Comparison of Traditional Payment and Blockchain Payment Methods in the Same Payment Point

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Abstract. In recent years, with the acceleration of economic globalization, the development of blockchain economy is more and more rapid, which plays a huge role in the fields of supply chain finance, cross-border payment, insurance claims and so on. Digital currency, as the only mature application scenario of blockchain, has great research value. Based on newsvendor model and from the perspective of payer, this paper discusses the income of payer in traditional cross-border foreign exchange transfer and block chain economic ripple foreign exchange transfer, and analyzes the corresponding data. In the future, the opportunity cost of payer and the income from arbitrage will be considered.

Keywords: exchange rate; newsvendor model; payer's income; foreign exchange transfer.

1. Introduction

With the acceleration of economic globalization, China's foreign trade has continued to expand. As the most actively traded market in the world, the foreign exchange market has an average daily transaction volume of more than $5 trillion. As its total transaction data continues to increase, its risks are also increasing, not only with external risks, but also with internal risks. Foreign exchange risk refers to the fact that when a financial company, a business organization, a country or an individual trades abroad, the assets measured in foreign currencies may rise or fall due to exchange rate fluctuations in the foreign exchange market. Foreign exchange risk is generally divided into trading risk, conversion risk, economic risk and country risk. How to make better use of foreign exchange risk is a problem that multinational corporations must solve in order to develop their economy and obtain greater profits on a global scale.

Typically, multinational companies use sensitivity and scenario analysis to assess foreign exchange risk. In the sensitivity analysis, an output is evaluated for several values of an input (exchange rate) (for trading risk, it may be after-tax profit in local currency units).Sensitivity is estimated as the ratio of output change to input change. The scenario analysis uses different combinations of input values to calculate the output values of multiple scenarios. Several studies predict that all companies should be exposed to foreign exchange risk because their cash flows are directly or indirectly affected by exchange rate movements (Levi, 1994, Marston, 2001).

In the traditional cross-border remittance mode, banks will process payment transactions in batches at the end of the day. Banks need manual reconciliations, and remittances can take anywhere from a few minutes to a few days. For the payer, there is an opportunity cost that cannot be ignored. Moreover, in the process of cross-border remittance, each transaction needs to be transmitted between multiple institutions, and there are problems such as high intermediate costs, low payment efficiency, and centralized security risks.

In the field of digital finance, blockchain can improve financial efficiency and level in areas such as supply chain finance, cross-border payment, financial supervision, inclusive finance, and asset management. Digital currency, as the only mature application scenario of the current blockchain, has great research value. The decentized "I owe you" (IOU) trading network, Ripple, is gaining increasing attention as a fast, cost-effective and efficient way to perform the same and cross-currency payments. It can effectively overcome the drawbacks of traditional cross-border remittance models.

Ripple built a distributed digital payment network with no central nodes, using a distributed identity authentication and transaction technology similar to Bitcoin. Through the company's network, bank customers can achieve instant international transfers and support different currencies in different

countries. The international payment network built at Ripple consists of international payment sponsors, financial institutions, market makers and system integrators. The network is a good replacement for the current cross-border settlement system, providing a zero-resistance mechanism for cross-currency settlement.Financial institutions can accurately settle cross-border payments in just a few seconds, achieving low cost and high efficiency. Payment. According to Ripple's estimate, the cost per transaction between banks will drop from $5.56 to $2.21, a 60% reduction to 2016.

In 2016, the number of more than 3 billion payment-type messages completed by swift can save about $10 billion in 2016.

2. Variable Definition and Model Design

Assume that two countries with different currencies enter an industry. When the exchange rate between two currencies changes unexpectedly, there is a financial risk, which is called foreign exchange risk (or exchange rate risk). Transaction risk arises only if there is a time lag between the time of occurrence of the financial liability and the maturity date. This is because, if the debt is denominated in the receiving party currency, the purchase price paid to the buyer/retailer on the settlement date may be different from the price at the time of the occurrence.

In this paper, we default the payer to take full risk, and the demand error and exchange rate risk error are independent of each other. The relevant parameters and variables are shown in the following table:

Table 1. relevant parameters and variables

Wr: expected outflow per unit of the payer	w: the expected inflow of the payee settled in the payee currency the amount
q: the number of payer orders	v: product residual value
d: product demand	p: product sale price
z: inventory factor	t: required to pay per unit using the ripple platform Service fee

For the payer's income function, it will be divided into two cases: when the payer's order quantity q is greater than the market demand for the product d, the payer will sell the quantity d of the product at the price p, and the remaining unit quantity (q-d) will be treated with the residual value v, the total purchase cost of the product is wr. When the payer's order quantity q is less than the market demand for the product d, the payer sells the quantity q product, the product unit profit rate (p-wr), and because it does not meet market demand, the payer will pay a shortfall penalty of s per unit. p, s, v are all expressed in the payee currency.

Assume that the order quantity has a valid range [A, B], the average value is μ, the standard deviation is σ, the density function is f(x), and the distribution function is F(x).

(1) If addicitive errors,

The income function of the payer under the traditional mode is as follows.

$$E[\pi_r(p,q)]=(p-w_r)[g(p)+\mu]-(w_r-v)\Lambda-(p+s-w_r)\phi$$

Also, because $w_r=\dfrac{w(1+\varepsilon_r)}{r}$,

$$E[\pi_r(p,q)]=\{(p-w_r)[g(p)+\mu]-(w_r-v)\Lambda-(p+s-w_r)\phi\}\cdot(1-\theta)$$
$$=\{[p-\frac{w(1+\varepsilon_r)}{r}][g(p)+\mu]-[\frac{w(1+\varepsilon_r)}{r}-v]\Lambda-[p+s-\frac{w(1+\varepsilon_r)}{r}]\phi\}\cdot(1-\theta)$$

The payor's revenue function under the blockchain economic ripple foreign exchange transfer mode is:

$$E(\pi_r')=(p-\frac{w}{r})[g(p)+\mu]-(\frac{w}{r}-v)\Lambda-(p+s-\frac{w}{r})\phi-qt$$

Because $\Lambda=\int_A^z(z-\varepsilon)f(\varepsilon)d\varepsilon$ $\phi=\int_z^B(\varepsilon-z)f(\varepsilon)d\varepsilon$,Let $E(\pi_r)\geq E(\pi_r')$ the conclusions are as follows:

When $w\leq\dfrac{(g+z)rt}{\varepsilon_r\{g+\mu+AF(A)-BF(B)+(z+1)[F(B)-F(A)]\}}$, the payer gains more in traditional way.

(2) If multiplicative errors,

$$E[\pi_r(p,q)]=(p-w_r)\mu g(p)-(w_r-v)\Lambda g(p)-(p+s-w_r)\phi g(p)$$
$$=[p-\frac{w(1+\varepsilon_r)}{r}]\mu g(p)-[\frac{w(1+\varepsilon_r)}{r}-v]\Lambda g(p)-[p+s-\frac{w(1+\varepsilon_r)}{r}]\phi g(p)$$

Let $E(\pi_r)\geq E(\pi_r')$ the conclusions are as follows:

$$E(\pi_r')=(p-\frac{w}{r})\mu g(p)-(\frac{w}{r}-v)\Lambda g(p)-(p+s-\frac{w}{r})\phi g(p)-qt$$

When $w\leq\dfrac{zrt}{\varepsilon_r\{\mu+AF(A)-BF(B)+(z+1)[F(B)-F(A)]\}}$,the payer gains more in traditional way.

Next, this article considers another way of thinking about. How to make the income of the two under the traditional way and the blockchain financial trading platform the same. If the two benefits are the same, the optimal order quantity must be the same. From the initial model, the optimal order quantity in the traditional mode is $q*=\dfrac{p*+s-w_r}{p*+s-v}$, it is deduced that the optimal order quantity of payer under blockchain economy is $q*=\dfrac{p*+s-\frac{w_r\cdot r}{1+\varepsilon_r}}{p*+s-v}$.

When $\dfrac{r}{1+\varepsilon_r}=1$ that is, when the exchange rate is 1 and the exchange rate is not affected by time, under the two payment methods, the payer receives the same income.

3. Data Analysis

It is assumed that the payer bears all risks and the demand error and exchange rate risk error are independent of each other. Let p=5, s=1, w=2, v=1, ε_r=0.2, r=0.8, t=1, z=6, d=100, q have a value range of [50,150], g=150.

In order to influence the variable identification model on $\Delta E = E(\pi_r) - E(\pi'_r)$, The sensitivity analysis of exchange rate is discussed.

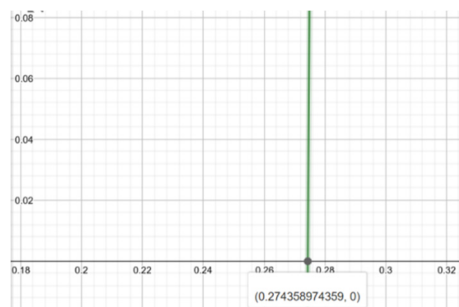(1) If addictive errors, ΔE=156r-42.8, the image is shown below.

Fig.1 the image

It can be seen from the figure that there is a linear positive correlation between ΔE and r. ΔE varies rapidly with r, sensitivity is higher and as r increases, ΔE also increases.

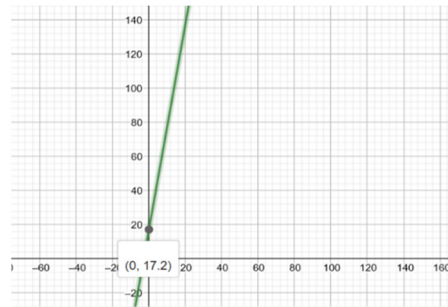(2) If multiplicative errors, ΔE=6r+17.2, the image is shown below.

Fig.2 the image

It can be seen from the figure that there is a linear positive correlation between ∆E and r, but in this case the sensitivity is lower than in the previous case. And ∆E is always greater than 0, as r continues to grow, the larger the payer's income is under the traditional mode.

4. Conclusion

This paper focuses on the income function of the payer under the two different scenarios of traditional cross-border foreign exchange and blockchain economic exchange. From the perspective of management, the payer's newsvendor model is studied. The foreign exchange transfer method that the payer should choose in different situations is given, and in-depth study of the impact of exchange rate changes on ∆E. The research results show that the default payer bears all risks, and the demand error and exchange rate risk error in the case where the differences are independent of each other, the payer has an optimal order quantity. When the exchange rate is 1 and the exchange rate is not affected by the time, Under the influence situation, the payers' incomes are equal under the two transfer methods, and there is a linear positive correlation between ∆E and r. In the future, the opportunity cost of the payer and the proceeds from the arbitrage will be considered.

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