International Financial Markets and Institutions

COMM 377

TRIAL MIDTERM WITH SOLUTIONS

Time allowed: **2.5 hours**

Instructions.

Before you begin read these instructions carefully.

There are nine questions in this examination.

Answer **all nine** questions in the spaces provided in this booklet. It is very important to allocate your time well, so remember to leave enough time to attempt all the questions.

You may use a hand-held calculator. You may not use a laptop.

Unless otherwise stated, all numerical answers should be accurate to 4 significant figures.

Show all your working and use very clear handwriting. **If the marker cannot read a solution, then it will earn zero marks. If you write your exam in pencil, you will not be able to have it regraded.**

This is a closed-book, closed notes examination.

There is a formula sheet at the end of the examination booklet.

If a piece of paper becomes detached from the examination booklet, write your name on it.

- FIRST NAMES
- SURNAME
- STUDENT NUMBER
- SECTION NUMBER

1. (18 marks)

   (a) What is an exchange rate (2 marks)
   It is how much you need of one currency to buy **1 unit** of another.

   (b) What is the direct quote convention? (2 marks)
   This is where we write down the number of units of home currency (HC) needed to buy 1 unit of foreign currency (FC) to get a quote of the form HC/FC.

   (c) Suppose that a computer costs USD 1000 in the US and GBP 1000 in the UK. The current spot rate is 0.5 GBP/USD. Tomorrow you fly from London to New York and you need a computer. Will you buy it in the UK or the US? (1 mark)
   US

   (d) A bank quotes the following rates: CHF/USD 2.5110-2.5140 and JPY/USD 245-246. What is the minimum JPY/CHF bid and the maximum ask cross rate that the bank would quote? (5 marks)

$$\begin{aligned}\left[\frac{JPY}{CHF}\right]_{bid} &\geq \left[\frac{JPY}{USD}\right]_{bid}\left[\frac{USD}{CHF}\right]_{bid} \\ &= 245 \times \frac{1}{2.5140} = 97.45, (4s.f.)\end{aligned}$$

$$\begin{aligned}\left[\frac{JPY}{CHF}\right]_{ask} &\leq \left[\frac{JPY}{USD}\right]_{ask}\left[\frac{USD}{CHF}\right]_{ask} \\ &= 246 \times \frac{1}{2.5110} = 97.97, (4s.f.)\end{aligned}$$

(e) Which of the following *best* describes what bid and ask rates are? (2 marks)

A The bid rate is the rate at which we can sell a currency to a bank and the ask is the rate at which we can buy. The bid rate will be lower than the ask rate so the bank makes money off the spread.

B The ask rate is the rate at which we can sell a currency to a bank and the bid is the rate at which we can buy.

C The ask rate is the rate at which we can sell a currency to a bank and the bid is the rate at which we can buy. The bid rate will be higher than the ask rate so the bank makes money off the spread.

D The ask rate is the rate at which a bank sells currency and the bid is the rate at which the bank is willing to buy. The bid rate will be higher than the ask rate so the bank makes money off the spread.

E The ask rate is the rate at which a bank sells currency and the bid is the rate at which the bank is willing to buy.

A, 2 marks
E, 1 mark

(f) Which of the following statements are true? (1 mark)

I Covered Interest Rate Parity implies that the forward exchange rate converges to the spot exchange rate as the delivery date for the forward contract approaches.

II Because the volume of trading on the spot market is greater than the forward, the spot rate drives the forward market.

III Covered Interest Rate Parity means that the foreign and domestic interest rates must be equal.

IV The causality implied by Covered Interest Rate Parity means that the forward rate can be predicted from the spot exchange rate and the foreign and domestic interest rates.

A I and II
B I and IV
C I
D II
E IV

C

(g) When the forward rate is higher than the spot, which one of the following alternatives is true? (1 mark)

A the forward is trading at a discount
B the spot rate will rise
C the forward is trading at a premium
D the spot rate will fall
E there is an arbitrage opportunity

C

Use the following information for sections 1(h) to 1(k). You read in the newspaper that yesterday's spot quote was CAD/GBP 2.20-2.23

(h) This is a quote for which currency? (1 mark)

A US Dollar
B Canadian dollar
C British Pound
D Irish Pound
E Euro

C

(i) Which of the following is the bid rate for GBP? (1 mark)

A 2.23
B 1/2.23
C 1/2.20
D 2.215
E 2.20

E

(j) Which of the following is the ask rate for GBP? (1 mark)

A 2.23
B 1/2.23
C 1/2.20
D 2.215
E 2.20

A

(k) Which of the following is the bid rate for CAD? (1 mark)

A 2.23
B 1/2.23
C 1/2.20
D 2.215
E 2.20

B

2. Consider two investors. The first investor obtains utility $u_1(x) = 2x^{1/2}$ from HC x and the second investor obtains utility $u_2(x) = 3x^{1/3}$ from HC x.

   Both investors face the following gamble:

   Tossing a fair coin and receiving HC 200 for heads and HC 0 for tails.

   (a) Compute the certainty equivalent of this gamble for each investor [6 marks]

   Investor 1:

   Expected utility from gamble

   [1 mark]

$$\frac{1}{2}2(200)^{1/2}$$

   [1 mark for working, 1 mark correct answer]

$$\begin{aligned} u_1(CEQ) &= \frac{1}{2}2(200)^{1/2} \\ 2\sqrt{CEQ} &= \sqrt{200} \\ CEQ &= \frac{200}{4} = 50 \end{aligned}$$

   Therefore certainty equivalent of investor 1 is HC 50

   Investor 2

   Expected utility from gamble

   [1 mark]

$$\frac{1}{2}3(200)^{1/3}$$

   [1 mark for working, 1 mark correct answer]

$$\begin{aligned} u_1(CEQ) &= \frac{1}{2}3(200)^{1/3} \\ 3(CEQ)^{1/3} &= \frac{1}{2}3(200)^{1/3} \\ CEQ &= \frac{200}{8} = 25 \end{aligned}$$

   (b) Which investor is more risk averse? [2 marks]

   The second investor has a lower certainty equivalent, so he is the more risk averse.

   (c) Consider an investor who has utility $u(x) = \frac{x^{1-\gamma}}{1-\gamma}$ from x USD. Suppose $\gamma = 10$ and the investor faces a gamble where she either receives 10 million USD or 2 USD. The probability of her receiving 2 USD is 0.000000001.

   1. What is the investor's certainty equivalent for this gamble? [3 marks]

      [2 marks, working]

$$\begin{aligned} u(c) &= (1-0.000000001)u(10M) + 0.000000001 \times u(2) \\ \frac{c^{1-\gamma}}{1-\gamma} &= (1-0.000000001)\frac{(10M)^{1-\gamma}}{1-\gamma} + 0.000000001 \times \frac{2^{1-\gamma}}{1-\gamma} \\ c &= 15.49 \end{aligned}$$

      [1 mark, correct answer]

   2. What is the investor's risk-adjusted probability of receiving 2USD? [2 marks]

      [1 mark, working]

$$\begin{aligned} (1-q)10M + q2 &= 15.49 \\ q &= 0.999999 \end{aligned}$$

      [1 mark, correct answer]

3. Based on your answer to this question, what do you think would be the impact on asset prices of a rare disaster, such as a 10% drop in GDP with an estimated probability of occurrence of 1/1000? [2 marks]

(d) (10 marks)

Now consider an investor who obtains utility $u(x) = -e^{-ax}$ from HC x, where $a > 0$. This investor receives the random payoff (or gamble) HC $\widetilde{y}$, where $\widetilde{y}$ is normally distributed with mean μ and variance σ^2, i.e. $\widetilde{y} \sim N[\mu, \sigma^2]$.

Find the investor's certainty equivalent for this gamble. [8 marks]

The certainty equivalent is $\delta_{\widetilde{y}}$. Hence

$$E[-e^{-a\widetilde{y}}] = -e^{-a\delta_{\widetilde{y}}}$$

[1 mark]

$$E[e^{-a\widetilde{y}}] = e^{-a\mu+\frac{1}{2}a^2\sigma^2}$$

[4 marks for correct answer, 1 mark for something close]

Therefore

$$\begin{aligned} e^{-a\mu+\frac{1}{2}a^2\sigma^2} &= e^{-a\delta_{\widetilde{y}}} \\ -a\mu + \frac{1}{2}a^2\sigma^2 &= -a\delta_{\widetilde{y}} \\ \delta_{\widetilde{y}} &= \mu - \frac{1}{2}a\sigma^2 \end{aligned}$$

[3 marks for correct answer, 1 mark for something close]

Give a brief explanation of your result. As part of your explanation, give a sensible interpretation of the parameter $a > 0$. [2 marks]

As a increases, the certainty-equivalent decreases. The quantity a is a measure of the agent's risk aversion.

[You will need to use the following facts. If $\widetilde{y} \sim N[\mu, \sigma^2]$, then $a\widetilde{y} \sim N[a\mu, a^2\sigma^2]$, and $E[e^{\widetilde{y}}] = e^{\mu+\frac{1}{2}\sigma^2}$.]

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3. Use the following spot rate data for this question

CAD/EUR	1.5691-1.5698
JPY/EUR	136.50-136.56
CAD/USD	1.2431-1.2440

Compute the following:

(a) The USD/CAD bid rate [1 mark]

$\frac{1}{1.2440} = 0.8039$

(b) The JPY/USD ask rate (to 5.s.f) [6 marks]

If I buy 1 USD how many JPY do I pay?
You pay 1.2440 CAD to get 1 USD
You pay $\frac{1}{1.5691} = .6373$ EUR to get 1 CAD
You pay $\frac{1}{1.5691} \times 1.2440$ EUR= 0.7928 EUR to get 1.2440 CAD
You pay $136.56 \frac{JPY}{EUR} \times 0.7928$ EUR=108.3 JPY to get 0.7928 EUR
Therefore the JPY/USD ask rate is 108.27
[5 marks for working, 1 mark for correct answer]

4. Suppose you sell at t=0, a 2 month GBP forward contract for $F_{0,2} = CAD/GBP$ 2

   Per annum interest rates are as follows: $r_{0,1} = 9\%, r_{0,2} = 10\%, r_{1,2} = 11\%, r^*_{0,1} = 6\%, r^*_{0,2} = 7\%, r^*_{1,2} = 8\%$

   (a) What is the value of your position at t=1 month, if the 1 month forward rate at t=1 month is $F_{1,2} = CAD/GBP$ 1.90? [4 marks]

   [1 marks for stating cashflows] If you sell a GBP forward contract you sell 1GBP and receive CAD $F_{0,2}$

   The present value of these cashflows at 1 month in CAD terms will be

$$\begin{aligned} GBP\ 1 \times \left(\frac{F_{0,2}}{1+r_{1,2}} - \frac{F_{1,2}}{1+r_{1,2}} \right) \frac{CAD}{GBP} &= CAD \times \frac{F_{0,2} - F_{1,2}}{1+r_{1,2}} \\ &= CAD \frac{2 - 1.9}{1 + \frac{.11}{12}} \\ &= CAD\ 0.09909 \end{aligned}$$

   [2 marks for discounting cashflows correctly, 1 mark for the correct answer]

   (b) What is the value of the spot rate at t=0? [3 marks]

$$\begin{aligned} F_{t,T} &= S_t \frac{1+r_{t,T}}{1+r^*_{t,T}}, \text{ [1 mark]} \\ \frac{CAD}{GBP} 2 &= S_0 \frac{1 + \frac{.1}{6}}{1 + \frac{.07}{6}} \\ S_0 &= \frac{CAD}{GBP} 2 \frac{1 + \frac{.07}{6}}{1 + \frac{.1}{6}} \text{ [1 mark]} \\ &= \frac{CAD}{GBP} 1.990 \text{ [1 mark]} \end{aligned}$$

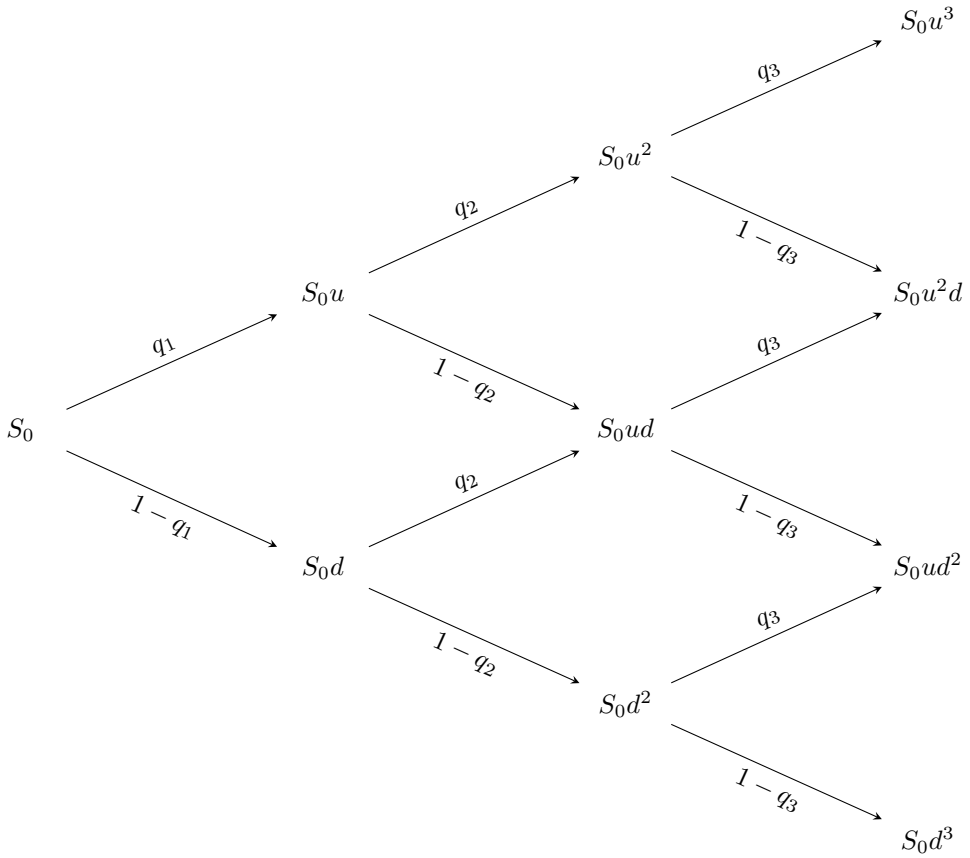
(c) Is the the 2 month GBP forward trading at a premium or a discount? [1 mark]

Premium

(d) What is the 2 month CAD/GBP swap rate? [1 mark]

$\frac{CAD}{GBP}0.009836$

5. The current, i.e. date 0 USD/GBP spot price is denoted by S_0. The USD/GBP spot price is assumed to evolve such that it can only move up or down each month, as shown in the binomial tree below:



You are given the following USD/GBP forward rates and USD interest rates

Maturity	Forward Rate	USD LIBOR rate, p.a.
1 mth	$F_{0,1}$	$r_{0,1}$
2 mth	$F_{0,2}$	$r_{0,2}$
3 mth	$F_{0,3}$	$r_{0,3}$

Suppose that $d = 1/u$.

(a) Write down a set of equations you can use to solve for q_1, q_2, and q_3 [9 marks]
No arbitrage implies that

$$
\begin{aligned}
F_{0,1} &= E_0^{\mathbb{Q}}[\tilde{S}_1] = q_1 S_0 u + (1-q_1) S_0 d \ [2marks] \\
F_{0,2} &= E_0^{\mathbb{Q}}[\tilde{S}_2] = q_1 q_2 S_0 u^2 + [q_1(1-q_2) + (1-q_1)q_2] S_0 ud \\
&\quad + (1-q_1)(1-q_2) S_0 d^2 \ [3marks] \\
F_{0,3} &= E_0^{\mathbb{Q}}[\tilde{S}_3] = q_1 q_2 q_3 S_0 u^3 \\
&\quad + [q_1 q_2 (1-q_3) + q_1 (1-q_2) q_3 + (1-q_1) q_2 q_3] \, S_0 u^2 d \\
&\quad + [q_1 (1-q_2)(1-q_3) + (1-q_1)(1-q_2) q_3 + q_1 q_2 (1-q_3)] \, S_0 u d^2 \\
&\quad + (1-q_1)(1-q_2)(1-q_3) S_0 d^3 \ [4marks]
\end{aligned}
$$

(b) Find the date-0 prices of the following Arrow-Debreu claims:

1. The Arrow-Debreu security which pays off 1 USD when the USD/GBP spot rate in 3 months time equals S_0u^3 and zero otherwise [2 marks]

$$\frac{1\,USD}{1+r_{0,1}}q_1q_2q_3$$

2. The Arrow-Debreu security which pays off 1 USD when the USD/GBP spot rate in 3 months times equals S_0u^2d and zero otherwise [3 marks]

$$\frac{1\,USD}{1+r_{0,1}}\left[q_1q_2(1-q_3)+q_1(1-q_2)q_3+(1-q_1)q_2q_3\right]$$

3. The Arrow-Debreu security which pays off 1 USD when the USD/GBP spot rate in 3 months times equals S_0ud^2 and zero otherwise [3 marks]

$$\frac{1\,USD}{1+r_{0,1}}\left[q_1(1-q_2)(1-q_3)+(1-q_1)(1-q_2)q_3+(1-q_1)q_2(1-q_3)\right]$$

4. The Arrow-Debreu security which pays off 1 USD when the USD/GBP spot rate in 3 months times equals S_0d^3 and zero otherwise [2 marks]

$$\frac{1\,USD}{1+r_{0,1}}(1-q_1)(1-q_2)(1-q_3)$$

(c) Find the date-0 price in USD of a 3mth European call option on 1 USD with a strike of K USD/GBP, where $S_0d^3 < K < S_0ud^2$ [3 marks]

$$\begin{aligned}&\frac{S_0ud^2-K}{1+r_{0,1}}\left[q_1(1-q_2)(1-q_3)+(1-q_1)(1-q_2)q_3+(1-q_1)q_2(1-q_3)\right]\\&+\frac{S_0u^2d-K}{1+r_{0,1}}\left[q_1(1-q_2)(1-q_3)+(1-q_1)(1-q_2)q_3+(1-q_1)q_2(1-q_3)\right]\\&+\frac{S_0u^3-K}{1+r_{0,1}}q_1q_2q_3\end{aligned}$$

6. (10 marks)You would like to buy CAD 1M, 12 months forward in exchange for USD. The current 12 month forward rate is USD/CAD 0.8, the 12 month CAD riskless rate is 5% p.a. and the 12 month USD riskless rate is 6% p.a.

(a) What is the current value of the above forward contract? [1 mark]
Zero

(b) Suppose you cannot trade forward contracts directly. How would you replicate the above forward contract? [9 marks]

You need replicate a receipt of 1M CAD, 12 months from now and a payment of 0.8M USD, 12 months from now.
Lend the present value of 1M CAD:

$$\begin{aligned} & CAD\frac{1M}{1+5\%} \text{ [1 mark]} \\ = \quad & CAD0.9524 \text{ [1 mark]} \end{aligned}$$

Borrow the present value of 0.8M USD:

$$\begin{aligned} & USD\frac{0.8M}{1+6\%} \text{ [1 mark]} \\ = \quad & USD0.7547 \text{ [1 mark]} \end{aligned}$$

Therefore in 12 months
Receive

$$\begin{aligned} & CAD\frac{1M}{1+5\%}(1+5\%) \text{ [1 mark]} \\ = \quad & CAD1M \text{ [1 mark]} \end{aligned}$$

Pay

$$\begin{aligned} & USD\frac{0.8M}{1+6\%} \times (1+6\%) \text{ [1 mark]} \\ = \quad & USD0.8M \text{ [1 mark]} \end{aligned}$$

[1 mark for anything legible]

7. (13 marks) State the Covered Interest Parity Relationship . Give a numerical example where CIP holds. Prove that CIP holds using no-arbitrage arguments.

$$F_{t,T} = S_t \frac{1 + r_{t,T}}{1 + r^*_{t,T}}$$

[2 marks]

3 marks for a correct numerical example.

8 marks for a correct proof

8. (12 marks) Consider a closed-economy, which produces output Y, which is either consumed by households (C), purchased by the government (G) or used for investment by firms (I).

   (a) Write down the relationship between output and the other variables [1 mark]

   $Y = C + G + I$

   (b) How is national savings (S) defined? Derive an expression for national savings in terms of investment.[2 marks]

   [If final soln is wrong, 1 mark for working]

$$\begin{aligned} S &= Y - (C + G) \\ &= I \end{aligned}$$

   (c) Now consider an open-economy. How do your two previous answers change? [2 marks]

   [If final soln is wrong, 1 mark for working]

$$\begin{aligned} Y &= C + G + I + B_C \\ S &= Y - (C + G) \\ &= I + B_C \end{aligned}$$

   (d) Suppose there are two countries in the world: Ruritania and Citovia. Ruritania has a current account deficit—its current account balance is RRD –200. Ruritania's investment expenditure is RRD 500. What proportion of Ruritania's investment expenditure is funded by non-Ruritanians? [2 marks]

[1 mark for dividing 200 by 500, 1 mark for correct answer]

$$\frac{200}{500} = 40\%$$

(e) The following table gives the average ratio of the absolute value of the current account to investment expenditure in Australia, New Zealand, Canada during the period 1870-1914.

Country	Australia	New Zealand	Canada
$\lvert B_c \rvert / I$	24%	34%	35%

During the 1980's the average ratio of the absolute value of the current account to investment expenditure in developing countries was 3%.

Was capital mobility between developing countries and the rest of the world in the 1980's higher or lower than capital mobility between Australia, New Zealand, Canada and the rest of the world during the period 1870-1914? Justify your answer. [5 marks]

[5 marks available but there are 6 points which can be made–each is worth a mark.]

From

$$S = I + B_C \text{ [1 mark]}$$

it follows that

$$I = S - B_C, \text{[1 mark]}$$

so a country which a current account deficit can fund investment using savings from other countries, [1 mark]

The proportion of investment funded using the savings of foreigners is

$$\frac{|B_C|}{I}.\text{[1 mark]}$$

When capital is more mobile, countries are more able to fund investment using foreigners' savings, so $\frac{|B_C|}{I}$ will be higher [1 mark]

Therefore, capital mobility between developing countries and the rest of the world in the 1980's was lower than capital mobility between Australia, New Zealand, Canada and the rest of the world during the period 1870-1914.[1 mark]

9. Explain briefly what the J-curve effect is. (It may be useful to draw a graph.) [5 marks]

Marks are available as follows up to a max of 5.

When CAD weakens against the currencies of Canada's major trading

partners the following occurs:

Imports becomes more expensive[1 mark] and exports become cheaper [1 mark]. That decreases the trade balance [1 mark]. But over time, importers start to import less [1 mark] and exporters export more [1 mark], increasing the trade balance.[1 mark]

[2 marks for correct graph (see lecture notes)–ask me and I will draw it for you and email you]

END OF EXAM
The next page is a formula sheet.

Formulae

$$\begin{aligned} Var\left(\widetilde{X}\right) &= E\left\{\left[\widetilde{X}-E\left(\widetilde{X}\right)\right]\right\}^2 \\ &= E\left(\widetilde{X}^2\right)-E\left(\widetilde{X}\right)^2 \\ Cov\left(\widetilde{X},\widetilde{Y}\right) &= E\left\{\left[\widetilde{X}-E\left(\widetilde{X}\right)\right]\left[\widetilde{Y}-E\left(\widetilde{Y}\right)\right]\right\} \end{aligned}$$

$$Var\left(a\widetilde{X}\right)=a^2Var\left(\widetilde{X}\right)$$

$$Var\left(\widetilde{X}+\widetilde{Y}\right)=Var\left(\widetilde{X}\right)+2Cov\left(\widetilde{X},\widetilde{Y}\right)+Var\left(\widetilde{Y}\right)$$

$$\begin{aligned} Cov\left(a\widetilde{X},\widetilde{Y}\right) &= aCov\left(\widetilde{X},\widetilde{Y}\right) \\ Cov\left(\widetilde{X},b\widetilde{Y}\right) &= bCov\left(\widetilde{X},\widetilde{Y}\right) \end{aligned}$$

If $\tilde{x}\sim N[\mu,\sigma^2]$, then $E[e^{\tilde{x}}]=e^{\mu+\frac{1}{2}\sigma^2}$