Documentation: oTreeZTS

Quick Demo

This section shows how to quickly run a demo session of the oTree ZTS application, which is intended only for demonstration purposes. For an experiment we need to set up a session.

1. Open the following URL in a browser: https://zts.otree.ethz.ch/
2. Click on the “ZTS” button to open a demo session
3. Click on the provided link under Single-use links and the session should start in a seperate tab.

Setup & Installation

These instructions will get you a copy of the Zurich Trading Simulator project up and running on your local machine for development and testing purposes.

Python Installation

Make sure that the following Python version (3.7.x) is installed on your machine before continuing with the next steps. We have realised that there might be problems installing the correct oTree distribution with newer or older Python versions for some reasons. Find out if a Python version is installed by issuing the following command in the terminal and checking the response:

```
$ python --version
Python 3.7.5
```

If Python is not yet installed follow the steps for your specific operating system listed on the following website:
https://realpython.com/installing-python/

oTree Installation

Follow the instructions on the oTree Documentation website to install the 3.0.1 version of oTree on your working machine: https://otree.readthedocs.io/en/latest/install.html. Again try to use version 3.x in order to avoid any incompatibility issues.
pip3 install

Download Source Code

Download the zip of the source code of the Zurich Trading Simulator (oTreeZTS) on github (https://github.com/Zurich-Trading-Simulator/OtreeZTS) by clicking on Code/Download ZIP. Extract the ZIP file into your working location (/Documents/ or wherever you prefer). People that are familiar with github should instead just clone the repository to their working directory.

Alternative: Download the .otreezip file of the oTreeZTS directly on the oTreeHub (https://www.otreehub.com/projects/otree-zts/) into your working directory and unzip it using the following command:

```
$ otree unzip /path/to/workingdirectory/otree-zts.otreezip
```

Starting Application on local testing server

To start the application locally for development and testing purposes follow the steps listed below:

1. Open your terminal and change to the oTreeZTS directory we set up previously.

```
$ cd /path/to/workingdirectory/otreeZTS/
```

2. Install the python dependencies required for the application by running the following command. This will install the python libraries that contain functions the code is using.

```
$ pip install -r requirments_base.txt
```

3. Start the application on a local testing server with the following command:

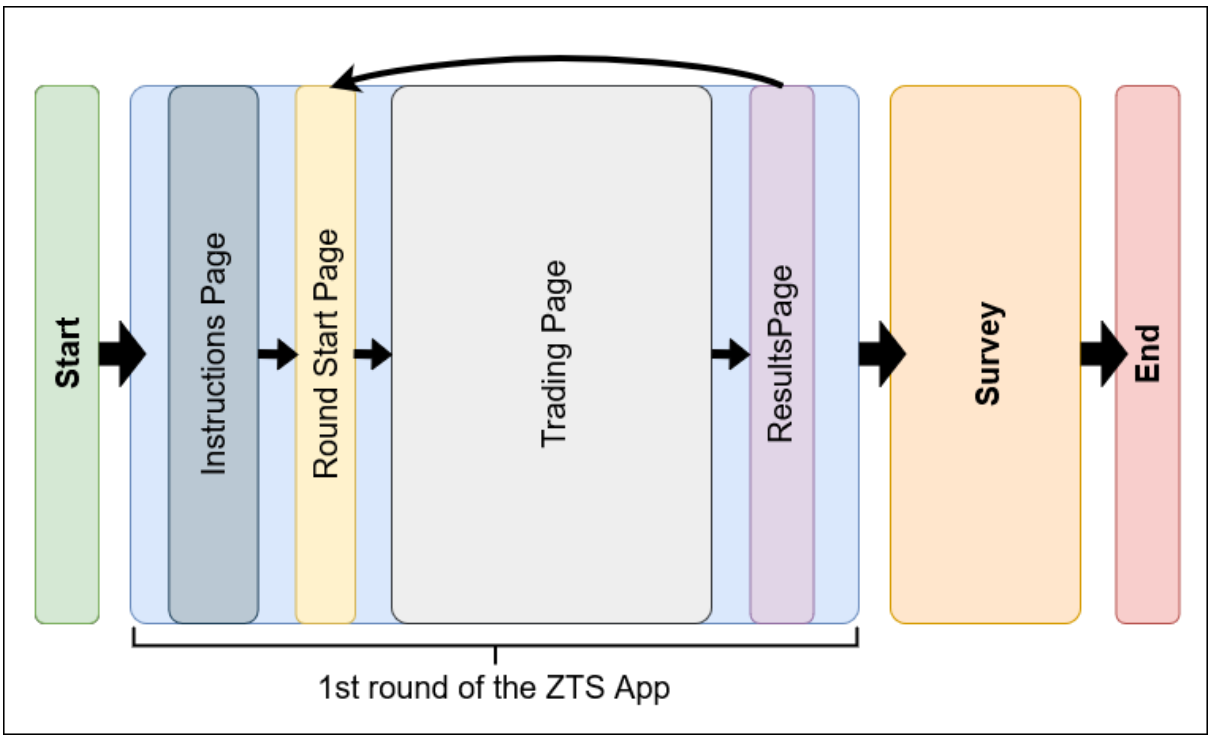
```
$ otree devserver
```

4. Open your browser to http://localhost:8000/ and the application should appear.

When you make changes to the code, save the changes with `ctrl + s` and the running application in the browser will automatically adjust.

User Guide

In this section we will look at how a participant should play the apps of the oTreeZTS experiment and how the interface is set up. The oTreeZTS consists of two apps, the actual ZTS (trading) app and the Survey. In oTree an app is just a programmatically independent module of the entire experiment. The ZTS app can consist of multiple rounds, you can set the number of rounds in the session configurations as shown here. In each round the player's holdings are reset to the initial endowment.



ZTS App

Instructions Page

The session participation links will redirect you directly to this page. It is currently empty, but is intended to be filled with instructions for the participants to clarify the setup and workflow of the experiment. Text can be added to this page under `/ZTS/templates/ZTS/InstructionPage.html`

The Instructions Page is only displayed at the start of the first round, in later rounds it will not be shown again.

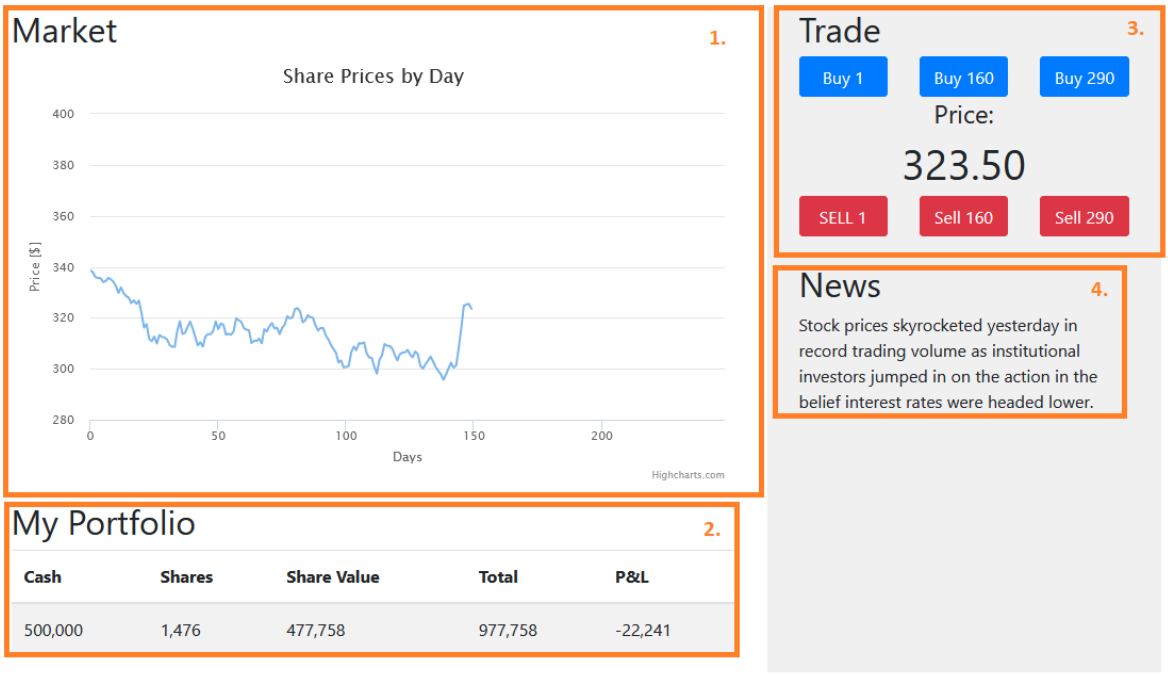
Start Page

This page shows which round we are in and serves as a preparation page before this round's trading game starts. To alternate the text shown in this page edit `/ZTS/templates/ZTS/StartPage.html`

Trading Page

On the trading page the actual trading game takes place, each participant sees a period of fictional or historical prices of a single share or an index. At the beginning, the share prices of the first day are shown and after the refresh_rate the share prices of the second day are added and so on. Each day the player can buy or sell shares according to his holdings and the current share price.
His **holdings** are set up in the following way: With one half of his initial cash endowment as much assets as possible are bought to balance out the holdings in cash and actual shares.

It is only possible to buy/sell full shares (minimum buy is 1 share), we do not provide the possibility to trade with partitions of assets.



1. **Prices Chart:** The chart shows the prices from day zero until the current day and after the time period of the refresh_rate it gets updated with a new price. It helps the player to understand how the asset has evolved in the past and makes it possible to make predictions on its future course.
2. **Portfolio:** In the portfolio we have metrics on the holdings and the current trading performance. It helps the player to assess how well his/her strategy is working up to this point in time.
3. **Trading Interface:** This panel is used for the buying and selling of shares. There are three buttons with different quantities for both the buying and the selling actions. The quantities are evaluated before the start of the game by the following rules:
    a. The buy and sell buttons on the left always have the quantity one.
    b. The buy and sell buttons in the middle correspond to roughly 10% of the maximum shares that could be bought with the cash at the start of the game (corresponds to half of the initial endowment, as we buy shares with the other half). We say roughly here, as we try to make them nice values (divisible by 10 if possible)
    c. The buy and sell buttons on the right correspond to roughly 20% of the maximum shares that could be bought with the cash at the start of the game. Again here, we try to make the values divisible by 10 if possible.
4. **News Panel:** If the time series file lists a column that provides news related to the market situation at some days, this will be shown in the news panel. The goal of it is to give the players further relevant information on the shares other than just the past prices. The news panel can hold up to 500 characters, so make sure the texts in the time series file are limited to this constraint.

Results Page

This page shows the final portfolio and performance metrics of the current round.

Survey

The survey part consists of a single page with a “Proceed to Survey” button that redirects the players to a survey under the link specified in survey_link from the session configurations. The survey can also be directly implemented in oTree, however we found it more useful to use an elaborate survey software (e.g. qualtrics).

Administrator Guide

In this guide we will mainly cover the specific administrative functionalities for the oTreeZTS application, but we will also look at some basic oTree functionalities. However, to find more in-depth information on the oTree features please visit https://otree.readthedocs.io/.

oTree basics

Overview

In oTree, a **session** is another word for the entire experiment using the same or at least similar application configurations. An example of a session in the case of the oTreeZTS would be:

“A number of participants will come to the lab to play several rounds of the ZTS trading game, followed by a questionnaire. Participants get paid some amount of money for showing up, plus their earnings from the games.”

A session is a series of **subsessions**; subsessions are the “sections” or “modules” that constitute a session. For example, in our case each trading round and also the post task questionnaire would be a seperate subsession.

Each subsession can be further divided into **groups** of players; for example, you could have a subsession with 30 players, divided into 15 groups of 2 players each.

In oTree, the terms “**player**” and “**participant**” have distinct meanings. The relationship between participant and player is the same as the relationship between session and subsession: A player is an instance of a participant in one particular subsession. A player is like a temporary “role” played by a participant. A participant refers to the same physical person during the whole session, he can be player 2 in the first subsession, player 1 in the next subsession, etc.

Setup a Session

To set up an experiment session follow the below steps:

1. Click on “Sessions” on the navigation bar on the top of the startpage.

2. Click on “Create New Session” or click on an existing session to continue with an existing experiment.
3. Choose the “ZTS” session config and type in the desired number of participants. The session config specifies the course of the experiment, namely Trading Game -> Survey, but we can also choose the Survey in the beginning by adding a new session config. You can find detailed instructions on how to do this here.
4. On the same page click on “Configure Session” and change the default configurations as desired. You can find A full list of the configurations and their meaning here.
5. Click on “Create”

Now you will be redirected to the Session Menu, where you will be able to see the session links that can be used to distribute to the participants to start the experiment. You can find more information on the Session Menu here.

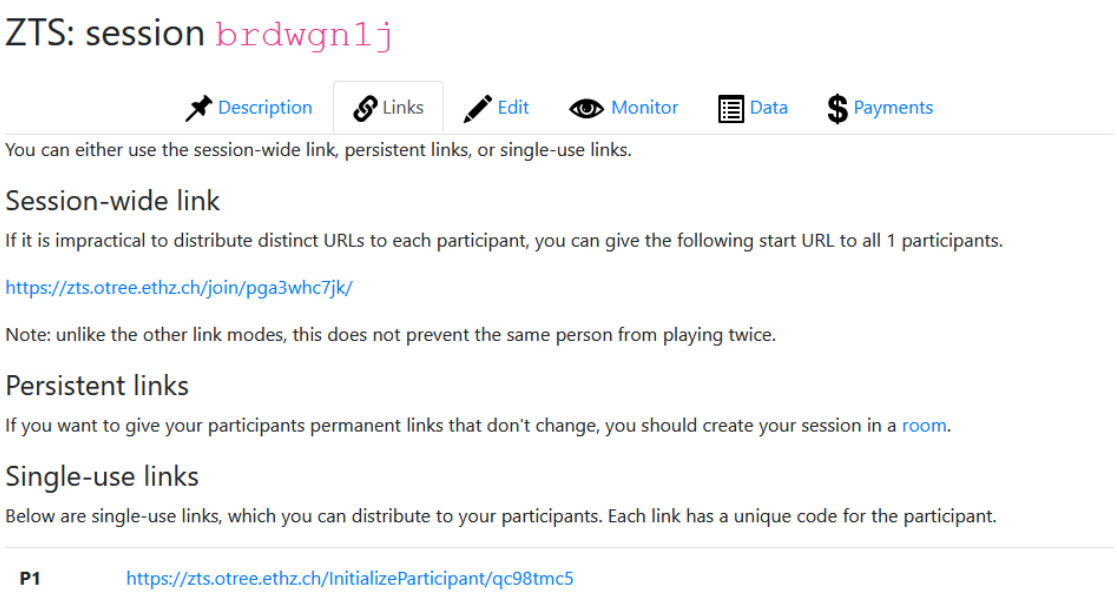
Setup a Room

OTree offers the possibility to open virtual experiment rooms, that offer some additional features than normal sessions:

- Links that you can assign to participants or lab computers, which stay constant across sessions
- A “waiting room” that lets you see which participants are currently waiting to start a session.
- Short links that are easy for participants to type, good for quick live demos.

More information on Rooms and how to set them up you can find on the oTree documentation: https://otree.readthedocs.io/en/latest/rooms.html.

Session Menu



- **Description:** provides a description of the sequence of apps (e.g. ZTS, Survey) and some additional information on each of thes apps.
- **Links:** On this page the experiment start links for the participants are listed. There are 3 types of links that are shown:
    - **Session-wide link:** A single link that can be used by all the participants to open their experiment. It will automatically redirect each participant to a new oTree Participant. This makes link distribution much simpler in some cases, but unlike the other link modes, this does not prevent the same person from playing twice
    - **Persistent links:** permanent links that persist over time, this feature is only enabled when inside a room. You can find more information on Rooms and persistent links here.
    - **Single-use links:** A list of single-use links, each one of them has a unique code for the corresponding participant.
- **Edit:** This page lets you edit some of the configurations for this session also after its creation.
- **Monitor:** On this page an experiment administrator can monitor the experiment including the status and progress of each participant. It also allows you to enforce a page advancement for particularly slow participants.
- **Data:** Here you can track the live experiment data during the session, this is very useful for debugging.
- **Payments:** Here you have a report of the payments, each participant has earned during this experiment. You can find more information on how the payoff is calculated or how this calculation can be altered in here.

ZTS Specific

Experiment Data

To download the experiment data click on “Data” on the navigation bar on the top of the startpage. For each App (ZTS, Survey) you can click on “Excel” (.xlsx) or “Plain” (.csv) to get a data file in the respective format that contains the entire data for each round of the app. For the ZTS app there is an additional data report, that contains the trading actions (BUY, SELL, START, END, HOLD) and related data to the actions such as timestamp, which participant, how much he/she bought/sold. To open the trading action report click on the preferred file format under ZTS (custom):

- **BUY:** A participant bought an amount of shares.
- **SELL:** A participant sold an amount of shares.
- **HOLD:** A participant did not perform any action during this specific simulated market day.
- **START:** Marks a start of a round in the Trading game (day 0).
- **END:** Marks an end of a round in the Trading game (last day).

Note: In oTree the data reports usually contain the data of all sessions, when trying to access the data of a single session one needs to filter according to the session!

The oTree standard data fields and their meaning can be looked up in the oTree documentation (https://otree.readthedocs.io/en/latest/models.html). In the following there is a list of the data fields from both reports that are ZTS specific:

cash	The amount of cash a player has
shares	The amount of shares a player has
share_value	The amount of cash the holded shares are worth
portfolio_value	The worth of the holded portfolio (= cash + share_value)
pandl	Profits & losses of the current round
action	Trading Action (BUY, SELL, HOLD, START, END)
quantity	If current action is a BUY or SELL, this specifies the amount of bought/sold shares
owned_shares	The amounf of shares a player has (= shares), the “owned” prefix is added for clarification in the custom report.
cur_day	The market day, the action took place in
asset	Asset name (configurable in session configurations)
roi	Return of investment, percentage of portfolio_value at end w.r.t portfolio_value at start

Session Configurations

Each session can be customized to specific experiment settings at creation. In this section you will find a list of the configurable parameters and their meaning, instructions on how to change the time series file that determines the daily asset prices and some other configurability options listed such as changing your app sequence.

List of Configuration Parameters

session_name	The name of the session
survey_link	Link to your possession survey (e.g. www.qualtrics.com/)
timeseries_file	Name of the timeseries file you want to use in this session. Only use the stem of the filename here! E.g. for the timeseries files demo_1.csv, demo_2.csv, etc. type in “demo”. The underscore, round number and file ending will be added automatically by ZTS.
num_rounds	How many rounds of the ZTS app you want to run

refresh_rate	Duration of one market day in ms
initial_cash	Initial cash endowement for each round (at round start half of the cash is invested in assets automatically)
random_round_payoff	If set to true, payoff will not be accumulated from all rounds but only from a single random round
training_round	If set to true, the first round will be in practice mode, meaning that the payoff of this round will not count towards the final payoff.
real_world_currency_per_point	The conversion rate used to get the converted payoff by multiplying it to the normal payoff

Change Time Series File

The time series file specifies the daily market prices and the news that are displayed in the trading game. To change this time series files follow the below instructions:

- **File Location:** The time series files are located under: `/_static/ZTS/timeseries_files/`

- **Replace or Add:** You can either replace the default files “demo_1.csv, demo_2.csv, demo_3.csv” by your custom ones or add new files to the folder with a different name and change the value of “timeseries_file” from “demo” to your own in the session configurations. By adding files you can e.g. create two experiment sessions that use different time series files.

- **File Naming**: Make sure the naming of the files is consistent, with what ZTS expects, namely “demo” (or your own name set in the configs) + “_[roundnumber]” + “.csv”. Also make sure there is a file for each round otherwise the application will fall into an error state.

- **File Format:** Make sure the files follow the same format as the default files, specifically they must both contain a column “AdjustedClose” (asset day prices) and a column “News” (the news displayed in the trading app). The column “Date” is not required but can provide some information for yourselves. The file format should be .csv with a “,” as delimiter.

Adjusting App Sequence

The default app sequence is set to ZTS -> Survey, however this can be adjusted to e.g. Survey -> ZTS. To adjust the app sequence add a new Session_Configs under `/settings.py` by adding the code signalled with the ###.

```
SESSION_CONFIGS = [
    dict(
```

```
        name='ZTS',
        num_demo_participants=1,
        app_sequence=['ZTS', 'Survey']
    ),

    ##################################################################
    #### Add the following Lines to add a new session config ####
    dict(
        name='ZTS_new'
        num_demo_participants=1,
        app_sequence=['Survey', 'ZTS']
    ),
    ##################################################################
]
```

Payoff

The payoff is the amount of money a player will be paid in the end. While the ZTS application will take over the entire payoff calculation for you, the payments still have to be done by yourselves. Remember that if training_round is set to true in the session configurations, the first round will have no effect on the final payoff. There are two methods for the payoff of the ZTS, it can be switched between these two methods through “Configure Session” at Session creation:

- **Random Round Payoff:** the payoff will be chosen from a random round (not training round).
- **Accumulated Payoff:** the payoff will be an accumulation of the payoffs of all rounds. This mode is applied if random_round_payoff is not enabled in the session configurations.

How is each round's payoff calculated in detail?
Remember: Player is an oTree object for a person in a single round while Participant represents the same person across all rounds. Each player has a payoff field. Participant.payoff automatically stores the sum of payoffs from all subsessions (if random_round_payoff is not selected).

In the ZTS the players payoff (meaning the payoff of a participant in a single round) is calculated as the **portfolio_value** at the end of the round (cash + share_value).

At the end of the experiment, a participant's total profit is calculated as follows:

$$total\,profit = participant.payoff * real\_world\_currency\_per\_point + participation\_fee$$

How to change the payoff calculation?

To manipulate the payoff calculation you have to adjust the python function that calculates it. The function is located in `/ZTS/models.py` and gets called at the end of each round.

```
def set_payoff(self):
    """
    Set the players payoff for the current round to the total portfolio
    value. If we want participants final payoff to be chosen randomly from
    all rounds instead of accumulated (oTree standard) subtract current
    payoff from participants.payoff if we are not in round_to_pay
    """
    self.payoff = self.portfolio_value
    random_payoff = self.session.config['random_round_payoff']
    if(random_payoff and self.round_number !=
                         self.participant.vars['round_to_pay']):
        self.participant.payoff -= self.payoff
```

Adjust Page Content

All Pages that are displayed in the oTreeZTS application are formatted using HTML and are located in `/ZTS/templates/ZTS/` or `Survey/templates/Survey` (there is a template directory for each registered App). In Addition to standard html syntax oTree also allows template syntax on their pages, as stated in https://otree.readthedocs.io/en/latest/templates.html. This can make it a lot easier to format your pages.

As an example below you can see the lines from `/ZTS/templates/ZTS/InstructionPage.html` that declare the Content of the Instructions page. Here we can rewrite any paragraphs and add additional structure elements.

```
{% block content %}

    <p>TODO: Add specific Experiment instructions here, this will only be
shown before round 1!</p>

    <p>To change this page's content adjust the html of the
/ZTS/InstructionPage.html file.</p>

    {% next_button %}

{% endblock %}
```

Deployment

Running the application locally, is enough for testing purposes, but please be aware that in order to perform any experiments the application needs to be run in a production environment, to guarantee safety and correctness. To deploy the oTreeZTS for production follow the oTree documentation steps under https://otree.readthedocs.io/ja/latest/server/intro.html.

MTurk

OTree provides integration with Amazon Mechanical Turk (MTurk):

1. From oTree's admin interface, you publish your session to MTurk.
2. Workers on Mechanical Turk participate in your session.
3. From oTree's admin interface, you send each participant their participation fee and bonus (payoff).

More information on how to setup this application with MTurk you can find on the otree documentation https://otree.readthedocs.io/en/latest/mturk.html.