19 epidemic can be seen as a circumstance like capital rationing with less access to capital and low confidence in market.

In conclusion, during epidemic of COVID-19, a special circumstance, IRR might be more useful in its own field, even the compatibility of the NPV and IRR doesn't change a lot. In another word, assume in 100 investment projects, NPV works well for all of them while IRR works well for only 40 of them in traditional situation; During the epidemic, NPV still works well for all of them while IRR still works well for 40 of them, but for the specific 40 in-vestments, the IRR has a more profound advantage over NPV than before.

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4. Comparison on Assumptions of NPV and IRR

4.1. The Assumptions in Traditional Situation

NPV assumes the intermediate cash flow is getting reinvested at a rate of cost of capital. And IRR assumes the intermediate cash flow is getting reinvested at a rate of IRR itself.

Both assumptions of NPV and IRR is not valid at all [9], even NPV's assumption is better, it's not good enough to be the excellent one among numerous measurements. Reinvested at a fixed rate is not valid in the reality and some analysis/rating agency does not use them as measurement for financial assets anymore, investors will not rely on single of them. However, the idea imposed in them, the time value is the key reason why they are still popular among investors and researchers. In all the advanced measurement for no matter valuation the cop or pay-out policy, the time value is important as quantitative evaluating the risk and uncertainty about future.

4.2. The Assumptions in Epidemic

Table 6: The dividend at pay day and dividend rate for each year.

Year	2016	2017	2018	2019	2020	2021	2022
Div Pay day	1.277407	1.528158	1.218789	1.507692	2.304526	3.003967	1.752478
Year	2016	2017	2018	2019	2020	2021	2022
Divdend rate	3.90734	1.64895	1.66189	1.967685	1.931338	1180.557	3.655239

From the data of companies in North American collected by CompStat, we get the average dividend at pay day and average dividend rate for each year from 2016 to 2022, as shown in table 4. From the figure above it is not hard to find that the companies are paying out more and more dividend and the rate of dividend paid out to the total return is getting higher. In terms of the abnormal high dividend rate in 2021, it is due to extreme high individual dividend rate caused by some companies, which pay too much dividend and cease to operate.

Thus, it is foreseeable that the assumption for IRR is getting more unrealistic dur-ing the special period-COVID 19. For company, according to the general frame-work for assessing dividend policy [10], rational manager will only pay more dividend only if they cannot find a good investment opportunity. Because the figure showed above are average number, so the influence of possibility that manager raises or cut dividend out of other reason, such as attract investor or encounter scandal, can be roughly cancelled off. Therefore, as management of companies cannot found good investment opportunities at cost of capital, it is more difficult to find a investment opportunity at a higher IRR.

In conclusion, the IRR's assumption becomes more unreliable during epidemic given that the intermediate cash flow may not be reinvested at a rate of IRR.

5. Conclusion

After analyzing the data and make critical reasoning, there are several conclusions in this paper. Firstly, the uniqueness of IRR have improved while the uniqueness of NPV does not changed because it is originally perfectly unique. In addition, within the context of compatibility the effectiveness and usefulness of IRR also increased because the epidemic created a context similar to capital rationing. Finally, the assumption of IRR becomes more unreliable.

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To sum up the investors now can trust more to IRR in the context of COVID-19, however they need to be cautious about the unreliable assumption of it and may also need to combine with other measurement to make decisions.

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