The Hedging Effectiveness of Options and Futures: A Mean-Gini Approach*

C. Sherman Cheung
Clarence C. Y. Kwan
Patrick C. Y. Yip

I. INTRODUCTION

The growing significance of financial futures and options can be seen by the proliferation of the types of instruments on various organized exchanges and by the increasing trading volume of each instrument since the first futures contracts on foreign currencies were introduced by the Chicago Mercantile Exchange in 1972 and the establishment of the Chicago Board Options Exchange in 1973. The usual economic rationale for futures and options is that they facilitate hedging. In other words, these instruments enable investors who hold the underlying assets to transfer the risk of price change to individuals who are more willing to bear such risk.

In the case of financial futures, their hedging effectiveness has been extensively studied by various researchers. Following the mean-variance portfolio approach, researchers usually examine the change in risk as futures are introduced into a portfolio containing the underlying assets. Examples are Ederington's (1979) study of futures written on two debt instruments (GNMA's and T-bills), Figlewski's (1984 and 1985) studies of futures written on stock indices, and Hill and Schneeweis' (1981 and 1982) studies of futures written on currencies, among others. In the case of options, Chang and Shanker (1986) have examined the hedging effectiveness of currency options. Paralleling these and other empirical studies are the theoretical developments of hedging performance by Howard and D'Antonio (1984) and Bell and Krasker (1986), among others.

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C. Sherman Cheung is an Assistant Professor in the Faculty of Business, McMaster University.

Clarence C. Y. Kwan is a Professor in the Faculty of Business at McMaster University.

Patrick C. Y. Yip is a Professor in the Department of Mathematics and Statistics, McMaster University.

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One common assumption underlying most empirical and theoretical studies of hedging performance is the validity of the mean-variance framework. In the case of futures, Helms and Martell (1985), and Cornew, Crowson, and Town (1984) have presented evidence suggesting that the normality assumption is not appropriate. In the case of options, a convincing case has been made by Bookstaber and Clarke (1985) against the normality assumption.[1] These empirical and theoretical arguments point to the need for an alternative framework for the examination of hedging effectiveness. Such an alternative presumably has to be unencumbered by the requirement of either normality of return distributions or quadratic utility as implied in the mean-variance framework.

The major purpose of this article is to evaluate the appropriateness of the mean-variance framework used in the existing literature. Two questions will be examined. First, is it proper to focus on the minimum variance portfolio alone and ignore all other points on the efficient frontier when assessing hedging effectiveness of an instrument? Many existing empirical studies, such as those by Ederington (1979), Figlewski (1984 and 1985), and Hill and Schneeweis (1981 and 1982), define hedging effectiveness as the ratio of the variance of a hedged portfolio with minimum variance to the variance of the underlying asset or minor variations thereof. It will be demonstrated that such measures can be misleading. Second, is the mean-variance framework itself appropriate for financial futures and options? In other words, how valid is the normality assumption of return distributions for assessing hedging effectiveness of these instruments? As discussed earlier, there are theoretical and empirical arguments pointing to the inappropriateness of the mean-variance framework in general.

The approach used in this study is the mean-Gini framework which is consistent with stochastic dominance rules. As such, the mean-Gini approach will produce consistent evaluations of risky prospects independent of the normality of return distributions or quadratic utility functions.

II. THE METHODOLOGY

Gini's mean difference is a statistic extensively used in the evaluation of income inequality in the economic literature. It was introduced recently into the finance profession as a measure of the variability of a random variable by Yitzhaki (1982 and 1983), Lerman and Yitzhaki (1984), and Shalit and Yitzhaki (1984). Following Shalit and Yitzhaki (1984), Gini's mean difference is given as

$$\Gamma = 2\int_{a}^{b} R[G(R) - \frac{1}{2}]g(R)\,dR = 2\,\mathrm{cov}[R,\, G(R)] \tag{1}$$

where $g(R)$ and $G(R)$ are, respectively, the probability density function and the cumulative probability density function of prospect R. It is assumed that there exists $a \geq -\infty$ and $b \leq \infty$ such that $G(a) = 0$ and $G(b) = 1$.

Yitzhaki (1982 and 1983) has shown that the conditions $\overline{R}_1 \geq \overline{R}_2$ and $\overline{R}_1 - \Gamma_1 \geq \overline{R}_2 - \Gamma_2$ are necessary for prospect $\overline{R}_1$ to dominate prospect R_2 according to the first and second degree stochastic dominance rules, where $\overline{R}_1$ and $\overline{R}_2$ are the means of the two respective prospects. The mean-Gini approach therefore is similar to the mean-variance framework in that it uses two summary statistics to characterize the distribution of a risky prospect. Unlike the mean-variance framework, the mean-Gini framework would not lead to a situation in which an investor chooses a portfolio that is considered inferior

[1]This may explain why the empirical evaluation of the hedging effectiveness of options in the mean-variance framework has not been as common as that of futures.

by individuals. With Gini as a measure of risk, the framework provides a necessary condition for stochastic dominance regardless of the probability distribution of returns. As a measure of variability, Gini has the simplicity of variance but it does not require the restrictive assumptions underlying the mean-variance framework.

The empirical implementation of the mean-Gini is relatively easy. The only complication involved in implementing eq. (1) is the empirical representation of $G(R)$. As Lerman and Yitzhaki (1984) have shown, one can first rank the n observations of return R in ascending order according to their values as $r = 1, 2, \ldots, n$, where r denotes the rank of each observation. The ratio r/n, which increases monotonically to its maximum value of one and satisfies all properties of a cumulative distribution, can be used as an estimate of $G(R)$. Then, Γ can be otained by calculating the covariance of R and r/n.

To judge whether the mean-variance framework will lead to the same conclusions as the mean-Gini framework regarding the hedging effectiveness of both options and futures, efficient frontiers including the minimum risk portfolios involving the two derivative assets and the underlying asset are constructed for each framework. If the efficient frontier of the hedged portfolios involving option contracts dominates the efficient frontier involving futures based on the mean-variance framework, one also would expect options to be a better hedging instrument based on the mean-Gini framework. Since the mean-Gini framework implies first and second degree stochastic dominance, which makes no assumption about any quadratic utility function or normal distribution of the return process, the lack of consistency between the two frameworks, if any, would suggest that the mean-variance framework is inappropriate. This in turn would lead one to question the existing theoretical and empirical works on the hedging performance of financial derivatives.[2]

Futures and options written on five currencies trading from September 1983 to December 1984 were used in this study.[3] Daily data for currency options and spot exchange rates for the British Pound, the Canadian Dollar, the German Mark, the Japanese Yen, and the Swiss Franc, all relative to the U.S. Dollar, were obtained from the *PHLX-OSU Currency Option Data Base* and the corresponding daily futures data were obtained from *Statistical Yearbooks* published by the Chicago Mercantile Exchange.

In this study spot (s) and call option (o) returns on day t are defined as

$$R_{s,t} = (P_{s,t} - P_{s,t-1})/P_{s,t-1} \tag{2}$$

$$\text{and} \quad R_{o,t} = (P_{o,t} - P_{o,t-1})/P_{o,t-1}, \tag{3}$$

respectively, where P represents the exchange rate. The return of the spot-option (so) portfolio on day t is given by

$$R_{so,t} = x_s R_{s,t} + x_o R_{o,t}, \tag{4}$$

where x_s and x_o $(=1 - x_s)$ are the portfolio weights. The hedge ratio, the magnitude of x_o/x_s, is the value of call options used to hedge against the long position of one unit of the underlying currency.

[2]Although few empirical studies compare the hedging effectiveness of futures and options as is done here, the issue of the appropriateness of the mean-variance fremework is still relevant for almost all empirical studies on the topic. One may want to compare how well several stock portfolios such as NYSE Composite Index, Dow Jones 30, etc. are hedged by one or more futures contracts as Figlewski (1984 and 1985) has done. The inappropriateness of the mean-variance framework can lead to erroneous conclusions whenever a comparison is made. Even if one is not interested in making any comparison, the absolute magnitude of hedging effectiveness can still be biased by the use of the mean-variance approach.

[3]One reason for choosing currencies as the underlying assets is to avoid complications arising from cash distributions such as dividends often associated with stocks.

Following Figlewski (1984 and 1985), futures (f) return and the spot-futures (sf) portfolio return on day t are defined as

$$R_{f,t} = (P_{f,t} - P_{s,t-1})/P_{f,t-1} \tag{5}$$

$$\text{and} \quad R_{sf,t} = R_{s,t} + x_f R_{f,t}, \tag{6}$$

respectively. Here the magnitude of x_f is the hedge ratio.

When a contract became available for trading, a hedged position was set up with a position in a currency and an opposite position in (i) the underlying option and (ii) the underlying futures. The above hedged position was then maintained until the maturity of the underlying option and futures with no additional trading or re-balancing in between. To facilitate comparison, futures and option contracts were chosen that had the same expiration date. The efficient frontiers in the mean-variance framework were then traced out for the hedged portfolio involving option and the hedged position involving futures. The efficient frontiers in the mean-Gini framework were traced out in a similar fashion. As mentioned ealier, if the hedged position involving one type of derivative asset dominates the other hedged position involving the other derivative asset in the mean-variance framework, one would not expect the dominance to be reversed in the mean-Gini framework. As indicated earlier, the inconsistency in the dominance of hedged positions, if any, would imply the inappropriateness of the mean-variance framework.

III. EMPIRICAL RESULTS

Some sample results taken from Japanese Yen contracts are given in Table I. Table I illustrates a case in which mean-variance and mean-Gini approaches lead to conflicting conclusions. Column 1 in Table I gives the mean returns of the two hedged portfolios involving options and futures. To obtain mean returns using eq. (4) or (6), sample means over the contract life for individual currencies, options, and futures were used. With the individual mean returns, portfolio mean returns for the hedged portfolio involving options given in column 1 can be obtained by varying the hedge ratio in eq. (4). Since the objective here is to trace out the efficient frontiers each involving two assets, the portfolio weights or the hedge ratio in each case can theoretically be selected over an arbitrary range. In this study the range was chosen so that any intersection of the efficient frontiers would be detected. Column 2 reports the various values of x_o. The portfolio's standard deviations of returns associated with various hedge ratios are provided in Column 3. For each value of the hedge ratios, the daily return series of the hedged portfolio were used to compute the mean return and the standard deviation of returns. The corresponding Gini was computed using eq. (1). Specifically, as described in Section II, with r representing the rank of each of the n observations of the daily return series, the ratio r/n was used to provide an estimate of $G(R)$ in eq. (1). The covariance given in eq. (1) is nothing more than the covariance between r/n and the value of each observation, and the resulting portfolio Gini for each hedge ratio is reported in column 4 of Table I. To construct the efficient frontier for hedged portfolios involving futures on the same frontier map, each hedge ratio was adjusted to produce the same range of mean returns as the optioned portfolio. The values of x_f for hedged portfolios involving futures are reported in column 5. This portfolio's standard deviation and Gini were calculated using the procedures previously described and are given in Columns 6 and 7. Column 8 is the difference between the optioned portfolio's standard deviation (Column 3) and the standard deviation of the hedged portfolio involving futures (Column 6) on the efficient frontier map. Positive differences for all values of the standard deviations will imply the dominance of futures over options in providing hedging effectiveness to the underlying

Table I
SOME SAMPLE RESULTS OF THE HEDGING PERFORMANCE OF FUTURES AND OPTION CONTRACTS

(1) port. return ×10	(2) weight: option $(s + o)$	(3) port. std. dev. $(s + o)$	(4) port. Gini $(s + o)$	(5) weight: futures $(s + f)$	(6) port. std. dev. $(s + f)$	(7) port. Gini $(s + f)$	(8) std. dev. diff. ×10	(9) Gini diff. ×10
−0.02000	−0.1366	0.016700	0.006241	−3.3757	0.013749	0.007350	0.029514	−0.01109
−0.01680	−0.1213	0.014415	0.005342	−2.9966	0.011748	0.006300	0.026679	−0.01109
−0.01360	−0.1059	0.012143	0.004454	−2.6174	0.009757	0.005253	0.023860	−0.00798
−0.01040	−0.0906	0.009892	0.003582	−2.2382	0.007786	0.004212	0.021063	−0.00630
−0.00720	−0.0075	0.007681	0.002741	−1.8590	0.005853	0.003189	0.018279	−0.00447
−0.00400	−0.0599	0.005558	0.001990	−1.4798	0.004015	0.002205	0.015426	−0.00214
−0.00080	−0.0445	0.003677	0.001461	−1.1006	0.002491	0.001356	0.011867	0.00105
0.00240	−0.0292	0.002628	0.001365	−0.7214	0.002123	0.001139	0.005045	0.00226
0.00560	−0.0139	0.003321	0.001763	−0.3423	0.003322	0.001675	−0.000003	0.00087
0.00880	0.0015	0.005090	0.002543	0.0369	0.005078	0.002556	0.000121	−0.00012
0.01200	0.0168	0.007178	0.003394	0.4161	0.006982	0.003543	0.001958	−0.00149
0.01520	0.0322	0.009375	0.004272	0.7953	0.008941	0.004565	0.004339	−0.00292
0.01840	0.0475	0.011619	0.005166	1.1745	0.010925	0.005601	0.006939	−0.00434
0.02160	0.0629	0.013887	0.006069	1.5537	0.012923	0.006645	0.009648	−0.00576
0.02480	0.0782	0.016170	0.006977	1.9328	0.014928	0.007696	0.012417	−0.00718
0.02800	0.0936	0.018461	0.007890	2.3120	0.016939	0.008750	0.015221	−0.00860
0.03120	0.1089	0.020758	0.008804	2.6912	0.018953	0.009806	0.018050	−0.01002
0.03440	0.1243	0.023060	0.009720	3.0704	0.020970	0.010864	0.020895	−0.01144
0.03760	0.1396	0.025364	0.010637	3.4496	0.022989	0.011923	0.023751	−0.01286
0.04080	0.1550	0.027671	0.011555	3.8288	0.025009	0.012983	0.026615	−0.01427
0.04400	0.1703	0.029979	0.012475	4.2079	0.027030	0.014043	0.029487	−0.01567
0.04720	0.1856	0.032289	0.013395	4.5871	0.029053	0.015103	0.032363	−0.01708
0.05040	0.2010	0.034600	0.014315	4.9663	0.031075	0.016164	0.035243	−0.01848
0.05360	0.2163	0.036911	0.015237	5.3455	0.033099	0.017225	0.038126	−0.01988
0.05680	0.2317	0.039224	0.016158	5.7247	0.035123	0.018287	0.041012	−0.02128
0.06000	0.2470	0.041537	0.017080	6.1039	0.037147	0.019348	0.043900	−0.02268

currency in the mean-variance framework over the sample period. Likewise, Column 9 is the difference between Column 4 and Column 7 and can be interpreted accordingly as a measure of dominance in the mean-Gini framework. The signs of the values in the two columns should be the same for the two approaches to be consistent. In the case of the results reported in Table I, mean-variance favors the use of futures as a hedging instrument, whereas the mean-Gini approach supports the use of options. This is a clear example of how the use of mean-variance in the evaluation of hedging effectiveness can lead to erroneous conclusions.

Table II examines the issue of hedging effectiveness for the same contracts from a slightly different perspective. The focus here is the hedged portfolio with minimum risk. The last column denotes the ratio of the minimum standard deviation/Gini of a hedged portfolio to the standard deviation/Gini of the underlying currency. This ratio is a measure of maximum risk reduction as a result of using options or futures in the two frameworks. It is this type of measure that is used in many empirical studies. Results shown in Table II conclusively point to the effectiveness of futures over options as a hedging instrument in both mean-variance and mean-Gini frameworks. In both frameworks, the futures contract reduces the risk by more than 55 percent, whereas the option contract lowers the risk level by about 45 percent. This conclusion contradicts results given in Table I and demonstrates the pitfall in focusing on the minimum standard deviation/ Gini portfolio.

A close examination of Tables I and II reveals how the seemingly contradictory results can be resolved. By focusing on the minimum risk portfolio, the futures contract emerges as a clear winner in both frameworks. The options contract, however, dominates futures at higher levels of return due to the crossing of the two efficient frontiers in the mean-Gini framework. In fact it can be generalized that basing decisions on the minimum risk portfolio will be erroneous whenever the two efficient frontiers cross in the mean-Gini framework. The use of the ratio of excess return to standard deviation/Gini, therefore, would seem to be a more appropriate measure of hedging effectiveness.[4]

[4]Specifically, the excess return is defined as the difference between the return and the riskfree rate. The excess-return-to-risk ratio is the measure that Elton, Gruber, and Padberg (1976) used in formulating the objective function of their mean-variance portfolio problem.

Table II
HEDGING PERFORMANCE OF OPTION AND FUTURES USING THE MINIMUM STANDARD DEVIATION/GINI AS THE BENCHMARK

	Portfolio Weights (s)	Portfolio Weights (o,f)	Mean Return of the Hedged Portfolio	Gini Reduction Ratio*
Spot & Option	1.033803	−0.033802	0.000144	0.547261
Spot & Futures	1.000000	−0.830122	0.000148	0.447440
	Portfolio Weights (s)	**Portfolio Weights** (o,f)	**Mean Return of the Hedged Portfolio**	**Standard-Deviation Reduction# Ratio**
Spot & Option	1.027418	−0.027418	0.000277	0.533724
Spot & Futures	1.000000	−0.832858	0.000146	0.416119

*Gini Reduction Ratio = Ratio of the Gini of the hedged portfolio with minimum risk to that of the unhedged position.

#Standard-Deviation Reduction Ratio = Ratio of the standard deviation of the hedged portfolio with minimum risk to that of the unhedged position.

The above case is only one of the eight possible scenarios listed in Figure 1. The risk reduction approach relies solely on the risk characteristics of the minimum standard deviation/Gini portfolio. The conclusion as to which derivative asset is a more effective hedging instrument using this approach depends on whether the mean-variance or mean-Gini framework is used. As mentioned earlier, the conclusion reached using the mean-Gini framework should be adopted whenever there is inconsistency as to which derivative asset is a better hedging instrument. Even if the two frameworks offer consistent conclusions based on the risk reduction approach, there is always the possibility that the efficient frontiers of the hedged portfolios using the two derivative assets cross over in at least one framework. The crossing over of the efficient frontiers in the mean-Gini framework, in particular, may render the conclusion based on the risk reduction approach erroneous, as demonstrated in the above example. By examining the entire efficient frontiers in the right panel of Figure 1, the pitfalls of the risk reduction approach can be delineated clearly.

The right panel of Figure 1 exhausts possible outcomes when mean-variance and mean-Gini frameworks are consistent (labelled C) and when they are inconsistent (labelled I). Consistency in conclusions regarding the superiority of a particular derivative asset using the risk reduction approach can be contradicted by the type of measure given in Column 8 (mean-variance efficient map) and Column 9 (mean-Gini efficient map). The consistency can be confirmed also by the mean-variance efficient map but rejected by the mean-Gini efficient map. The third possibility is the confirmation of the consistency in the mean-Gini efficient map and the rejection in the mean-variance efficient map. The fourth possibility is the confirmation of the consistency by the efficient frontiers in both frameworks. The above four possibilities are labelled C1 to C4, respectively.

The possibility of crossing over is just as important when consistency cannot be achieved using the risk reduction approach. Here, the examination of efficient frontiers may reveal the same four possible outcomes described above. In other words, the conclusion reached in the mean-variance framework based on the risk reduction approach can be contradicted by the types of measures given by Columns 8 and 9. The conclusion

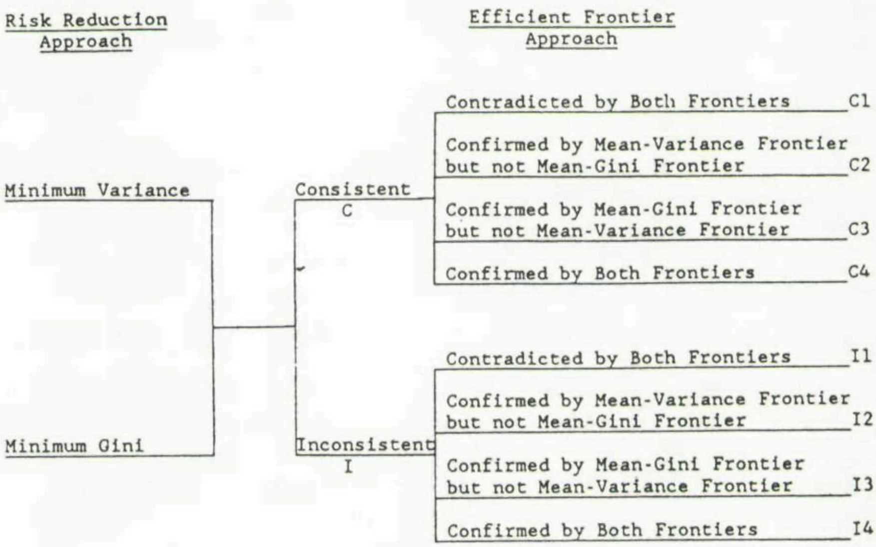

Figure 1
All Possible Hedging Outcomes

can be confirmed also by the mean-variance frontiers but rejected by the mean-Gini frontiers. The third possibility is the confirmation of the conclusion by the mean-Gini frontiers but rejection by the mean-variance frontiers. The fourth possible outcome is the confirmation of the conclusion by both frameworks. These four possible outcomes are labelled I1 to I4, respectively.

An example for each outcome is selected from the samples for presentation in Table III. Each case in Panel A of Table III is an abbreviated version of Table I with everything deleted except the mean returns, the difference in standard deviations (Column 8 in Table I), and the difference in Gini (Column 9 in Table I). As explained earlier, these last two measures capture the difference between the risk of the optioned portfolio and the risk of the portfolio involving futures at each level of mean return. A positive difference implies the dominance of futures over options. Panel B is an abbreviated version of Table II showing the hedging effectiveness from the perspective of the minimum risk portfolio. Presented in Panel B are the kinds of measures for hedging effectiveness used in most empirical studies for both instruments in both frameworks and their respective mean returns.

Case C1 is a case for Canadian dollar in which the efficient frontiers cross over in both frameworks. In other words, the efficient frontiers in both mean-variance and mean-Gini contradict the conclusion based on the minimum risk portfolio. Since the futures contract reduces risk by about 50 percent in both frameworks according to the minimum risk portfolio in Panel B, it is clearly a better hedging instrument. Panel A shows the dominance of the option and thus reverses the above conclusion. Case C2 also favors futures in both frameworks according to Panel B of Table III. The above conclusion can still be maintained if one focuses on the mean variance results in Panel A. The problem here is that there is a crossing over in the mean-Gini framework and thus reverses the above conclusion. Note that just as in the example in Tables I and II, this is another case in which the general mean-variance framework is inappropriate. The situation for C3 is similar to the one given by Tables I and II, although different futures and option contracts are involved. The measure of dominance based on the mean-Gini framework given in Panel A confirms the conclusion reached on the basis of minimum risk portfolio presented in panel B. However, the results based on the efficient frontiers in the mean-variance framework fail to support the above conclusion. Finally, case C4 is the ideal situation for researchers who rely on the minimum risk portfolio as the benchmark. The conclusion based on the results in Panel B is confirmed by the results in Panel A.

As for the situation where the minimum variance framework and the minimum Gini framework cannot agree on the superiority of a particular derivative asset, the sample of 127 cases detects no trace of I2 and I3. Case I1 is a case for the German Mark in which the conclusion based on the minimum variance portfolio is contradicted by the results based on efficient frontiers in both frameworks. On the other hand, Case I4 is a situation for German Mark where the conclusion based on the minimum variance portfolio is supported by the results based on Panel A.

Table IV summarizes all the 127 cases under consideration, with each case representing both an option contract and a futures contract written on a currency involving identical expiration dates. The outcome of each case is classified according to the scheme set out in Figure 1. With Table IV, the shortcoming of the particular risk reduction approach used in various empirical studies and of the mean-variance framework in general can be assessed quantitatively.

The case against risk reduction can be made rather easily using mean-Gini frontiers as the benchmark. This amounts to the sum of cases C1, C2, I1, and I2 for various curren-

Table III
PANEL A
MEAN RETURNS, DOMINANCE MEASURES IN BOTH MEAN-VARIANCE AND MEAN-GINI FRAMEWORKS

C1			C2			C3		
Mean Returns	Difference in Standard Deviation	Difference in Gini	Mean Returns	Difference in Standard Deviation	Difference in Gini	Mean Returns	Difference in Standard Deviation	Difference in Gini
0.00000	0.006235	0.003543	0.00000	0.037400	0.014307	0.00000	0.000067	−0.002357
0.02906	−0.174182	−0.104084	0.09375	0.090874	−0.280578	0.03125	0.055862	−0.045680
0.05813	−0.350241	−0.210325	0.18750	0.207902	−0.577123	0.06250	0.109697	−0.083297
0.08719	−0.526109	−0.316471	0.28125	0.325188	−0.873152	0.09375	0.163459	−0.120859
0.11625	−0.701929	−0.422555	0.37500	0.442538	−1.169021	0.12500	0.217202	−0.158427
0.14531	−0.877730	−0.528619	0.46875	0.559911	−1.464837	0.15625	0.270938	−0.196009
0.17438	−1.053521	−0.634683	0.56250	0.677298	−1.760623	0.18750	0.324669	−0.233593
0.20344	−1.229306	−0.740747	0.65625	0.794690	−2.056388	0.21875	0.378398	−0.271174
0.23250	−1.405088	−0.846811	0.75000	0.912088	−2.352142	0.25000	0.432125	−0.308751
0.26156	−1.580867	−0.952873	0.84375	1.029486	−2.647895	0.28125	0.485852	−0.346328
0.29063	−1.756645	−1.058934	0.93750	1.146891	−2.943645	0.31250	0.539578	−0.383905
0.31969	−1.932422	−1.164996	1.03125	1.264294	−3.239394	0.34375	0.593304	−0.421478
0.34875	−2.108198	−1.271058	1.12500	1.381699	−3.535138	0.37500	0.647028	−0.459049
0.37781	−2.283973	−1.377120	1.21875	1.499102	−3.830881	0.40625	0.700753	−0.496618
0.40688	−2.459747	−1.483181	1.31250	1.616510	−4.126622	0.43750	0.754477	−0.534187
0.43594	−2.635523	−1.589241	1.40625	1.733918	−4.422359	0.46875	0.808201	−0.571755
0.46500	−2.811296	−1.695295	1.50000	1.851324	−4.718093	0.50000	0.861925	−0.609324

Table III *Continued*

C4			I1			I4		
Mean Returns	Difference in Standard Deviation	Difference in Gini	Mean Returns	Difference in Standard Deviation	Difference in Gini	Mean Returns	Difference in Standard Deviation	Difference in Gini
0.00000	1.462601	0.639861	0.00000	0.052377	0.015353	0.00000	0.012313	0.001268
0.01250	5.459615	2.349550	0.01250	0.173581	0.065403	0.03750	0.096632	0.037213
0.02500	12.389680	5.343235	0.02500	0.277248	0.107269	0.07500	0.172517	0.068997
0.03750	19.319600	8.336816	0.03750	0.374452	0.146430	0.11250	0.248146	0.100557
0.05000	26.249470	11.330370	0.05000	0.469550	0.184558	0.15000	0.323717	0.132168
0.06250	33.179330	14.323910	0.06250	0.563781	0.222171	0.18750	0.399266	0.163810
0.07500	40.109190	17.317450	0.07500	0.657586	0.259522	0.22500	0.474805	0.195441
0.08750	47.039030	20.310980	0.08750	0.751151	0.296712	0.26250	0.550338	0.227083
0.10000	53.968880	23.304520	0.10000	0.844570	0.333834	0.30000	0.625867	0.258762
0.11250	60.898720	26.298050	0.11250	0.937892	0.370887	0.33750	0.701394	0.290441
0.12500	67.828560	29.291570	0.12500	1.031148	0.407912	0.37500	0.776919	0.322119
0.13750	74.758410	32.285120	0.13750	1.124356	0.444921	0.41250	0.852444	0.353782
0.15000	81.688240	35.278650	0.15000	1.217530	0.481904	0.45000	0.927967	0.385445
0.16250	88.618040	38.272180	0.16250	1.310676	0.518868	0.48750	1.003489	0.417108
0.17500	95.547940	41.265720	0.17500	1.403801	0.555818	0.52500	1.079011	0.448756
0.18750	102.477800	44.259250	0.18750	1.496911	0.592763	0.56250	1.154533	0.480403
0.20000	109.407600	47.252770	0.20000	1.590006	0.629704	0.60000	1.230054	0.512051

PANEL B

MEAN RETURNS, RATIOS OF THE STANDARD DEVIATION OF THE HEDGED PORTFOLIO WITH MINIMUM RISK TO THAT OF THE UNHEDGED POSITION, AND RATIOS OF GINI OF THE HEDGED PORTFOLIO WITH MINIMUM RISK TO THAT OF THE UNHEDGED POSITION

	C1				C2				C3			
	Mean Returns	Std. Dev. Reduction Ratio	Mean Returns	Gini Reduction Ratio	Mean Returns	Std. Dev. Reduction Ratio	Mean Returns	Gini Reduction Ratio	Mean Returns	Std. Dev. Reduction Ratio	Mean Returns	Gini Reduction Ratio
Spot & Option	−0.000025	0.8834	−0.000036	0.8669	0.000370	0.8309	0.000385	0.8865	−0.000213	0.7719	−0.000209	0.7556
Spot & Futures	−0.000003	0.5024	−0.000003	0.4882	0.000124	0.3031	0.000126	0.3079	−0.000221	0.8365	−0.000164	0.7621

	C4				I1				I4			
	Mean Returns	Std. Dev. Reduction Ratio	Mean Returns	Gini Reduction Ratio	Mean Returns	Std. Dev. Reduction Ratio	Mean Returns	Gini Reduction Ratio	Mean Returns	Std. Dev. Reduction Ratio	Mean Returns	Gini Reduction Ratio
Spot & Option	0.000257	0.7084	0.000258	0.7219	−0.000845	0.6269	−0.000727	0.6391	−0.000421	0.7471	−0.000282	0.6630
Spot & Futures	0.000070	0.3774	0.000074	0.3858	0.000395	0.6352	0.000392	0.6034	−0.000160	0.6871	−0.000146	0.7136

Table IV
SUMMARY OF VARIOUS HEDGING OUTCOMES BASED ON MEAN-VARIANCE AND MEAN-GINI FRAMEWORKS

	British Pound	Canadian Dollar	German Mark	Japanese Yen	Swiss Franc	Total
C1	13	4	16	10	15	58
C2	0	0	1	2	0	3
C3	0	0	0	2	0	2
C4	8	6	18	10	16	58
I1	0	0	1	0	0	1
I2	0	0	0	0	0	0
I3	0	0	0	0	0	0
I4	1	1	0	0	3	5
Total Cases	22	10	37	24	34	127
$\frac{\text{C1 + C2 + I1 + I2}}{\text{Total Cases}}$	59.1%	40.0%	48.6%	50.0%	44.1%	48.8%
$\frac{\text{C2 + C3 + I2 + I3}}{\text{Total Cases}}$	0.0%	0.0%	2.7%	16.7%	0.0%	3.9%

cies. Of all currencies under consideration, 48.8 percent of the cases involve a situation in which the risk reduction approach favors a particular derivative asset, whereas efficient frontiers on the mean-Gini suggest otherwise. Moreover, this figure appears to be quite uniform across all currencies.

The case against the mean-variance approach in general is far from convincing. This can be seen from cases C2, C3, I2, and I3 in which the conclusion reached based on the efficient frontiers in the mean-variance framework is reversed based on the efficient frontiers in the mean-Gini framework. Of all currencies under consideration, a mere 3.9 percent gives rise to a reversal in the conclusions reached.

IV. CONCLUDING REMARKS

A new framework has been suggested in this study for the examination of the hedging effectiveness of futures and options. The new framework, mean-Gini, is unencumbered by the normality assumption of return distributions or quadratic utility funtion. A few observations emerge from this study regarding the usual approach of most empirical studies. Focusing on the minimum variance portfolio can lead to erroneous conclusions regarding the hedging effectiveness of financial derivatives. The likely reason is due to the crossing over of efficient frontiers at higher levels of returns. This should come as no surprise because the construction of the minimum variance portfolio does not require any expected return estimates. The positively sloped efficient frontier, on the other hand, relies on both expected returns and the variance-covariance structure.[5] The erroneous conclusion arises from discarding the useful information on the return characteristics of the assets under consideration. However, the mean-variance approach in general appears to be quite robust with respect to distributional requirements. The approach is inappropriate in only a few cases out of the 127 cases considered.

[5]See Merton (1972) for a proof.

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