The Puzzle of Filtering Index Options

UChicago WI 23: FINN 329*

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Abstract

In this article we will summarize our efforts to replicate the filtering described in appendix B of *The Puzzle of Index Option Returns* by **?**. We provide additional insight on how these filters shape the distribution on implied volatility and moneyness. Moreover, due to the unavailability of index option data from 1985 to 1995, we focus our comparison on the dataset of 1/1996-1/2012 as well as extending this analysis forward from 2/2012 to 12/2019. Our analysis can be readily found on our Github [1].

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[1] `https://github.com/harrypandas/finm-32900_final_project.git`

1 Replicating Table B1

In the appendix B of **?**, three levels of filters are described with the intent to minimize quoting errors in the construction of their portfolios. In this section we will summarize our implementation and briefly discuss the differences.

1.1 Level 1

This application of filters is fairly straight forward. However, an unexplainable difference occurs upon the application of the Volume = 0 filter. In Table B1 of **?**, no options have a Volume = 0 in their dataset. However, we observe 2,093,744 options with a Volume = 0. Unfortunately, no more details are given in the manuscript describing this step. In order to not diverge from their data pool we choose to drop 0 options, this is reflected in our table: **??**

1.2 Level 2

1.3 Level 3

Table 1: Table B.1

		OptionMetrics: 1996-01 to 2012-01		OptionMetrics:2012-02 to 2019-12		Total	
		Deleted	Remaining	Deleted	Remaining	Deleted	Remaining
Starting	Calls		1,704,220		7,901,901		9,606,121
	Puts		1,706,360		7,901,427		9,607,787
	All		3,410,580		15,803,328		19,213,908
Level 1 filters	Identical	0		277,102		277,102	
	Identical except price	10		2,557,330		2,557,340	
	Bid = 0	272,078		1,069,116		1,341,194	
	All		3,138,492		11,899,780		15,038,272
Level 2 filters	Days to expiration ¡7 or ¿180	1,297,729		3,080,910		4,378,639	
	IV ¡5% or ¿100%	16,432		63,639		80,071	
	K/S ¡0.8 or ¿1.2	550,227		1,987,486		2,537,713	
	Implied interest rate ¡ 0	592,726		4,421,368		5,014,094	
	Unable to compute IV	38,434		207,215		245,649	
	All		642,944		2,139,162		2,782,106
Level 3 filters	IV filter	0		0		0	
	Put-call parity filter	0		0		0	
	All		642,944		2,139,162		2,782,106

Number of observations that are removed upon application of appendix B filters.

2 B Filters, Implied Volatility, Moneyness

3 Replicating Table2

This table describes how many options are found, go missing, or expire in the dataset. An option is found if it reappears the next trading day. An option is missing for if it does not reappear the next trading day. Multiple days missing, counts as multiple options missing. Lastly, if an option is lost and expires this is noted as expired.

We would like to note an interesting aspect of this dataset. Over 80% of the options expire on a Saturday or a non-trading day. To handle this, we push the expiration day to the nearest Friday, presumably the nearest trading day. However, there are quite a few edge cases which would explain the discrepancy between our analysis and **?**. Further investigation is required.

Table 2: Table 2 Sample

	Calls				Puts			
Observations	1996-01 to 2012-01		2012-02 to 2019-12		1996-01 to 2012-01		2012-02 to 2019-12	
All trading days								
Found	267,403	84%	723,059	70%	265,777	82%	672,848	68%
Missing	734	0%	3	0%	787	0%	4	0%
Expired	51,587	16%	308,820	30%	56,460	17%	319,294	32%
Last trading day of the month								
Found	7,924	79%	246,010	83%	8,158	77%	229,842	81%
Interpolated	2,130	21%	50,930	17%	2,391	23%	53,063	19%

Tracking the instances options are found, missing or expired.

4 Data

Our option data is queried from OptionMetrics provided by Wharton Research Data Services (WRDS). We limit the query to SECID = 108105, S&P 500 Index - SPX. We use the three month Tbill as our interest rate, this is from the Federal Reserve Board's H15 report supplied by WRDS.

In comparison to their data, we have pulled 184 more options than them. It is unclear where the discrepancy lies. First, we assumed we were off by a day however this will truncate or elongate the dataset by over 300 points. We credit the discrepancy to OptionMetrics updating their data to be more accurate.

The following links contain the documentation and helpful links for the WRDS database:

- Option Metrics Overview
- Option Metric Keys
- Option Metrics Query
- Federal Reserve Report

Comments

Here is a textbox...

I give an example of a simple table in Table

Table 3: A Simple Table From Pandas, No. 1

		OptionMetrics: 1996-01 to 2012-01		OptionM
		Deleted	Remaining	Deleted
Starting	Calls		1,704,220	
	Puts		1,706,360	
	All		3,410,580	
Level 1 filters	Identical	0		277,102
	Identical except price	10		2,557,330
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	IV ¡5% or ¿100%	16,432		63,639
	K/S ¡0.8 or ¿1.2	550,227		1,987,486
	Implied interest rate ¡ 0	592,726		4,421,368
	Unable to compute IV	38,434		207,215
	All		642,944	
Level 3 filters	IV filter	0		0
	Put-call parity filter	0		0
	All		642,944	

Here I show some data...

5 Model

The Black–Scholes equation governing the price evolution of derivatives under the Black–Scholes model is given in (??). Some aligned equations are given in (??) and (??). I give an example in which the two share a single equation number in (??). Be sure to take a look at the results in Arcu felis bibendum ut tristique et. Eget gravida cum sociis natoque penatibus et magnis. Elit pellentesque habitant morbi tristique senectus et netus et.

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$$\frac{\partial V}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} - rV = 0 \tag{1}$$

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$$P(S_t, t) = Ke^{-r(T-t)} - S_t + C(S_t, t) \tag{2}$$

$$= N(-d_-)Ke^{-r(T-t)} - N(-d_+)S_t \tag{3}$$

$$\begin{aligned} P(S_t, t) &= Ke^{-r(T-t)} - S_t + C(S_t, t) \\ &= N(-d_-)Ke^{-r(T-t)} - N(-d_+)S_t \end{aligned} \tag{4}$$

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Appendices

A Proofs

TODO

B Recycle Bin

(Short-term parking spot for material that may be re-used or deleted at a later time)

TODO