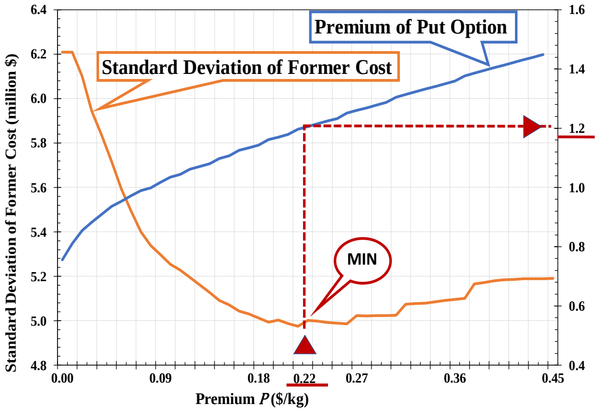

Fig. 9. Reduction of standard deviation of farmer cost and income

It can be seen that with increasing premium for the put option, the strike price at which the option provider can gain a certain profit increases; the standard deviation of the farmer cost for the premium rapidly declines to approximately \$0.18 and then gently rises when the premium takes a minimum value of approximately \$0.22.

With the premium at approximately \$0.18, the strike price was \$1.4 to \$0.8 and it was possible to suppress market price variation in this range. It can be seen, however, that when the premium exceeded \$0.22, variation in shipment amount arose, and conversely the farmer income varied. With well-balanced reduction of variations in market price and shipment amount, it was possible to obtain a price combination that most reduces farmer income variation.

6 Conclusion

Farmer income from potato sales and company cost for potato purchase together with the variation in market price interact with variation in shipment amount in a structure that has become unstable.

A farmer holding a put option can perform trading at the strike price if the market price falls below that and can avoid the risk of income instability due to variation in market price. If the strike price is set higher, then income from selling potatoes can be made more stable, but for the option provider to gain a certain income with the increased strike price, a higher premium must be set. The premium is paid per unit amount of potatoes traded, and therefore if the premium is priced high, variation in the shipment amount will affect the net income.

The company holding the call option can perform trading at the strike price if the market price exceeds it and thus avoid the risk of cost instability due to market price variability. If the strike price is set lower, then a higher possible stability of the cost of purchasing the potatoes can be obtained, but a higher premium must be set for the option provider to gain a certain income. As the premium is paid per unit amount of traded potatoes, a high premium with cause variation in shipment amount to affect the cost.

The advantage of the option proposed in this study is that it can reduce variation in both market price and shipment amount, which are causes of variation in net income. Reduction of variations in both market price by the strike price and in shipment amount by the premium stabilizes the costs to both the farmer and the company.

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