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Front Pages

Athens Journal of Business & Economics

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The current issue is the fourth of the tenth volume of the *Athens Journal of Business & Economics (AJBE), published by the Business & Law Division and the Economics Unit of ATINER.*

Gregory T. Papanikos
President
ATINER

Athens Institute for Education and Research

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19th Annual International Symposium on Economic Theory, Policy and Applications 30 June & 1-3 July 2025, Athens, Greece

The Economics Unit of ATINER, will hold its **19th Annual International Symposium on Economic Theory, Policy and Applications, 30 June & 1-3 July 2025, Athens, Greece** sponsored by the Athens Journal of Business & Economics. The aim of the conference is to bring together academics and researchers of all areas of economics and other related disciplines. You may participate as panel organizer, presenter of one paper, chair a session or observer. Please submit a proposal using the form available (https://www.atiner.gr/2025/FORM-ECO.doc).

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- Dr. Henry Thompson, Head, Economics Unit, ATINER & Emeritus Professor, Auburn University, USA.
- Dr. Chris Sakellariou, Head, Economics Unit & Associate Professor of Economics, Nanyang Technological University, Singapore.

Important Dates

- Abstract Submission: **26 November 2024**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **2 June 2025**

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5-8 May 2025, Athens, Greece

The Business, Economics and Law Division (BLRD) of ATINER is organizing its **12th Annual International Conference on Business, Law & Economics, 5-8 May 2025, Athens, Greece,** sponsored by the Athens Journal of Business & Economics and the Athens Journal of Law. In the past, the six units of BLRD have organized more than 50 annual international conferences on accounting, finance, management, marketing, law and economics. This annual international conference offers an opportunity for cross disciplinary presentations on all aspects of business, law and economics. This annual international conference offers an opportunity for cross disciplinary presentations on all aspects of business, law and economics. Please submit an abstract (email only) to: atiner@atiner.gr, using the abstract submission form (https://www.atiner.gr/2025/FORM-BLE.doc)

Important Dates

- Abstract Submission: **1 October 2024**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **7 April 2025**

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- **Dr. Gregory T. Papanikos**, President, ATINER.
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Evaluation and Further Development of the B2B Startup Experimentation Framework: Application in B2C E-Commerce

By Carsten H. Hahn[*]*, Vili Sotirova*[±]*, Patrick Brecht*[°] *& Anja Ströbele*[•]

Different challenges and uncertainty arise from digital transformation as managers are forced to find new channels or make alternative investments decisions. Companies can use experiments as knowledge-generating resources to mitigate the uncertainty surrounding the adapted business model. The B2B Startup Experimentation Framework (B-SEF) was developed for startups in the B2B environment to discover and validate a business model's desirability through business experiments. This study uses the criteria completeness, consistency, plausibility, accuracy, and feasibility to investigate to what extent the B-SEF can be adapted to conduct business experiments in a B2C environment. Based on the B-SEF approach, two experimentation rounds are conducted regarding multiple online advertising channels and their efficiency in generating new customers in a B2C cosmetic online shop. Findings show that the B-SEF's generic structure is also suitable for conducting business experiments in the B2C environment when two adjustments are made regarding the sales funnel in the macro-level of the framework. First, the funnel levels required reordering to represent the customer journey better. Second, the new funnel level "awareness" needs to be added, as tracking awareness is relevant in the success of an e-commerce store. This research contributes by providing a guideline for entrepreneurs who want to conduct similar business experiments and extracting the company's most and least efficient advertising channels to acquire new profitable customers. The study's originality lies in assessing the B-SEF's suitability in the B2C context and providing a tool for its application to conduct business experiments comprehensively and successfully, especially regarding documentation and data collection.

Keywords: *digital business models, validation, validation framework, business experiments, B2C e-commerce*

Introduction

McKinsey (2021) analyzed digital strategies for companies in the post-pandemic era as a significant increase in digitization was recorded. The study revealed nine out of ten companies believed they needed a digital business model transformation or have already implemented one to remain economically viable until 2023.

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Furthermore, 64% of the respondents believed in the need to build new digital businesses while 21% said they needed to integrate digital technologies into their current business model. Merely 11% claimed their current business model's profitability can be ensured until 2023 (McKinsey 2021). Accordingly, the COVID-19 pandemic has intensified the need to adopt digital technologies in business processes and tasks and to fundamentally integrate digital strategies into business models (Seiler 2021). Although transforming or introducing new business models fosters profitability, associated uncertainties and risks must be regarded. Due to evolving market dynamics, technological advancements, or changing customer demands, companies must adapt their business models, find new sales channels, or make new investments. Thus, managers are increasingly confronted with making business-relevant decisions in an uncertain environment. In the absence of historical data, decision-making might be based on intuition and experience. If this data type is available, it may not reflect current consumer behavior or interests accurately, and possibly turn out to be irrelevant data (Thomke and Manzi 2017). In the case of e-commerce, research has shown digital business models were also impacted by COVID-19. For instance, Chevalier (2022) reported 40% of e-commerce decision-makers in North America and Europe experienced tougher competition levels. Bhatti et al. (2020) observed strategies, focusing on expediting the supply chain and logistics, had to be adapted to accommodate changed consumer behavior and preferences. This change in consumer behavior was confirmed by Van Gelder (2023) investigating the United Kingdom (UK) who reported a 75% growth in online shopping between March 2020 and February 2021. Unsurprisingly, a significant decline in offline shopping was registered (Van Gelder 2023).

Business experiments pose a potential solution to navigate in uncertain environments (Bland and Osterwalder 2020). Experiments intentionally reproduce processes or events to generate knowledge about dependencies or relationships (Aityan 2022). Potential benefits include risk reduction, improved competitiveness, and facilitated and efficient decision-making (Mind Tools Content Team n.d.). However, business experiments can also be a waste of time or resources when unfruitful ideas are relentlessly pursued or results are misinterpreted (Toolshero n.d.). In the pursuit of a universal tool to conduct experiments, attention was drawn to the B2B Startup Experimentation Framework (B-SEF) by Brecht et al. (2021). The framework helps business-to-business (B2B) startups to conduct business experiments and quickly and cost-effectively validate a business model's attractiveness. It comprises a macro and a micro level, each consisting of four sequential steps. The macro level provides a general overview of the business model and the customer journey, while the micro level focuses on specific components and conducts experiments to validate different assumptions regarding the business model (Brecht et al. 2021).

This research is set out to investigate whether the B-SEF is also suitable for experimentation in the business-to-consumer (B2C) environment, while considering the known differences between the two markets. The B2C environment has a larger potential customer base than the B2B market and focuses on end-consumers as clients rather than other companies. Since the nature of customers, decision-

making, relationships, transaction types, and sales processes differ between B2B and B2C markets (Werani 2012), it could be assumed that different approaches to experimentation for the respective business contexts may be necessary. This research's main goal is to apply and initially evaluate the B2B validation framework in a B2C context by validating the business model of a chosen target company. To accomplish this, the model is examined under the premise of conducting validation experiments to improve the company's business model and identify efficient channels for online advertising. Therefore, the following research question is formulated: *To what extent can the B-SEF be used to conduct business experiments to improve a company's business model in the B2C environment?*

After applying the framework and evaluating it according to five criteria derived from the acceptance indicators by Gerberich (2011), this study concluded the B-SEF's generic structure is suitable for conducting business experiments in the B2C environment. The case study revealed a possible efficient application when two minor adjustments are considered in the macro-level of the framework. The funnel levels need to be reordered, which will improve the B2C business model representation in the customer journey. Furthermore, adding the new funnel level "awareness" showed to be relevant as tracking awareness plays a significant role in the success of an e-commerce store.

The remaining paper is structured as follows. Next, the next section provides a brief review of theoretical foundations. The third section describes the methodological approach chosen to answer the research question. In the consecutive parts, the results and findings are reported. This paper continues with discussing findings and deriving limitations and suggestions for future research. This paper concludes with final remarks.

Literature Review

B2C – B2B in E-Commerce

Regarding the differences between the B2B and B2C environment, one can highlight that B2B e-commerce encompasses electronic sales transactions between companies, who can either be suppliers and consumers. In contrast, B2C e-commerce companies are only suppliers, who sell goods or services to end customers via online shops (Aichele and Schönberger 2016). B2C markets have a larger potential customer base with lower sales per customer. The purchase decision is usually based on the emotional decision-making processes of an individual, entrepreneurs face less risk, and payments are likely made after the transaction. In contrast, B2B entrepreneurs must bear higher risks, transactions are more complex, and purchase decisions are typically made by a buying center. The latter two characteristics create a more elaborate sales process. Lastly, unlike end consumers, whose consumption is guided by emotions, business representatives typically make purely rational decisions based on the company's actual needs (Rėklaitis and Pilelienė 2019). Table 1 summarizes the main differences between the two markets:

Table 1. *Differences between B2C and B2B Markets*

Criterion	**B2C**	**B2B**
Target customer	End consumers	Companies
Market size	Large	Smaller
Sales volume (per customer)	Low	High
Decision maker	Individual	Group
Risk	Low	High
Purchase process	Short	Long
Immediate payment	Often	Not required
Transaction	Simple	Complex
Decision	Emotional	Rational
Demand based on	Desire	Need
Use of mass media	Essential	Avoidable

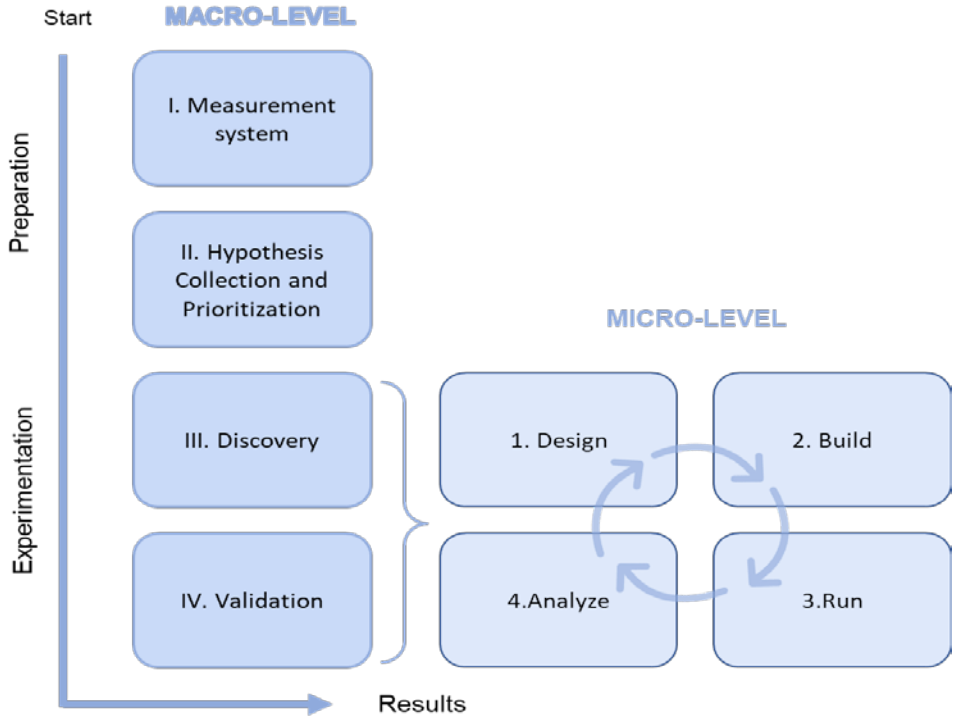
(Validation) Experiments

In research, two terms are essential for understanding the nature of experiments, namely validation and verification. Validation attempts to prove whether the correct product (or model) has been developed. The product or model is deemed valid if the usage goals and requirements are achievable. Verification, in comparison, assesses if the model meets the requirements enabling its performance while focusing on whether the model was constructed correctly (Mügschl-Scharf 2021). Experiments are carried out observations, during which data is collected and analyzed. These observations are normally conducted under artificial conditions (Aityan 2022). In experimentation, data is collected in multiple iterative cycles and interpreted with the help of hypotheses, which increases the reliability of findings (Thomke 2003). Therefore, experiments can support companies and decision makers in various business aspects, for instance, in attracting new customers or increasing customer satisfaction by testing and validating new products or business ideas or determining specific cause-effect relationships. Unlike intuitive decision-making, business experiments generate realistic data and new knowledge to validate products, processes, or ideas. Thus, facilitating a more sophisticated decision-making to minimize risks, reduce costs, and avoid uncertainty (Thomke 2020).

B2B-Startup Experimentation Framework (B-SEF)

This framework supports business-to-business (B2B) startups in conducting business experiments to validate a business model's attractiveness quickly and cost-effectively. As illustrated in Figure 1, the B-SEF framework consists of a macro and a micro level, each containing four sequential steps. The macro level is divided into two phases – preparing an experiment (preparation) and applying it (experimentation). The micro-level, inspired by Thomke's four-step iterative cycle, loops the startup iteratively through the design, build, run, and analyze phase to derive insights (Brecht et al. 2021).

Figure 1. *B2B-Startup Experimentation Framework*



The Macro-Level

In the first step of the framework, a measurement system is developed based on the McClure's customer acquisition funnel. The funnel visualization helps companies analyze and allocate resources efficiently in different stages of the sales process. McClure's funnel, also known as the Pirate Funnel, describes the customer journey from initial contact to revenue generation. The stages are acquisition, activation, retention, referral, and revenue (AARRR) (McClure 2007). There are various variations of the funnel, such as AIDA model, purchasing funnel, marketing funnel, sales funnel, or conversion funnel, depending on the business model and goals. Regardless of the chosen variantion, the funnel approach should support the effective experimentation in business settings (Arney 2021). To develop the measurement system, different metrics are assigned to each phase of the funnel and company-specific threshold values are defined, which play a relevant role for the later analysis of the results (Brecht et al. 2021). The second step focuses on formulating and prioritizing different hypotheses with the help of the business model canvas (BMC), which divides a business into nine relevant categories. After the canvas is filled out with all relevant content, assumptions are made for each field. In this context, potential business risks, which are extracted in the process, can be converted into hypotheses. Consecutively, these hypotheses are prioritized, and the most essential subjects transferred to the framework's second phase – the experimentation. Experimentation involves discovery and validation experiments. Discovery experiments verify a concept's core idea, while validation experiments

provide more meaningful evidence but require more resources such as time, personnel, and money (Brecht et al. 2021, Bland and Osterwalder 2020).

The Micro-Level

The micro-level consists of a four-step iterative cycle, inspired by Thomke (2003). First, the conceptual design of the experiment takes place, which is based on the existing findings and observations from the preparation phase (design). The tests are then designed next (build) and executed in a real-world environment to achieve increased external validity (run) (Brecht et al. 2021). Finally, the results are analyzed, and potential insights are derived (analyze). The previously developed measurement system is applied at this cycle stage to draw a comparison between the expected and the actual results. If the hypotheses are verified or falsified with sufficient accuracy, the experimental cycle is concluded. Otherwise, the newly gained knowledge should be used to modify the experiment accordingly and begin the cycle anew.

Methodology

Sample Choice

A real-life e-commerce store selling natural cosmetics was used to evaluate and further develop the validation framework. The company is suitable for the case study as it is a digital business model from the B2C industry operating from Austria. The cosmetic products for skin, hair, and oral care are suitable for men and women of all ages and are sold directly to end consumers via an online store. Therefore, they have been offered to the public via mass media.

Method

To answer the research question, the B-SEF was evaluated in a case study focusing on a B2C e-commerce shop. The framework was applied to conduct representative validation experiments, which were conducted in a natural environment with scenarios corresponding to the online store's actual work processes. Thus, field experiments with uncontrollable environments and potential disturbing factors interfering might be encountered. The experimentation derived two types of findings. On the one hand, the findings gave new insights into the current business models of the B2C e-commerce store and revealed potential improvement possibilities. Due to the scope of this study, hypotheses were formulated regarding prioritized advertising channels. On the other hand, the findings produced improvement potential for the framework itself. To extract this potential, the application was evaluated based on five evaluation criteria (Rabe et al. 2008, Gerberich 2011). The criteria originated from the work by Rabe et al. (2008) and were further enhanced by Gerberich (2011), creating the so-called acceptance indicators. The evaluation

aimed to check the completeness, consistency, plausibility, accuracy, and feasibility of the theoretical model. Table 2 shows the conception of the evaluation process.

Table 2. *Conception of the Evaluation Criteria*

Evaluation criteria	Description
Completeness	Evaluation in terms of absent relevant factors for the design of validation experiments.
Consistency	Evaluation of the coherence regarding interrelationships of individual components and the consistency of the framework's terminology.
Plausibility	Evaluation of the traceability of the entire framework
Accuracy	Evaluation of the level of detail and the granularity of the framework
Feasibility	Evaluation of feasibility/practicability in implementing the framework

Research Execution

The research is executed by applying the macro and micro-level of the B-SEF framework. Beginning with *Preparation*, a measurement system with the key performance indicators is developed to measure the success and failure of the experiments. Next, the main questions and hypotheses are derived from the business model canvas of the example company in *Experimentation*. Finally, the micro-level is assessed by looping through the four-step cycle.

Macro-Level: Preparation
Measurement System

When developing the measurement system based on McClure's CAF, the first peculiarity of the B2C online shop's business model was identified (McClure 2007). The pirate funnel and its sequence did not fully match the company's funnel. In this digital business model, customers typically made a paid purchase first before recommending the product or returning for a repeat purchase. The original funnel was developed for a different type of business model, namely software as a service (SaaS) and therefore could not be applied for the purposes of this experiment without adaptation (Winter 2022). To adapt it to the company's business model in the case study, the order of the funnel level was changed to acquisition, activation, revenue, retention, and referral. Customers generate revenue shortly after being activated, with repeat orders or referrals occurring, if they are satisfied with the product. The difference in the funnel order was not necessarily due to the B2B or B2C difference, but due to the type of business model. Additionally, a new level – *Awareness* – was introduced as an initial step, allowing potential customers to discover the product solving their problem (Jansen and Schuster 2011). This phase was measured and analyzed to determine factors that generated high awareness instead of revenue, which is typical for the e-commerce business model.

Table 3 provides an overview of all metrics from the B2C online shop's customer journey, which together represent the measurement system for the experiment. The

table shows six funnel levels. For each step in the customer journey, metrics have been defined to analyze successes and failures. Across most funnel levels, two metrics were considered. First, the absolute number of people who have reached this step in the customer journey. Second, this number is related to the total expenses to calculate the average cost incurred to achieve this event.

Table 3. *Measuring System of the Example Company*

Funnel level	Metrics	Description
Awareness (TOF)	Impressions	The frequency ads appearance among the target audience.
	CPM	The average cost per 1,000 impressions. Calculated by dividing the total amount spent on an advertising campaign by the number of impressions and multiplying by 1,000.
Acquisition (MOF)	Website Visitors	The total number of website visitors, corresponding to the number of link clicks as all links lead to the website.
	CPC	The average cost per link clicks. Calculated by dividing the total expenses by the number of clicks on the link.
Activation (BOF)	Adds to Cart	The number of attributed events where visitors have added something to the shopping cart.
	CPATC	The average cost per add to cart. Calculated by dividing the total expenses by the number of add to cart events.
Revenue (BTF)	Results	The number of successful events based on campaign goals; in this case, the number of orders.
	CPR	The average cost per order. Calculated by dividing the total expenses within the selected timeframe by the number of results.
	ROAS	The overall return on advertising spent from website purchases. Calculated by dividing the conversions from website purchases by the total amount of expenses.
Retention	Returning Customers	Percentage of recurring customers out of the total number of customers.
	CLV Customer Lifetime Value	Equivalent to customer lifetime value, representing an investment-based customer worth.
Referral	NPS Net Promoter Score	The percentage of customers likely recommending the company.

Hypotheses and Prioritization

The second step in the preparation phase was formulating hypotheses, which were tested in the experiment. Following the suggestion of the B-SEF, the hypotheses

were derived from the company's BMC (Brecht et al. 2021). In this study, the canvas element *channels* were given the highest priority, more precisely, online advertising channels due to their potential impact on the company's cost structure. The largest cost factor with potential for optimization was identified as the advertising costs for online ads on platforms such as Facebook, Instagram, Google, and YouTube. The case company needed to find an efficient way to use these channels for the different customer journey phases to optimize their resource allocation and revenue. The management's assumption that Facebook was the only profitable social media platform for customer acquisition was tested using different advertising channels. Therefore, the following hypotheses were derived and tested in parallel during the first experiment:

H1: Profitable customer acquisition can be achieved through advertising on Facebook.
H2: Profitable customer acquisition can be achieved through advertising on Instagram.
H3: Profitable customer acquisition can be achieved through advertising on Google.
H4: Profitable customer acquisition can be achieved through advertising on YouTube.

Customer acquisition was considered profitable if the costs and ROAS stay within the threshold values specified in the next step of the experimentation.

Micro-Level

To verify or falsify the hypotheses with sufficient accuracy, the micro experimentation cycle ran twice. Based on the insights of the first iteration, the second experimentation cycle ran with modified parameters.

Iteration 1

(1) *Design and Build:* The channels relevant for the experiment were selected, considering three main aspects: most common social media channels, the platforms targeted at an active audience, and the results of a competitive analysis. Facebook, Instagram, Google, and YouTube were the selected channels for the experiment's design. For each channel, several customer segments were identified based on the customer journey phases from the measurement system. Different advertising types were included to detect or neutralize potential side effects in the channel's performance. The content selection was based on a competitive analysis aimed to find widely spread ad types and content by various companies in the same industry generating high engagement. To increase the results' validity, another variable was considered in the experiment. The same ad types were displayed with content for two different products. More precisely, two carousels for two different products were shown for each customer segment on Facebook. This approach can increase the reliability of the hypothesis's falsification or verification if both products showed the same trend in the results.

Next, the relevant metrics for an experiment to verify or falsify the hypotheses were defined. The first four levels of the measurement system were used to track the customer journey, and all the metrics were measured and analyzed. Threshold values were set for each metric to evaluate the results in a later stage. The retention

and referral levels were excluded from the experiment due to time and budget constraints. Historical and predicted data were used to determine the threshold values for each metric, the calculations are summarized in Table 4.

Table 4. *Calculation of Threshold Values*

1. Historical Data (Jan 2022-May 2022)		**Threshold**
Customer Lifetime Value (CLV)	Average values from the internal database of the online store	45.00 €
Average Order Value (AOV)		31.00 €
Average Cost per Order (ACPO)		17.00 €
Click-Through-Rate (CTR)		2.35 %
Added-to-Cart-Rate (ATCR)		6.47 %
Conversion Rate (CR)		3.13 %
2. Calculation of Relative Key Figures (+36% deviation at BEROAS*)		
Break-Even-ROAS (BEROAS)	= (AOV / ACPO) × 0,64	1.2
CPM	= (CTR × CR × 1000 × CLV / BEROAS)	28.36 €
CPC	= (CR × CLV / BEROAS)	1.21 €
CPATC	= (ATCR × CLV / BEROAS)	2.49 €
CPR	= (CLV / BEROAS)	38.56 €
3. Calculation of the Absolute Key Figures		
Planned budget (BDG)		2,200.00 €
Impressions	= BDG / CPM × 1000	77,569
Website Visitors	= BDG / CPC	1,823
Adds to Cart	= BDG / CPATC	882
Results	= BDG / CPR	57
*To compensate for the average discrepancy resulting from tracking limitations of the Ads Manager tools, an additional 36% is added in the calculation of threshold values.		

This experiment aimed at profitable customer acquisition, therefore *cost per result (CPR)* and *return on ad spend (ROAS)* were deemed the most significant metrics since they measure average costs and profitability. For initial customer acquisition, CPR corresponded to customer acquisition costs (CAC). If the average CPR for a channel was higher and profitability was lower than the threshold, a business model selling through that online advertising channel was not validated, and alternative channels should be sought.

(2) Run and Analyze: During the first experimental cycle, all advertising materials were launched simultaneously without any modifications during the execution. After running for seven days with the originally planned budget, the results were analyzed using a developed Excel template to consolidate data from different channels. The template could potentially support the B-SEF's feasibility and applicability in practice. The hypotheses were not verified or falsified in the first cycle, prompting to retest certain factors under modified conditions in the second cycle.

Iteration 2

(1) Design and Build: The results from the first iteration cycle helped build an understanding of advertising channels. Therefore, the first experimentation cycle served as discovery experiment. To verify or falsify the hypothesis with a higher probability, an identical experiment with minor modifications was conducted for the second cycle.

(2) Run and Analyze: During the second cycle, ads were run continuously for another seven days with a higher budget. Unlike the first round, the performance of ads was monitored, and adjustments were made if necessary. Ads showing negative profitability for more than two days were turned off, and the budget was reallocated to better-performing ads. This approach made the second experiment more realistic and allowed more budget to be allocated to profitable channels and customer segments.

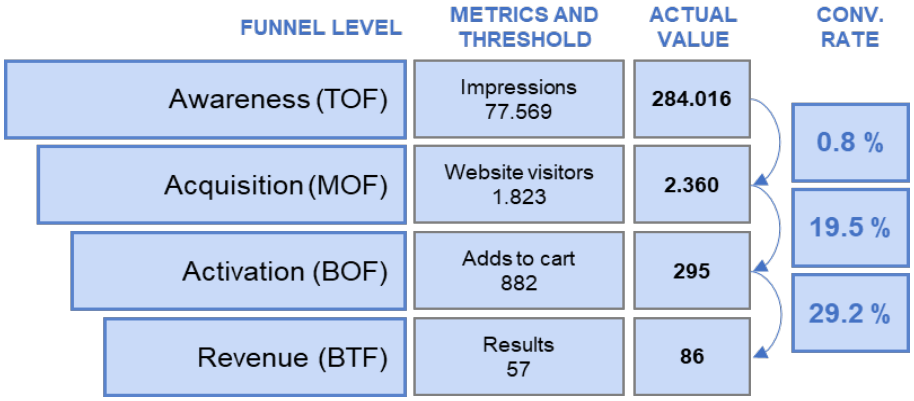
Results & Findings

Iteration 1

The analysis shows Facebook acquired the largest customer share via the ad type *blogpost*. However, these results cannot be considered valid as the meta-algorithm did not invest in the other available ad types, and thus prevented them from generating impressions. Therefore, in the next iterative cycle, all other ad types on Facebook were included in a new ad set to avoid side effects and analyze their performance separately. Instagram acquired customers with a ROAS below 1.0 for almost all ad types and customer segments, indicating that this advertising channel may not be profitable. It should be noted that the *blogpost* ad type, which produced above-average results on Facebook, was not available on Instagram. Therefore, it is recommended to further test Instagram, especially as a channel with a supporting role in a multichannel strategy. The last two channels, YouTube, and Google did not acquire any customers. Some ads did not generate impressions as no budget was spent. The reason was possibly because the algorithm did not collect any data and information on potential customers in the previous months, and the allocated budget could not be invested. Modifications can be made for these two channels in the second experiment cycle before excluding them from future advertising campaigns.

Figure 2 summarizes the results from the first experimental cycle in terms of the customer acquisition funnel. With a budget of 2,200 EUR, the advertising generated more than three times the expected number of impressions (282,016). The metric of website visitors also exceeded expectations, reaching a total number of 2,360 visitors. However, the expected add to cart events were not achieved due to inadequate conversion rates between these two funnel stages. Two of the four channels incurred costs without generating income, but the expected order number was exceeded. In the first experiment cycle, 86 new customers were acquired, exceeding the expected 57 orders.

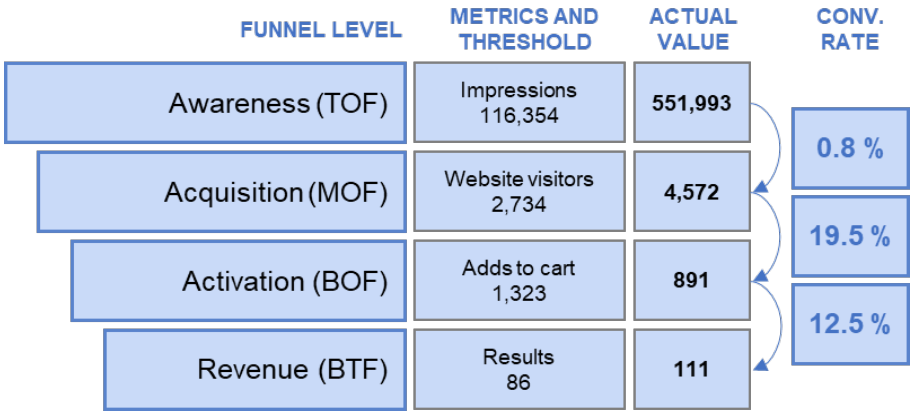
Figure 2. *Experiment Cycle 1, Results*



Iteration II

Based on the first cycle, four factors were identified that negatively affected the validity of the results, prompting to introduce four modifications. (1) Blog posts were published in a separate ad set on Facebook, (2) automatic placement was used to allocate budget on Instagram, for the (3) Google and (4) YouTube campaigns targeting clicks instead of conversions were chosen to make budget allocation for customer acquisition easier. Figure 3 shows the results of the second experiment cycle that was conducted with a 30% budget increase. With the new budget of about 3,300 EUR more than half a million users were reached, resulting in almost doubling the number of website visitors (4,572), 891 add to cart events and 111 new customers.

Figure 3. *Experiment Cycle 2: Results*



In conclusion, several insights for the company were gained through the two experimental cycles. Regarding hypothesis 1, which identified Facebook as a channel for profitable customer acquisition, was verified. However, the remaining three hypotheses, addressing Instagram, YouTube, and Google for profitable customer acquisition – were falsified. The B2C online shop should use these insights for further experiments by testing these channels using other ad content, customer segments, or methods. Despite the many variables influencing the field

experiments, it can be stated that Facebook, especially with the blogpost advertisement format, is suitable for profitable customer acquisition for the target company.

Evaluation of the Framework

The B-SEF is a generic model that includes all the necessary elements for conducting experiments in the B2C context effectively. Applying the model in the case study confirmed that it is ***complete*** regarding its contents. Separating the framework into macro and micro levels is useful for conducting experiments iteratively and in a structured manner. Although experiments could be conducted solely based on the micro level, the macro elements give a holistic view of the experiments and the business model. It enables the example company to prioritize and allocate its limited resources to relevant experiments. Even though it is not necessary to separate the experiments in the case study, separating discovery and validation experiments appears beneficial for tailoring experiment types, contents, and criteria to a specific company.

The evaluation criterion ***consistency*** was largely fulfilled, however, there is room for improvement in one aspect. The framework uses a coherent and understandable terminology applicable to the B2C context of the example company. The differences between the macro-level measurement system metrics and thresholds of the micro-level were not directly apparent. Specification regarding main differences with additional descriptions is recommended.

The B-SEF was found to be logical and intuitive (***plausible***) in the case study. The framework includes an iterative experimentation cycle, which was shown to be useful for testing and modifying successful customer acquisition channels in a B2C online shop. The structured testing and the resulting insights can motivate entrepreneurs and help them make informed decisions about their business model. The B-SEF is a plausible and structured framework that provides a clear and understandable connection between its elements.

The ***accuracy*** criterion was largely fulfilled as the framework has sufficient detail to be applied to the B2C context. Some elements of the framework needed to be adapted due to the specificities of the e-commerce business model, such as using a modified customer acquisition funnel. It is recommended to offer a selection of different customer acquisition funnels for different business models to make the B-SEF more efficient. The framework's flexibility allowed for business experiments with different scenarios, however further research was necessary to fully implement the framework. Therefore, the description of the elements and their application could be further refined.

The ***feasibility*** criterion has been largely met, but the initially developing certain elements, such as the measurement system or BMC, was time-consuming. Startups face challenges in designing business experiments to uncover underlying causality. For very young companies applying the B-SEF may be limited, and therefore potentially not feasible. In the case of the B2C online shop, extensive data was available, which made it easier to determine suitable thresholds. For startups with fewer data available, guidance for determining thresholds could be

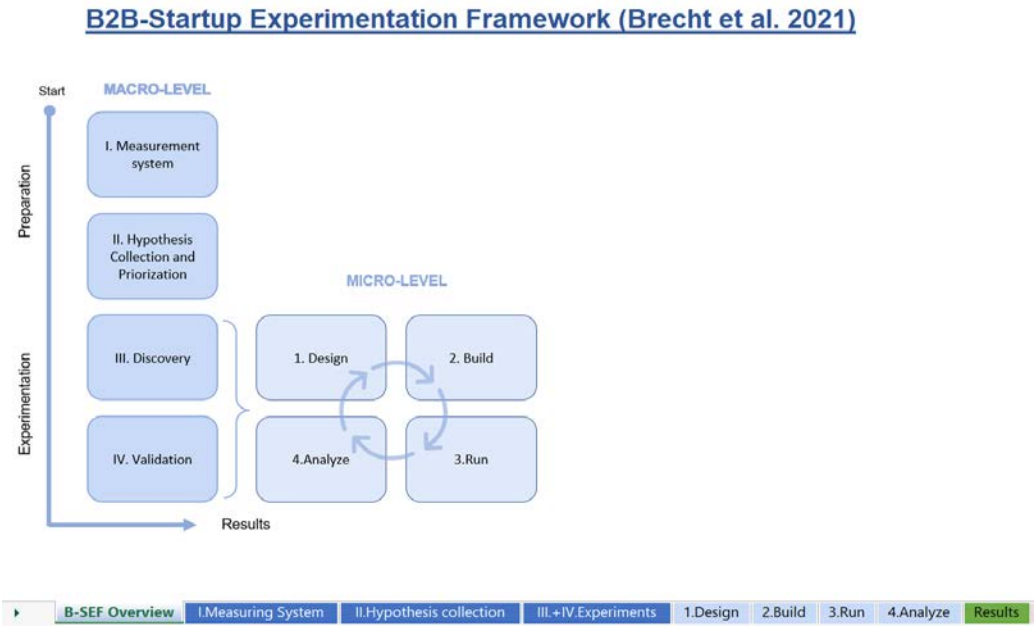
helpful as it is a time-consuming but important step in obtaining valid results. The practical relevance of the B-SEF for B2C startups is undisputed, but some elements may limit its generalizability. A tool covering all relevant steps of the framework and enabling a structured evaluation of results could increase feasibility.

Further Development of the Framework

The B-SEF framework was applied in a B2C online shop, revealing significant potential for development. To address this, an Excel tool inspired by the B-SEF was created to aid in experiment planning, documentation, and analysis. The tool facilitates data collection, comparison, and evaluation, supporting decision-making for cross-channel advertising. Its universal applicability and user-friendly features should allow its usage for various companies and business areas. Figure 4 displays an excerpt of the Excel template, a tool encompassing multiple worksheets, each representing a step from the framework.

The first worksheet provides an overview of the B-SEF and its elements with hyperlinks facilitating easy navigation to each step's respective worksheet. Templates were created for both the macro and micro levels, simplifying each execution and documentation step. For example, the second and third worksheets contain templates of the customer acquisition funnel and business model canvas with instructions, supporting preparing the experiments on the macro level. Regarding the micro level, it allows users to conveniently summarize and consolidate prioritized hypotheses, chosen methodology, and success criteria using test cards. It facilitates effective planning and documenting the experiment design in the first step. In the second step, the tool enables users to develop and capture the necessary framework conditions for analysis, such as defining variables and their respective values. It ensures consistency and organizes information, which is crucial for accurate and reliable analysis. In the third step, the Excel tool serves as a platform for executing experiments, allowing seamlessly consolidating data from various advertising reports. It streamlines the data collection process and provides efficiency. Finally, in the fourth step, the tool simplifies data analysis by automatically transferring relevant information to the designated analysis worksheet. It saves time and reduces the potential for errors, enabling smoother result evaluations and interpretations. Overall, the framework steps are interconnected, with information from previous phases frequently required for subsequent phases. Linking relevant cells across worksheets simplifies information transfer between steps and reduces time and potential errors. The Excel tool serves as a comprehensive and practical resource, providing essential functionalities and capabilities to facilitate the execution, documentation, and analysis of experiments at each micro-level stage.

Figure 4. *Excel Tool for Operationalizing the B-SEF*



Discussion

In this paper, the research question was centered around examining to what extent the B-SEF can be used to conduct business experiments to improve a company's business model in the B2C environment. It was assumed that with minor adjustments to accommodate the differences between B2B and B2C markets, mainly in the supporting theoretical models, B-SEF can be effectively applied in a B2C context for conducting business experiments. The initial validation of the B-SEF involved analyzing the results from the conducted experiments, which provided significant insights into the business model and customer journey of the example company at the macro level. This helped identify a relevant problem regarding the efficiency of advertising channels. Building upon this, two experiment cycles were designed and executed at the micro level to identify profitable customer acquisition channels, revealing that only Facebook was effective out of the tested channels (Facebook, Instagram, Google, and YouTube). The experiments reached approximately 830,000 potential customers with a budget of 5,000 EUR, resulting in 167 new customers and an average customer acquisition cost (CAC) of around 31 EUR, below the threshold of 38 EUR, making the customer acquisition profitable.

Upon evaluation of the results and analysis of the data, the initial assumption was confirmed. The B-SEF framework shows promise in providing a structured and holistic approach to conducting experiments in the B2C context, offering valuable insights for startups and entrepreneurs in optimizing their business models. In terms of consistency, accuracy, and feasibility, the case study suggested that the framework is largely suitable for conducting experiments with room for improvement in structured execution and documentation. Detailed descriptions of

individual elements and using software solutions could enhance the framework's accuracy and feasibility. In this light, it is important to note that this evaluation represents an initial assessment of the framework within a single case study. Further research is required to validate and generalize these findings. Areas for improvement include clarifying the distinctions between macro- and micro-level elements, refining the elements and their application, and addressing challenges related to data availability and determining suitable thresholds. Overall, the B-SEF framework exhibits potential as a practical and relevant tool, but its generalizability and feasibility may benefit from further development and refinement.

Other limitations within this study relate to the available data and experimental conditions. The reliability of data collected by advertising platforms can be questioned because results from the internal system differ from those of the meta-ads manager as they only represent statistically aggregated estimates. Furthermore, interpretation of the results relied heavily on assumptions due to uncontrolled variables in field experiments. Future experiments are needed to increase the degree of validation of the findings. The evaluation of the B-SEF framework was limited to a specific B2C e-commerce company. It is recommended to apply and evaluate the framework in other experiment types and with other B2C business models to increase the validity of the results. Other suggestions for future research are to apply a quantitative approach, in which several companies from different industries and with different business models apply and evaluate the B-SEF. Another research area that should be examined in more depth is the evaluation of the framework through comparison with other comparable approaches. It might generate impulses for expanding the B-SEF. The developed tool for operationalizing the framework can also be used and tested in further studies and expanded for other types of experiments. Additionally, the suitability of the B-SEF for other business models should be investigated.

The findings of this study have significant implications for other managers and business owners in the field. Applying and evaluating the framework provided valuable insights into its potential uses and highlighted the benefits of its generalizability. Managers can leverage this knowledge to enhance their understanding and application of the framework, particularly in the context of identifying efficient online advertising channels. The case study presented in this research serves as a practical example, demonstrating how the framework can be effectively applied. Overall, the findings of this study contribute to this research field, enabling others to harness the advantages of the framework and its applications for improved business outcomes.

Conclusion

This work confirms the practical relevance of the B-SEF by describing another successful application and supporting its applicability in other case studies. The presented adaptation and application of the validation framework in an B2C e-commerce business model can provide guidance for similar businesses with comparable experiment goals and types. Especially in the areas of data collection

and documentation, the case study showed the importance of working through the process steps thoroughly to ensure success and extract the benefits provided by the framework. Future research should focus on more applications by startups operating in different industries to test the limits of the framework regarding the business model type and further confirm its applicability in the B2B and B2C environment.

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How does Cultural Distance Affect Chinese Companies' Outward Foreign Investment? Evidence from the Belt and Road Initiative

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Being proposed from 2013, the Belt and Road Initiative highlights five focuses, which are policy coordination, unimpeded trade, financial integration, facilities connectivity and people-to-people bond respectively. However, we propose that the implementation of people-to-people bond could be hampered by cultural distance between different countries and thus negatively affecting the fulfillment of other focuses. Hence, it' s an essential prerequisite to verify the impact of cultural distance so as to better promote the connectivity among Belt and Road partners. In this study, we conduct an empirical study on the impact of cultural distance on Chinese companies' OFDI using a panel data set of 40 countries along the Belt and Road over the period 2014-2020. Results show that cultural distance has a negative impact on Chinese companies' OFDI in Belt and Road partner countries. What is more, it' s found that based on the model of national culture developed by Hofstede, Chinese companies pay more attention to the similarity in the cultural dimension of masculinity with host countries when making outbound investment. Our research has both theoretical and practical implications to relevant research fields and the Belt and Road practice.

Keywords: *the Belt and Road initiative, cultural distance, Chinese companies' OFDI, cultural dimension, masculinity*

Introduction

The Belt and Road, including the Silk Road Economic Belt and the 21st Century Maritime Silk Road, closely links the cross regional collaboration among Asia, Europe and Africa in terms of policy, commerce and capital. Since the proposal was put forward, companies in Belt and Road countries have gradually taken partner countries as their main choice for outbound investment. However, due to the cultural distance between different countries and regions, as well as the expensive cost of cultural integration, corporations' outward investment activities may be hindered.

In order to build a community of interests among partner countries, the Belt and Road Initiative has focused on implementing a five-pronged approach which includes policy coordination, facilities connectivity, unimpeded trade, financial integration, and people-to-people bond. However, we argue that if there is a large

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cultural distance between countries, the "people-to-people bond" will be harder to achieve, which may further hinder the fulfillment of other four focuses, such as "unimpeded trade" and "financial integration".

Hence, in our study, we aim to empirically explore whether cultural differences between China and other Belt and Road partner countries affect the actual investment choices made by Chinese enterprises. If so, what is the degree of the impact? Meanwhile, how does particular cultural dimension affect companies' foreign investment choices? To solve these problems, first in this introduction, we briefly introduce the Belt and Road Initiative and its five main focuses, and argue that cultural distance might inhibit these strategies, especially the people-to-people bond. In the theoretical foundation and literature review, we introduce the Hofstede national culture model for better studying cultural distance, and review the influence of cultural distance on international business in existing literature. Furthermore, in data and methods, we introduce our sample selection process, variables' definition, and analytical model. Then, in results, we use random effects models to test the effects of both cultural distance and gap between particular cultural dimensions on Chinese companies' OFDI (Outward Foreign Direct Investment), and verify the robustness of our research methods and indicators. Finally, in discussion, we summarize our research findings, significance, suggestions, limitations, and propose possible future research directions. Possible results and conclusions of our study may play an important role in reminding Chinese enterprises to focus on the closer people-to-people bond when they are planning to make investment into other Belt and Road partner countries, and take actions to improve the adverse effects of cultural distance, which will surely help them promote their performance when they invest in host countries.

Theoretical Foundation and Literature Review

Hofstede (2001) argued that culture is the common programming of ideas unique to a group. In our study, we use the six dimensions of national culture model (Hofstede 2001, Hofstede et al. 2010) to represent the characteristics of culture in our sample nations and to obtain the cultural distance between these nations. The six representative cultural factors are Power distance (PDI), Individualism vs. Collectivism (IDV), Masculinity vs. Femininity (MAS), Uncertainty avoidance (UAI), Long vs. Short term orientation (LTO) and Indulgence vs. Restraint (IND). Here, we take China as an example to introduce these six cultural dimensions. As illustrated by Figure 1, China gets relatively high scores on factors of Power distance, Masculinity and Long term orientation, and relatively low scores on factors of Individualism, Uncertainty avoidance, and Indulgence. Proposed by Hofstede and his colleagues (Hofstede 2001, Hofstede et al. 2010), power distance in firms refers to the degree to which employees want to challenge the inequality which they are confronted with. Chinese culture gets relatively high scores on this dimension, which means that people have a greater tolerance for hierarchical systems in companies. And since Chinese culture tends to be

collectivism rather than individualism, Chinese people focus more on organizational interests rather than their personal stake. Further, Chinese society is characterized by masculinity, so that people expect to make achievement and would like to sacrifice their own leisure time to their work tasks. Moreover, the score of uncertainty avoidance in Chinese culture is relatively low, which indicates that people in this society are more entrepreneurial and feel less uncomfortable with taking risks. Besides, since China gets very high scores on long term orientation dimension, we can infer that local people care less about immediate benefit but more about future development. Furthermore, since China gets very low scores on the dimension of indulgence, we can infer that people take it for granted that they should follow social norms and control their desires.

As different cultures shape different psychological and behavioral patterns, cultural distance between countries may also have a significant impact on managers' outward foreign investment decisions and thus their companies' international activities. Indeed, cultural distance has been widely studied in international business research (Azar and Drogendijk 2016, Shenkar 2001). It was clarified by the study of Shenkar (2001) that, according to the theory of familiarity, cultural distance negatively affects companies' outward investment choice towards culturally distant countries. And based on the Uppsala process model (Johanson and Vahlne 1977), cultural distance has an impact on firms' entry sequence among different foreign markets. This study also mentioned that due to the consideration of uncertainty and cost, cultural distance also affects the degree of control over foreign business and therefore the entry mode to foreign markets. Besides, cultural gap also has an impact on the performance of subsidiaries. In addition, a recent meta-analysis review researched by Beugelsdijk et al. (2018) has summarized the influence of cultural distance on the whole procedures of enterprises' international business. It was concluded in this review that firms often do not prefer to invest in countries with distant cultures, but if they do so, they are inclined to choose greenfield investment rather than acquisitions when expanding to such countries. However, the impact of cultural distance is not always significant. There have been studies which couldn't validate the adverse impact of cultural gap (Beugelsdijk et al. 2018). Also, the study of Brouthers and Brouthers (2000) did not find a significant impact of cultural distance on Japanese parent companies' choices between greenfield investment and acquisitions when they decide to conduct business in some of the European countries. Setting aside the impact of overall cultural distance, some scholars emphasize more on the impact of particular cultural dimensions on enterprises' outbound investment. For instance, Barkema et al. (1997) argued that culture is too complex to be overly simplified, and they found that the distance in uncertainty avoidance between two cultures has significant adverse effects on international joint ventures (IJVs) due to different levels of risk tolerance. Another example suggested that high power distance implies low trust, and therefore increases the perceived transaction costs, leading to the preference for direct outward investment rather than licensing (Shane 1992). Recently, based on the sample of Myanmar IJVs, Andrews et al. (2022) explored how MNCs react to superstitions in the host country by conducting qualitative

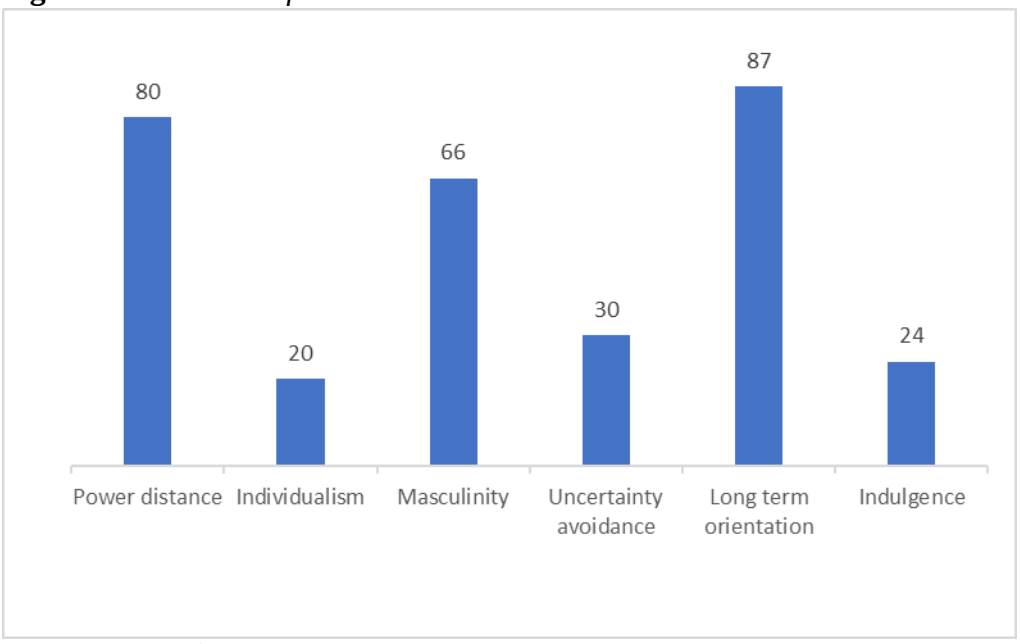
studies. Khan et al. (2023) found that cultural factors such as shared border and common official language have a positive influence on Chinese OFDI in Belt and Road countries. Therefore, we can infer from previous studies that a particular cultural dimension can also influence enterprises' outbound investment decisions.

Based on existing studies, our research wants to explore how cultural distance affects Chinese enterprises' outbound investment along Belt and Road partner countries. Currently, there have been a few scholars who have conducted research on this topic (e.g., Mohsin et al. 2021, Khan et al. 2023), but due to the limited number of studies which have taken Belt and Road countries as the research sample, further empirical testings are still needed on this topic, so as to further verify the impact of cultural distance as a whole and by its single dimensions on Chinese firms' investment along Belt and Road countries. Due to the uncertainty brought about by cultural differences, Chinese companies may find it costs more to invest in countries with distant cultures, so they may be more inclined to invest in countries with similar cultures at first (Drogendijk and Blomkvist 2013). According to the above review and analysis, we hypothesize that:

Hypothesis 1: Cultural distance negatively affects Chinese enterprises' OFDI to Belt and Road host countries. The greater the cultural distance between China and Belt and Road partner countries, the smaller the OFDI of Chinese firms.

Hypothesis 2: Distance on particular cultural dimension negatively affects Chinese enterprises' OFDI to Belt and Road host countries. The greater the cultural distance on each of the six subdimensions between China and Belt and Road partner countries, the smaller the OFDI of Chinese firms.

Figure 1. *The Scores of China on Six Cultural Dimensions*



Source: https://www.hofstede-insights.com/country-comparison/china/.

Data and Methods

In this part, we first introduce what we have done in determining the study sample. Next, we present the dependent variable, independent variables, and control variables of our study. Lastly, we illustrate how we constructed the models of the influence of cultural distance on Chinese Companies' OFDI.

Sample Selection

In order to calculate the cultural gap between China and Belt and Road partner countries, we surfed the hofstede-insights website and achieved the scores of cultural dimensions for Belt and Road countries. After manual screening and sorting, we obtained the cultural data for 47 Belt and Road countries except for China. However, 6 sample countries were then excluded due to missing scores on LTO or IND cultural dimensions. After removing Belt and Road sample countries without complete data of all the six dimensions, we obtained complete cultural data for 41 Belt and Road countries excluding China. Then, we matched cultural scores with OFDI data of Chinese companies, and excluded one country who had missing investment data from the 41 sample countries. Finally, we collected the panel data of 40 Belt and Road partner countries during 2014 to 2020, and used them to empirically test how cultural distance affects the outbound investment of Chinese enterprises. National name and cultural dimension scores of 40 sample countries are listed in Table 1.

Table 1. *National Name and Cultural Dimension Scores of 40 Sample Countries*

No.	Country code	Country name	Scores on cultural dimensions					
			PDI	IDV	MAS	UAI	LTO	IND
1	ALB	Albania	90	20	80	70	61	15
2	ARE	United Arab Emirates	74	36	52	66	22	22
3	AZE	Azerbaijan	85	22	50	88	61	22
4	EGY	Egypt	80	37	55	55	42	0
5	EST	Estonia	40	60	30	60	82	16
6	PAK	Pakistan	55	14	50	70	50	0
7	BLR	Belarus	95	25	20	95	81	15
8	BGR	Bulgaria	70	30	40	85	69	16
9	MKD	North Macedonia	90	22	45	87	62	35
10	BIH	Bosnia and Herzegovina	90	22	48	87	70	44
11	POL	Poland	68	60	64	93	38	29
12	RUS	Russia	93	39	36	95	81	20
13	PHL	Philippines	94	32	64	44	27	42
14	GEO	Georgia	65	41	55	85	38	32
15	KAZ	Kazakhstan	88	20	50	88	85	22
16	MNE	Montenegro	88	24	48	90	75	20

17	CZE	Czech Republic	57	58	57	74	70	29
18	HRV	Croatia	73	33	40	80	58	33
19	LVA	Latvia	44	70	9	63	69	13
20	LBN	Lebanon	62	43	48	57	22	10
21	LTU	Lithuania	42	60	19	65	82	16
22	ROU	Romania	90	30	42	90	52	20
23	MYS	Malaysia	100	26	50	36	41	57
24	BGD	Bangladesh	80	20	55	60	47	20
25	MDA	Moldova	90	27	39	95	71	19
26	SRB	Serbia	86	25	43	92	52	28
27	SAU	Saudi Arabia	72	48	43	64	27	14
28	SVK	Slovakia	100	52	100	51	77	28
29	SVN	Slovenia	71	27	19	88	49	48
30	THA	Thailand	64	20	34	64	32	45
31	TUR	Turkey	66	37	45	85	46	49
32	UKR	Ukraine	92	25	27	95	86	14
33	SGP	Singapore	74	20	48	8	72	46
34	HUN	Hungary	46	80	88	82	58	31
35	ARM	Armenia	85	22	50	88	61	25
36	IRQ	Iraq	97	31	53	96	12	23
37	IRN	Iran	58	41	43	59	14	40
38	IDN	Indonesia	78	14	46	48	62	38
39	JOR	Jordan	70	30	45	65	16	43
40	VNM	Vietnam	70	20	40	30	57	35

Source: https://www.hofstede-insights.com/country-comparison/.

Variables

Dependent Variable

Chinese enterprises' OFDI towards Belt and Road partner countries was chosen as the dependent variable in our study. The variable was measured by the year-end stock of Chinese firms' OFDI, and the data was retrieved from CSMAR Belt and Road database.

Independent Variable

Cultural distance (CD) between China and Belt and Road partner countries is the most important independent variable in our research. As mentioned above, the original data of six cultural dimensions was obtained from hofstede-insights website. To calculate the gap between two different cultures, we applied the index develped by Kogut and Singh (1988). The formula of the index is as follows:

$$CD_i = \sum_{j=1}^{6} \left\{ \left(I_{ij} - I_{CNj} \right)^2 / V_j \right\} / 6 \#(1)$$

where, subscript *i* means the *i*th nation, *CN* means China and *j* represents the *j*th cultural dimension. CD_i stands for the cultural gap between China and another partner nation *i*, I_{ij} is the symbol indicating the score on the *j*th cultural factor of a particular nation *i*, I_{CNj} stands for the scores of China on every single cultural factor, and V_j is an abbreviation for the variance of the *j*th cultural factor.

Besides, in order to measure the gap of the six particular cultural dimensions between China and Belt and Road partner countries, the calculation formula (2) was established as follows, in which CD_{ij} reflects the gap in the *j*th cultural dimension between China and the partner country *i*. The interpretations of other symbols are the same with those of formula (1).

$$CD_{ij} = \left(I_{ij} - I_{CNj}\right)^2 / V_j \#(2)$$

Control Variables

China's economic scale (GDPCN). The scale of China's economy is represented by GDP, which reflects the economic base and strength of a country. Generally speaking, economic scale will have an impact on enterprises' outward investment. A good economic foundation reflects a country's economic strength and also represents the economic driving force for firms' outward investment.

The market scale of partner country (GDP). In our research, since GDP can well reflect the overall strength and market demand of the host nation, we also use GDP of Belt and Road partner countries to represent their market capacity. Usually, the larger the market scale of the partner nation is, the greater the future development opportunities for firms will be, and the stronger the investment motivation of Chinese firms will have towards the host country.

Degree of infrastructure construction (INFRA). Perfect infrastructure allocation can help enterprise reduce costs and therefore attract foreign investment. Referring to the research of Yuan et al. (2018), since the internet is becoming increasingly indispensable for daily and working use, and is likely to affect the investment of foreign enterprises into the host nation, we use the Internet penetration rate of Belt and Road host countries to represent the level of infrastructure improvement.

Degree of technological development (TECH). We regard the high-tech exports of partner countries as a representative of the level of technological development, so as to control the impact of the degree of technological development of Belt and Road partner countries, for the reason that countries with advanced technologies are more likely to be favored by foreign enterprises so that they can attract more foreign capital inflow.

Safety concerns (SAFE). The security situation of a partner country is represented by its proportion of military expenditure to GDP, and we suppose that security is also an important consideration for Chinese enterprises when they are making foreign investment decisions.

Data for all the control variables were achieved from the CSMAR Belt and Road database.

Analytical Model

In order to test the influence of cultural distance on Chinese companies' outward foreign investment, we drew on the widely used gravity model proposed by Anderson (1979). Through taking natural logarithm for some variables and putting all variables into the gravity model, the equation was obtained as follows:

$$\ln \mathrm{OFDI}_{it} = \beta_0 + \beta_1 \mathrm{CD}_i + \beta_2 \ln \mathrm{GDPCN}_t + \beta_3 \ln \mathrm{GDP}_{it} + \beta_4 \mathrm{INFRA}_{it} + \beta_5 \ln \mathrm{TECH}_{it} + \beta_6 \mathrm{SAFE}_{it} + \varepsilon_{it} \#(3)$$

where, ln*OFDI*$_{it}$ is the natural logarithm of Chinese companies' OFDI indicated by the year-end investment stock in partner country *i* in year *t*. *CD*i reflects cultural distance between China and the *i*th partner country. One of the control variables, ln*GDPCN*t, indicates China's GDP in year *t* after taking natural logarithm. Other control variables ln*GDP*$_{it}$, *INFRA*$_{it}$, ln*TECH*$_{it}$, and *SAFE*$_{it}$ respectively represent the natural logarithm of GDP, the Internet penetration rate, the natural logarithm of high-tech exports, and the proportion of military expenditure in GDP of the *i*th Belt and Road partner country in year *t*. ε_{it} is a random error term.

In addition, as we need to specifically estimate the influence of cultural gap between China and Belt and Road partner countries on six particular cultural dimensions, we further established equation (4), where the cultural gap between China and the *i*th partner country on the six particular cultural factors are expressed as *PDI*$_i$, *IDV*$_i$, *MAS*$_i$, *UAI*$_i$, *LTO*$_i$ and *IND*$_i$, respectively. The interpretations of other variables are as the same as those in equation (3).

$$\ln \mathrm{OFDI}_{it} = \beta_0 + \beta_1 \mathrm{PDI}_i + \beta_2 \mathrm{IDV}_i + \beta_3 \mathrm{MAS}_i + \beta_4 \mathrm{UAI}_i + \beta_5 \mathrm{LTO}_i + \beta_6 \mathrm{IND}_i + \beta_7 \ln \mathrm{GDPCN}_t + \beta_8 \ln \mathrm{GDP}_{it} + \beta_9 \mathrm{INFRA}_{it} + \beta_{10} \ln \mathrm{TECH}_{it} + \beta_{11} \mathrm{SAFE}_{it} + \varepsilon_{it} \#(4)$$

Results

To start with, in order to get the intact and neat panel data, we treated the raw data through merging and making up the missing values. Next, we conducted descriptive statistical analysis on the variables. Before regression, we also used two test methods to exclude the possible serious multicollinearity problem between variables. Subsequently, we used random effects models to estimate the impacts of both overall and individual cultural distance on Chinese enterprises' OFDI. Finally, we also tested the robustness by altering the calculation way of cultural distance index.

Data Processing and Descriptive Statistics

First, we calculated the cultural distance using the cultural data that had been achieved earlier. Then, we merged and matched the data among Chinese firms'

OFDI, cultural distance between China and partner nations, as well as several control variables, and finally we got the panel data for 40 sample countries from 2014-2020 for further research and analysis. After merging these data, it was found that some variables of a few sample countries had missing values, such as high-tech exports, Internet penetration rate and the proportion of military expenditure in GDP. Thus, we leveraged the method of linear interpolation to make up for the missing data. For the missing values that failed to be compensated with linear interpolation, we supplemented them in other ways. For example, the spss 16.0 software couldn't linearly interpolate the data of high-tech exports for some sample countries since there exist too many missing years, so we used the method of mean replacement instead. And for the negative values that appear after using the method of linear interpolation, we assigned them the value of one, whose value will equal zero if taking logarithm.

The outcomes of the descriptive statistical analysis of our chosen variables are listed in Table 2, where we can find five kinds of statistical properties of variables including their mean value, standard deviation and so on. Each variable contains 280 observations of 40 Belt and Road sample countries over seven years from 2014 to 2020. Among them, natural logarithm conversion is conducted on variables including year-end stock of Chinese enterprises' OFDI, China's GDP, GDP of host countries, and high-tech exports of host countries.

Table 2. *Descriptive Statistics of Variables*

Variable	Variable meaning	Number of observations	Mean	SD	Min	Max
lnOFDI	Chinese enterprises' OFDI	280	10.060	2.771	3.466	15.600
CD	Cultural distance	280	2.426	0.984	0.798	4.970
PDI	Power distance	280	1.066	1.483	0.000	5.991
IDV	Individualism vs. Collectivism	280	1.768	3.073	0.000	14.300
MAS	Masculinity vs. Femininity	280	2.264	2.401	0.014	11.150
UAI	Uncertainty avoidance	280	5.008	3.229	0.000	9.886
LTO	Long vs. Short term orientation	280	3.403	3.646	0.002	12.740
IND	Indulgence vs. Restraint	280	1.046	1.352	0.006	6.160
lnGDPCN	GDP of China	280	16.340	0.122	16.170	16.510
lnGDP	GDP of host countries	280	11.560	1.439	8.299	14.520
lnTECH	High-tech exports	280	20.800	3.002	0.000	25.800
INFRA	Internet penetration rate	280	66.190	19.140	11.120	100.000
SAFE	Proportion of military expenditure to GDP	280	2.352	1.831	0.001	13.330

Source: SPSS 16.0 software.

Initial Testing

Before regression, we tried to get the correlation coefficient matrix through correlation test so as to check the correlation coefficient between variables, aiming to determine if there would be a serious multicollinearity problem among explanatory variables. According to the result of correlation test which is presented in Table 3, we can find that the absolute values of the correlation coefficients between different explanatory variables are relatively small. Except for the correlation coefficient between the host country's GDP (lnGDP) and high-tech exports (lnTECH) of 0.579, the correlation coefficients between other variables are less than 0.5. What's more, according to the results of VIF test (see Table 4), the maximum VIF of the variables equals 2, and the average equals 1.43, all of which are far less than the critical value of 10, which further helped us eliminate the possibility of multicollinearity between explanatory variables.

Table 3. *Correlation Coefficient Matrix of Main Variables*

Variable	lnOFDI	CD	lnGDPCN	lnGDP	lnTECH	INFRA	SAFE
lnOFDI	1						
CD	-0.200	1					
lnGDPCN	0.132	0	1				
lnGDP	0.816	0.006	0.048	1			
lnTECH	0.489	0.063	-0.006	0.579	1		
INFRA	-0.178	0.223	0.301	-0.169	-0.033	1	
SAFE	0.189	0.100	0.011	0.253	-0.149	0.106	1

Source: SPSS 16.0 software.

Table 4. *VIF Test Results*

Variable	VIF	1/VIF
lnGDP	2	0.501
lnTECH	1.820	0.549
SAFE	1.320	0.759
INFRA	1.270	0.789
lnGDPCN	1.130	0.884
CD	1.070	0.932
Mean VIF	1.430	-

Source: SPSS 16.0 software.

Regression Result Analysis

Since cultural distance as the core explanatory variable does not change over time, using the fixed effects model as the analytical model was excluded from our study. Next, an LM test was used on the sample, and the test results showed that the null hypothesis that there is no individual random effect was denied. Therefore, the pooled model was ruled out but the random effects model was

picked as our estimation approach. Finally, we got the estimated results (see Table 5).

We used the random effects model to estimate equation (3), aiming to test the influence of cultural distance on Chinese companies' OFDI. From the results reported in Regression (1) of Table 5, it can be found that the estimated coefficient is -0.588, which is significant at the 1% level, indicating that cultural distance does have a negative effect on Chinese enterprises' outward investment, and thus hypothesis 1 is supported. Specifically, when the cultural distance index between China and the partner country increases by one unit, Chinese companies' OFDI in this partner country will decline by 58.8%. In addition, the estimated coefficients of other control variables indicate that for every 1% increase in China's GDP, the OFDI of Chinese enterprises increases by 2.39%; Every 1% increase in partner country's GDP will promote Chinese enterprises' OFDI in that country by 1.361%; And when the high-tech exports of the partner country increases by 1%, the investment of Chinese firms to the host nation increases by 0.045%. All these effects are significant at the 1% significance level, indicating that control variables including Chinese economic prosperity, host countries' market scale and their technological development level have played important roles in promoting OFDI of Chinese companies. However, the estimated results also show that both the Internet penetration rate, which reflects the degree of infrastructure construction, and the share of military spending in GDP, which reflects the security measures, have no significant influence on Chinese firms' OFDI, which can be inferred that when investing in Belt and Road partner countries, Chinese enterprises consider less infrastructure and security factors, but more cultural, economic, and technological factors of the host nations.

Besides, we also estimated equation (4), which further includes explanatory variables of cultural distance in six particular cultural dimensions, in order to find their influence on Chinese companies' OFDI. The outcomes of estimating equation (4) are shown in Regression (2) of Table 5. Among these six cultural dimensions, we found that only masculinity (MAS) has a significant negative effect on Chinese firms' OFDI at the 10% significance level, which partially supports hypothesis 2.

Robustness Check

Our research referred to the methods available in existing literature to test robustness (e.g., Qi et al. 2012). It was to recalculate the cultural distance between China and partner nations using Euclidean space distance measurement method (EDI). The formula for EDI index is shown in equation (5), where the symbols represent the identical meaning as those in equation (1).

$$CD_j = \sqrt{\sum_{j=1}^{6} \left\{ \left(I_{ij} - I_{CNj} \right)^2 / V_j \right\}} \quad \#(5)$$

The results presented in Regression (3) of Table 5 show that the cultural distance calculated by EDI index still has a significant negative impact on Chinese enterprises' outbound investment at the 1% significance level, which implies that Hypothesis 1 is still valid in this case, thus identifying the robustness of our empirical method.

Table 5. *The Influence of Cultural Distance on Chinese Firms' OFDI*

Variable	Regression (1)	Regression (2)	Regression (3)
	lnOFDI	lnOFDI	lnOFDI
CD	-0.588***		
	(0.220)		
lnGDPCN	2.390***	2.333***	2.383***
	(0.818)	(0.829)	(0.818)
lnGDP	1.361***	1.326***	1.352***
	(0.121)	(0.149)	(0.121)
lnTECH	0.045***	0.048***	0.044***
	(0.017)	(0.015)	(0.017)
INFRA	-0.003	-0.002	-0.003
	(0.006)	(0.006)	(0.006)
SAFE	0.102	0.107	0.105
	(0.071)	(0.075)	(0.071)
PDI		0.033	
		(0.167)	
IDV		-0.143	
		(0.110)	
MAS		-0.187*	
		(0.097)	
UAI		-0.023	
		(0.072)	
LTO		-0.075	
		(0.074)	
IND		0.116	
		(0.135)	
CD_2			-0.763***
			(0.286)
Cons	-44.244***	-43.622***	-42.619***
	(12.595)	(12.801)	(12.610)
N	280.000	280.000	280.000
R^2	0.716	0.732	0.717

Standard error in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: SPSS 16.0 software.

Discussion

In our study, we used the panel data of 40 Belt and Road sample countries from 2014 to 2020 to test the effect of cultural distance on Chinese Companies' OFDI. In correspondence with most existing studies, our research proves that cultural distance will negatively affect Chinese companies' investment along Belt and Road partner countries. Besides, we also find that farther distance in the particular dimension masculinity will inhibit Chinese enterprises' outbound investment in Belt and Road host countries. Since China gets a high score on the cultural dimension of masculinity, people live and work in Chinese society usually pay more attention to values such as achievements, money, self-confidence, and heroism. Accordingly, the result indicates that Chinese enterprises place greater emphasis on the similarity with the host countries in the cultural dimension of masculinity, which may further reflect that Chinese enterprises pay more attention to performance when making investment decisions in Belt and Road partner countries (Shenkar 2001). In addition, our empirical research also proves that China's GDP, host country's GDP, and host country's technological development level positively influence Chinese enterprises' outward investment choices, which suggests that both home country and host country can promote international business like foreign investment by expanding market size and upgrading technology.

Our research results are similar to those of existing studies. For example, by analyzing the OFDI of Chinese companies into 174 host countries from 2003 to 2009, Drogendijk and Blomkvist (2013) found that cultural distance negatively affects Chinese OFDI, and two cultural dimensions including power distance and uncertainty avoidance significantly negatively affect Chinese OFDI. Besides, the study of Mohsin et al. (2021) found that institutional distance promotes Chinese OFDI, while cultural distance suppresses OFDI. And since the negative effect of cultural distance is greater than the promoting effect of institutional distance, their study emphasized the importance of cultural distance. In their study, subdimensions including masculinity vs. feminity, uncertainty avoidance, and long vs. short term orientation significantly affect Chinese OFDI. Based on the research results, it's found that cultural distance generally negatively affects Chinese enterprises' OFDI, but perhaps due to different samples or other factors, the cultural subdimensions which play significant roles vary.

Overall, our study verifies the impacts of cultural distance and the distance of particular cultural dimension on Chinese enterprises' OFDI, emphasizing that close people-to-people bond is an important requirement for companies to participate in international business. Therefore, enterprises should be aware of the inhibitory effect of cultural distance, take actions to shorten the distance, try to achieve closer interpersonal connections, and thereby create a better cultural environment for their foreign business. It is suggested that enterprises should consider the impact of cultural distance when planning to make outbound investment in Belt and Road partner countries, and actively seek the support of local governments and chambers of commerce. They need to better understand the

local culture of the host country, cultivate more cross cultural management talents and strengthen cultural communication and integration with people from the host country, thus weakening the negative impact of cultural distance.

Belt and Road partner countries should pay more attention to exchange and integration in terms of economy, culture and technology. First of all, they should encourage their enterprises to deeply understand the culture of host countries when investing in other Belt and Road partner countries, maintain an inclusive and receptive attitude towards different cultures, and avoid stereotyping of the society and culture of the host countries. Secondly, since our research results have shown that the economic development level of home and host countries can promote OFDI, Belt and Road partner countries should not only continue to develop their economies, but also establish a win-win situation, in which countries can achieve common progress by strengthening cooperation and investment activities with each other, thereby realizing a positive cycle of investment growth and economic development. Finally, since the level of technological development is also conducive to OFDI, Belt and Road partner countries are advised to attach importance to the cooperation of scientific and technological innovation as well.

Limitations and Suggestions for Further Research

In our study, among the six cultural dimensions, we only find that the difference in masculinity affects Chinese companies' outward foreign direct investment significantly. Besides, due to the use of second-hand data for testing, it is hard to discover how cultural distance and distance of particular cultural dimension exert their influence on Chinese enterprises' OFDI. Also, it is difficult to determine whether there are other cultural factors which are playing significant roles that have been overlooked by using second hand data. Therefore, it is suggested that future research leverage qualitative method to further explore the concrete mechanism by which cultural distance affects Chinese enterprises' investment decisions along Belt and Road countries, as well as to discover as many particular cultural factors as possible that are playing important roles.

Conclusions

In our empirical research, we use random effects models to estimate the panel data, and verify the inhibitory effect of cultural distance on Chinese enterprises' OFDI along Belt and Road partner countries. At the same time, it is also found that the particular cultural dimension of masculinity significantly negatively affects Chinese Companies' OFDI, representing that Chinese firms pay more attention to the similarity with the host country in the masculinity (performance) dimension when making investment choices. Our study offers supplementary validation to the literature related to cultural distance and OFDI. We have verified that cultural distance generally has a negative influence on Chinese OFDI, but the cultural subdimension that plays a significant role varies across different research

samples when compared with previous literature. In this regard, given the limitations of our method, we call for more qualitative research, so as to discover how cultural distance and gap of particular cultural dimension affect Chinese OFDI.

We suggest that enterprises should recognize cultural distance and take actions to mitigate its negative impact, such as understanding the culture of the host country, actively seeking support from the government and chambers of commerce, and cultivating more cross cultural management talents. In addition, since we find that the economic development level of China and host countries as well as the technological development level of host countries significantly promote the OFDI of Chinese enterprises, we also suggest that Belt and Road countries should not only strengthen cultural integration, but also focus on the cooperation and exchange in terms of economy and technology.

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Domestic Growth and External Equilibrium: The Early Years of Transatlantic Economic Integration

By Simone Selva[*]

This contribution explores the category of international economic interdependence through the case study of the economic mobilisation within each of the infant Atlantic Alliance's member state economy, as well as the industrial and trade integration that NATO's multilateral rearmament programs stimulated in the early 1950s. Assuming a definition of economic interdependence as the ratio of transnational flows in capital and consumer goods to domestic growth, this article focuses on the transition from U.S. bilateral assistance programs to the inception of multilateral off-shore procurement programs (OSP) launched by NATO to provide European partners with both military assistance, and balance of payments support as well as continued economic assistance to industrial production and employment after the termination of Marshall Plan economic aid. Some references are made to the case study of Italy to explore this multifaceted nature of NATO collective rearmament as then Italy both suffered from balance of payments disequilibria, and came with a real economy that, unlike many other European economies, featured both unutilised industrial capacity and a painful rate of unemployment. The allotment of military production contracts to the Italian aircraft and mechanical industry to provide the Italian and other NATO partners with military end items and products, combined with a call by Washington on the West European governments to raise defense spending, was intended to target the U.S. objective of making the Atlantic Alliance the engine to attain at the same time industrial integration, trade partnership and balance of payments equilibrium among its member nations, as well as sustained aggregate demand within each of them. Therefore, the off-shore procurements programs were a combination of these elements and became the fly-wheel to combine domestic growth and high level of transnational flows in capital and consumer goods germane to the process of economic interdependence. A set of data aimed at comparing key macroeconomic conditions affected by bilateral and multilateral aid as employment rates, balance of payments equilibrium, foreign exchange reserves, and particularly the inflow of dollar-denominated assets, as well as the terms of trade of OEEC countries with the United States and the dollar world from prior to the inception of multilateral military assistance to the full implementation of the OSP programs are offered to provide a quantitative assessment of the impact that multilateralisation of rearmament had on the European economies of NATO in a matter of a few years.

Keywords: *transatlantic economic relations, military assistance, economic integration, rearmament and balance of payments, NATO off-shore procurements, balance of payments, trade balance, employment rate, foreign exchange reserves*

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Introduction

Since the ascendancy of the United States to global economic power following World War I and the ensuing interwar years, the U.S. international economic policy had become a major factor in the process of international economic interdependence geared to the last century's international economy. Since at least as early as the economic take off that the advanced industrial democracies of Western Europe experienced during the 1960s, a number of social scientists from different disciplines and scholarly perspectives established a linkage between on the one side the process of supra-national exchange in goods and the expansion in capital flows across nations, and the wide spread upward economic growth typical of the Bretton Woods decades on the other one (Cooper 1972, Cooper 1980, Hirschman 1945, Katzenstein 1978, Keohane 1989, Kindleberger 1972, Krasner 1976, Machlup 1943, Polak 1947).

Political scientists, economic historians and political economists made an effort to compare domestic GDPs and international trade in commodities and consumer goods, as well as flows in capital goods. This number of methodologically far-ranging investigations pointed out the imbalance between the level of domestic growth within each West market economy and the process of international economic integration among all of them, with the latter by far exceeding the rate of national economic growth. The international political economy literature was on the forefront of this interdisciplinary exploration. Harvard University Professor Richard Cooper (1972, 1986) made the argument that, in the framework of this imbalance, a sustained process of international integration among the leading market oriented economies got underway against the backdrop of upward economic growth and rising living standards within each of the capitalist democracies involved in the process. In so doing, he defined the scale of economic interdependence between two economies not so much as the net rate of exchange in goods, services and commodities between them, further as a proportionate relation between the rise in net exchange and the level of internal economic growth. In other words, according to Cooper (1972, pp. 159–181, 1986, 1 ff.) and his scholarly fellow travellers, the process of economic interdependence can be defined as the proportionate impact of international integration between two economies on the net rate of domestic development in each of them.

If one keeps an eye on historical aggregate data about import of goods and services and capital flows compared to national GDP by limiting attention to the United States and a few advanced industrial economies, the aggregate data are apparently at variance with this concept and interpretation of economic interdependence and its historical development over the postwar decades. Between the years 1960 and 1970, according to WTO data, world trade values at current U.S. $ more than doubled before surging during the following decades (WTO 2022); at the same time on aggregate world GDP at current $ nearly tripled, increasing from trillion U.S. $ 1.38 to circa trillion U.S. $ 3 (World Bank 2022). If one limits attention to the pillar of the postwar global economy, the United States, a discrepancy between trends in domestic growth and dynamics of supra-national market integration is apparently even larger. As a matter of fact, during the same

decade the GDP of the United States in millions of U.S. $ more than doubled (U.S. Bureau of Economic Analysis 2023), whilst the U.S. capital account experienced a negative balance throughout the decade (Center for Financial Stability 2023).

By definition, the concept of economic interdependence formulated by Cooper (1980) and other social scientists was premised over economic prosperity and capital account equilibrium as an essential framework to bind up two economies one's another. Recently, a renewed scholarly interest on the international economic dimension of the great slump of the early 1930s put into question this interpretative framework to argue that prior to the series of financial contagions that from the United States spread across the West European economies following the 1929 financial crash, the American and the Western economies significantly suffered from a striking imbalance between industrial growth and international trade. In particular, Boyce (2009) focused attention on the gap between physical output and flows in goods and capital prior to 1929 as a result of the deflationary impact of the Gold Standard. As a result of fixed exchange rates and a tight control on currency in circulation and money supply under the umbrella of the Gold Standard, industrial production and domestic aggregate demand lagged behind international goods and capital movements. This disequilibrium substantially contributed to set out the stage for a decline in both investment and employment eventually leading to an economic shortfall caused by supply exceeding employment and demand. Irrespective of his analysis of how this turned into the following inflationary strains, Boyce makes the late 1920s the hallmark for revising the concept of economic interdependence as tied up to international economic growth and booming domestic economies.

In the framework of this important historiographical move, a number of recent scholarly works in the field of international economic history on the post World War II process of international integration between the American economy and its European partners suggest to turn historical research back to the path-breaking turning point of the post-1945 international economy. From the early U.S. attempt to encourage closer economic integration among the West European economies and cooperation with the American markets (Healey, 2011: 229 ff.), to broader interpretations of post war americanization of Western Europe that revamped the politics of productivity argument (Ellwood 2012), through further archival evidence on the early post-1945 Anglo American initiative to set in motion a multilateral flow in currency and trade on the basis of convertibility and non-discrimination (UK Government 1949), the post war momentum deserves further attention and investigation as the historical time when the resurrection of the international trade and payments system was born out of an upward economic trend eventually leading to closer economic integration among the Atlantic bloc economies, and coupled with domestic economic recovery and successive robust expansion across the West European economies and Japan.

Before this classical economic interdependence backdrop, and considering this contrast between the theoretical argument fine-tuned in the social sciences and evidence provided by macroeconomic data on world economic integration and domestic growth rates summoned up in this introductory section, this article approaches the post war years to tackle the interplay between the restoration of

international trade and payments and the recovery of national economies across the western community. Through the case study of the military assistance programs implemented since the closing down of the Marshall Plan, it argues that in reactivating international trade and by mobilising capital flows in U.S. $ the United States aimed to set in motion sustained and long-lasting domestic economic growth in each of her European partners as the basis for both continental and transatlantic economic bonds. A close attention to the so called off shore procurement program (OSP), the first multilateral military assistance program channeled to the Europeans under the aegis of NATO, helps reconstructing the twin objective underpinning American economic assistance after the end of the European Recovery Program (ERP): the restoration of balance of payments equilibrium, foreign exchange reserves and terms of trade across Washington's European partners was conducive to further internal industrial investment and mighty expansionary policies, in turn viewed as necessary conditions to keep the west European economies well locked into the sphere of influence of the United States and NATO.

In the pursuit of this scholarly objective, from the methodological point of view this article adopts a combination of archive-based qualitative reconstruction with some quantitative data on convergences and divergences between transnational flows in goods and capital and domestic growth across the United States and the West European countries touched by the OSP programs from prior to the enactment of multilateral NATO procurement contracts through their heydays and termination. The bulk period of the OSP programs, from roughly 1952 to the peak year of the OSP programs, 1953, is considered.

A Blueprint for Linking Equilibrium on the Foreign Exchange Markets to the Shaping of Domestic Aggregate Demand: The United States and the Definition of Multilateral Military Assistance

By as late as 1956 the U.S. Department of Defense reckoned that "the Marshall Plan, starting in 1948, greatly assisted the expansion of Western Europe's basic industries, the development of which was fundamental to any growth in defense production." (U.S. Department of Defense 1956) However, at the same time the U.S. military was aware that the road to erect a productive capacity of the European industrial complex as high as required to fulfil any realistic plan for mutual security was far from well-accomplished. Moreover, the Marshall Plan had not fixed once and for ever the problem of hard currency scarcity across the old continent and the world economies, the so called dollar gap: the dollar balance of the world against the United States, which had improved in 1950, by the end of 1951 turned to a deficit equal to about three-quarters of the 1949 levels (Table 1).

Table 1. *Total Deficit of the World with the United States, 1946 to 1953*

Year/Period	Millions of United States Dollars at Quarterly Rates
1946	1,664
1947	2,454
1948	1,289
1949	1,310
First half, 1950	536
Second half, 1950	-287
First half, 1951	523
Second half, 1951	1,320
First half, 1952	980
Third quarter, 1952	652

According to the U.N. Economic Indicators, notwithstanding mild improvements in the dollar balance of the advanced industrial economies with the United States during 1952, "this improvement was, however, precarious", as a result of a slackening in economic activity and a fall in the rate of stock building in many non-dollar countries (United Nations, Department of Economic Affairs, 1953, p. 12).

Therefore, by the time the Marshall Plan was about to be phased out, neither the remaking of European industrial capacity nor the fixing up of dollar deficit across the non-dollar countries were but to a limited extent accomplished objectives.

Against this backdrop it was initiated the U.S. commitment to provide the infant Atlantic Alliance born out of the 1949 Atlantic Pact with some sort of financial support in the pursuit of continued economic assistance after the end of the ERP. This course of action began with the launch of the Mutual Defense Assistance Program (MDAP), an economic assistance program that Washington set in motion to finance a military build-up aimed to provide its West European allies with a defense posture against external military threats (Memorandum of Conversation General MacArthur- W.A. Harriman 1950). This early aid program certainly permitted the Truman Administration to speed up the process of rearmament that in the first two years after World War II had provided Western Europe with the minimum required military defense posture[1]. Furthermore, according to the Eisenhower Administration, by the end of 1952 the MDAP

[1]With reference to the debate on the nature and objectives of rearmament within the Truman Administration prior to the birth of the Atlantic Alliance see CU, RBMD, papers of W.A. Harriman, pp. 2–5.

prompted a moderate expansion in GNP and industrial production and a modest progress toward economic integration across Europe. More importantly, the net external dollar deficit of European NATO countries and Germany dropped substantially from FY 1952 to FY 1953, plummeting from $ 3.9 billion to $ 600 million: a trend to which military procurements allotted to European countries in connection with the MDAP did certainly contribute according to the U.S. Administration (U.S. National Security Council n.d.). Notwithstanding these positive economic results, the program was considered in Washington not well-equipped to face up to the competitive economic race between East and West: "the rate of economic growth in NATO Europe is dangerously slow in relation to that of Eastern Europe and, to a lesser extent, to that of the United States" (Office of the Director for Mutual Security 1953). Furthermore, and more importantly from the research perspective of this contribution, it essentially remained a bilateral military assistance program directed to each of America's European partners. As such, it could not serve the twin U.S. objectives of making up the so called *dollar shortage* in Europe and promoting intra-European trade and monetary integration in Western Europe in one go (U.S. Office of Secretary of Defense 1955).

In contrast to the MDAP, the off-shore procurement programs implemented since 1951 under the umbrella of the Mutual Security Program, such was the name of the broader military aid initiative, effected a multilateralization of rearmament that was closely linked to the financial and monetary stabilization of intra-European trade and payments and helped Europeans to recover from dollar shortage (Office of the Director for Mutual Security 1953). The Eisenhower Administration conceived the OSP contracts as a fly-wheel to promote trade and monetary cooperation between the dollar markets and European economies.

During the two years prior to the beginning of the OSP programs, American military assistance lacked these twin features because there was both a widespread fear that rearmament might imperil economic recovery in Europe, and fierce opposition from the U.S. business community to the expansion of the European military industrial complex, as well as to the financial scope and impact of the MDAP.

In comparison to the early military assistance programs, the off-shore procurement program launched in the very beginning of the decade let the U.S. government and NATO turn bilateral military assistance into a set of multilateral programs intended to address both defense and security targets, as well as monetary stabilisation and trade integration among the Western bloc economies. In this respect, although the MDAP was above all a first-aid program, it set out the stage to bind up the Western bloc economies one's another. As a matter of fact, from as early as 1949 up to 16 per cent of total appropriations approved under the MDAP were reserved for financing the expansion of self-sufficient industrial capacity in Europe. The American aim was to build up a European military industry that would provide European partners with self-sufficient manufacturing capacity of military spare parts, machine tools and end-items. In turn, this self-sufficiency in manufacturing would raise demand for raw material and investment goods on the international commodity markets bound to both the sterling and the dollar currency areas (ECA, Office of the U.S. Special Representative in Europe

1951). This leap in demand for raw material and investment goods was closely linked to the problem of coping with a shrinking current account in the balance of payments of European countries involved in the rearmament process. This problem arose as early as 1950, and prior to the beginning of the OSP program, as a result of the inflationary spiral that stemmed from the rise in raw material and commodity prices during the Korean War (U.S. National Advisory Council on International Monetary and Financial Problems, 1950, August 2). In reviewing the economic limits of the MDAP the Secretaries of State and Defense, Acheson and Lovett, and the Director for Mutual Security Harriman, pointed attention to the persistent inflationary trends, heavy budget further burdened by rearmament and economic controls all contributing to hold back increases in productivity and improvements in the balance of payments of European allies. According to these top-notch personalities of U.S. diplomacy, in the aim of fixing up their balance of payments difficulties "the Western European countries and Japan need to maintain a high rate of domestic investment in order to expand their industrial base and to raise productivity" (U.S. Secretaries of State and Defense 1953). To put it another way, the balance of payments disequilibria that at the start of the new decade affected the European member states of NATO, where it coupled with an inflation-triggered current account deficit, could only be fixed by raising raw material production and through a well-developed manufacturing system across Europe capable of reducing dependence on external supply. Therefore, inflationary strains made all the more urgent to increase European industrial capacity to ameliorate both the current account balance, and the dollar deficit by increasing productivity and reducing import. The founding of the off-shore procurement programs served this twin objective of reducing dependence on foreign supplies and easing off pressure on foreign currency reserves, whilst at the same time increasing intra-European trade and payments. Available data on the structure of U.S. foreign economic commitment from 1952 to 1953 confirm the rising share of OSP programs financing in total U.S. aid disbursement abroad: since the outbreak of hostilities in Korea the United States financed the purchasing of U.S. military supplies by Japan. This course of action continued with the start of the OSP programs directed to Europe. Until mid-1952 U.S. disbursement to Western Europe under this heading had been limited: however, out of total $ 683.8 million disbursed for military assistance purposes, the vast majority were appropriated to the various European countries. Thereafter the program was significantly expanded and explicitly linked to the objective of industrial and trade cooperation among the European member nations of NATO. In the third quarter of 1952 France received an advance of U.S. $ 154 million from the Export-Import Bank of the United States against orders for offshore military purchases (United Nations, Department of Economic Affairs 1953, p. 92).

The beginning of the OSP programs and these new objectives took place in the framework of a fundamental turn in the ways Washington conceived the relationship between economic assistance and military buildup. As a matter of fact, from the outset of Washington's planning of the earlier military aid package, the Truman Administration was concerned about the impact that a significant involvement of the European military industrial complex in the war mobilization

might have on civilian consumption and aggregate demand. This concern led some American policymakers to argue in favor of financing European imports to prevent the process of rearmament from imperilling the monetary and financial stabilization pursued through the Marshall Plan.

Notwithstanding this early stand, over the course of 1950 a growing number of policymakers within the Truman Administration became convinced that economic assistance and security policies could co-exist, and that rearmament posed no danger to the process of economic recovery. Indeed, this view gained ground within both the U.S. Administration and NATO[2]. A short time after the outbreak of war in Korea, during lengthy discussions held in Washington regarding both the need and feasibility for an expansion of industrial output in Europe, it emerged that a wide range of government agencies and policymakers shared two leading principles that would determine the implementation of military assistance programs in the future. Within the National Advisory Council on International Monetary and Financial Problems, there was widespread consensus among government members regarding two policy principles. Firstly, they argued that financial appropriations destined to the stimulation of industrial output in European economies should not be plowed back into national reserves or used to complete postwar monetary stabilization. Indeed, Dean Acheson himself, at that time U.S. Secretary of State, stubbornly insisted that both financial assistance appropriated to Western Europe under the umbrella of the MDAP, as well as the counterpart funds generated within the ERP and held at European central banks, be used to finance imports related to defense production and internal industrial investments (U.S. National Advisory Council on International Monetary and Financial Problems, 1950, August 2).

Secondly, government members stressed that military aid should help European countries "to contribute toward their own defense, and that we were not requesting the Congress for funds to provide aid except insofar as it was necessary to carry out rearmament without an unacceptable and excessive deterioration in their own economies" (U.S. National Advisory Council on International Monetary and Financial Problems, 1950, December 26). In the United States, during 1950, notwithstanding a fierce opposition from the business community to the feasibility of combining war mobilization and economic growth (The Journal of Commerce 1950), among high ranking experts on security-related economic policy problems, a growing number of personalities put forward the opposite argument. According to the U.S. representatives on the economic and financial bodies of NATO involved in multilateral negotiations on the OSP during the 1950s, the rearmament of Western Europe was to serve as a fly-wheel to jump-start aggregate demand for civilian consumer goods (Memorandum by T.Voorhees to G.Gray, April 10, 1950;

[2]In this respect the testimony by Milton Katz, between 1950 and 1951 at the head of the Defense Financial and Economic Committee of NATO should be noted: "I did not, as some people did, regard NATO as a diversion from the Marshall Plan objectives. I regarded it as a recognition that one of the requirements for achieving the Marshall Plan objective of restoring the economies, political independence and cultural vitality of a self-sustaining and self-regenerating Europe was a sense of military security." Milton Katz interview, p. 121, in Harry S. Truman Presidential Library (HSTPL), Oral History interviews.

Hammerich 2011, p. 34). In May 1950 at the Atlantic Council (the inter-ministerial Committee of NATO made up of the Foreign, Defense and Finance Ministries from the member countries) Acheson maintained that defense effort in the European economies should be coupled with an expansionary economic policy to permit a robust growth of European domestic markets and a bettering of the employment rate (U.S. Department of State 1950). It is worth stressing that one can only understand the feasibility of this predominant American view by considering it in a comparative European perspective. In fact, in 1950 the European economies varied greatly. Some of these countries had a high rate of underemployed manpower that could be usefully employed in new production lines. In fact, the Department of the Treasury stressed that Italy was just such a case: by 1950 the country experienced the lowest postwar employment rate in industrial manufacturing (Figure 1), the key economic sector involved in, and likely to be boosted by, military productions.

Figure 1. *Employment in Manufacturing in Italy 1950-2010*

Source: U.S. Bureau of Labor Statistics.

Hence, rearmament in Italy was both to expand industrial output and to open new production lines, and thus to improve the living standards of the Italian population by stimulating the re-employment of labor and by increasing the average weekly working hours of the working population. On the contrary, some other West European nations with higher rates of economic growth came into a very different category. For example, the United Kingdom, the Netherlands and Denmark already had full utilization of industrial plants and manpower at the time. Therefore, in these economies the rearmament effort would generate a severe internal economic downturn (U.S. National Advisory Council on International Monetary and Financial Problems 1950). The only way to avoid a drop in civilian demand was to raise finance and imports for consumer goods.

During 1950, the government of the United States combined these policy guidelines with a strict policy on European national defense expenditure. The United States pressured Washington's European partners to increase the ratio of the defense budget against total state expenditures. Repeated calls for broader defense appropriations were made to London from the Summer of 1950 through

January 1951 (The UK Secretary of State, 1950; The UK Secretary of State and the Chancellor of the Exchequer, 1950). The Americans extended the same requests to most West European countries, including Italy (Record of a conversation Attlee-O.Franks-E.Plowden-D.Acheson, Washington, 1950, December 7: 353-354; Geiger, 2004: 7-10; Geiger, 2008: 345-347). The pressure exerted by the United States clearly shows the impact that the ongoing reorganization of rearmament had on European countries as early as 1950 and the years soon thereafter; in short, Europeans were to expand their budget appropriations both to strengthen their national armies, and to stimulate industrial output through the financing of imports and domestic industrial investments.

Therefore, between 1950 and the beginning of the off-shore procurement programs in early 1952, the rearmament programs had become a process involving both industrial integration, and trade partnership and balance of payments equilibrium, as well as budgetary and monetary stability. The multilateral production program implemented through the off-shore procurements was thus a combination of these elements.

Sharing the Burden of Rearmament: The Birth of the OSP in the Push towards OEEC Trade and Industrial Integration, Foreign Exchange Equilibrium and Internal Economic Stability

Throughout 1950, NATO and the United States government pursued the effort to engineer a multi-level coordination of the Western bloc economies that would integrate their budgetary, industrial and monetary assets. A particular commitment in this direction came from NATO: the organisation strove to set up a number of high rank coordinating committees to activate European industrial capacity required to meet the requirements of the military build-up without impairing the balance of payments of each European member country (Segreto 2005, p. 176, Geiger 2008, p. 354).

The aim of this consistent effort to coordinate the economies of NATO was setting up and improving economies of scale among the European countries (The Secretary of State Dean Acheson 1950). This process was intended to promote a continent-wide trade exchange in raw materials, instrumental goods, spare parts and end-item weapons. The final objective was a rationalization of production and the elimination of duplicates. The launch of this coordinated production program among the West European economies and the American economy led to lengthy discussions within NATO and its operating bureaus to improve the exploitation and coordination of raw material, investment goods, manpower and manufacturing capacities among all economies. These lengthy debates lasted throughout 1951 in the aim to figure out two stakes. First, the Atlantic Alliance was committed to estimate each West European economy's overall manufacturing capacity as well as its ratio to the overall national defense effort, in order to abide by NATO build-up targets. Furthermore, the objective was to pinpoint whether or not each European economy had a surplus industrial output of either manufacturing capacity or manpower that could be used on behalf of NATO and other member countries

to meet the build-up objectives set at NATO level. In addition, each NATO member state was expected to estimate its financial limits for the importing of weapons and military components produced in other countries under the Atlantic Alliance procurements policy (Italian National Association of Manufacturers, 1951, April 16; id., 1951, April 19; and id., 1951, March 6).

Therefore, from as early as spring 1951, Washington and NATO were committed to identifying each European economy's manufacturing strength and the balance of payments threshold beyond which the defense effort would cause imbalances on the foreign exchange equilibrium. By the fall of 1951 it was clear that NATO aimed to link the payment of future off-shore procurements allotted to NATO member states to the funding of imports and investments required by industrial mobilization. In other words, this policy was designed to deal with the impact of war mobilization on the European balance of payments against both the U.S. dollar currency area, as well as the intra-European currency disequilibrium that rearmament might trigger (Italian Foreign Office, 1952, February 12; Rappresentanza italiana presso l'OECE-Parigi, 1951). As a matter of fact, in late 1951 NATO launched an initial program of military procurements divided among the European economies. These orders were produced in Europe and allotted to the West European NATO member states but paid off in U.S. dollars out of the United States' federal balance sheet (Italian National Association of Manufacturers, 1952). The bulk of these production programs were carried out in 1952 and 1953, when these OSP contracts reached a peak. The largest share of these contracts were placed with the ammunition and aircraft productions sectors, with the latter one stimulating a spill over on industrial productions of not only end items but also instrumental goods, spare parts and equipment, including electronics. As widely reconstructed in the historical literature, the OSP contracts led to joint production of British type fighters in Belgium and the Netherlands, production of the Marcel Dassault Mystère plane in France, and assembly of F-86 all-weather fighters in Italy (Geiger 2004, Sebesta 1991, Selva 2012).

Hence, it was the U.S. taxpayer who bore the financial burden of these rearmament programs. Right from the beginning of this multilateral production program, the Italian and German economies were considered by the United States to be the ideal manufacturing countries owing to the unutilized industrial capacity and manpower.

This military production program implemented in the second half of 1951 charged NATO and its operating bureaus with fixing production capacities and defense requirements in each West European member state of the Atlantic Alliance. In this respect, NATO was to serve as a sort of filter between the producing economies, the importing countries, and the United States government (ISAC 1951). Although this program marked a step forward for the enforcement of production coordination and financial equilibrium within the Western bloc, the payments for military procurements were still an issue. Provisionally, this program could finance them in U.S. dollars because the United States government registered them as U.S. military end items transferred to West European national armies. Several high ranking policy makers within the Truman Administration focused attention on this problem. Bissell, pro-tempore director of ECA, tackled the

problem of how the multilateral military production programs would be financed and paid for in the future. He suggested that each member state of NATO should share this financial burden as far as possible. In calling for this approach, he anticipated what would become the so-called "burden-sharing" principle (Magistrati 1951). The French Prime minister, Pleven, adopted the same approach. During 1950 he recommended that a sort of common financial fund be established among the NATO member states. He believed that each state should contribute to this fund in proportion to its annual national income (U.S. Department of State, 1950: regarding the liquidity contribution of Italy to the common budget fund of NATO see: Ministero del Tesoro, 1952). During winter 1950 many hypotheses were elaborated within the Atlantic community regarding which institution should administer this common fund (U.S. National Advisory Council on International Monetary and Financial Problems, 1952, March 13; L.Targiani, 1952, January 7). Eventually, in early 1952, a common budgetary fund was set up within the Atlantic Alliance. Each member state was called on to share its budget appropriations in proportion to its national income. This principle meant that the United States should pay the largest amount into this common fund. The government of the United States took the lead because of its twofold aim to finance the European public finances on the one side, and the balance of payments of both the Sterling area and the member countries of the European Payments Union currency areas on the other. The Department of State maintained that sharing out the financial burden of rearmament called for the United States to drive for "cutting the Gordian Knot which had prevented real progress in military planning." (Department of State 1952).

The establishment of a NATO common fund and a collective defense budget of the Atlantic Alliance aimed to resolve not only the need to provide the European countries' balance-sheets with monetary liquidity to finance their defense effort, but also to stabilize their balance of payments: it was considered a priority to offset the strain of rearmament-induced industrial mobilization and the aforementioned inflation spirals (Italian Foreign Office, 1952, February 12).

The early military assistance program was negotiated against the backdrop of this multilateral evolution of rearmament programs. When it got underway, in the course of 1951, it was a first step towards integration of the manufacturing capacities and resources of the European nations in the Atlantic Alliance, and it bound this industrial interdependence to a truly intra-European trade area. This was the most distinctive feature of the off-shore procurement programs that Washington implemented through the end of the first Eisenhower Administration. In the years following the end of the OSP programs, the Pentagon played an ever-increasing role in this mechanism as it paid for investment goods and military end items produced and traded among the West European countries of NATO. In this respect, the Aeronautical sector, which has been the focus of specific studies aimed at supporting this interpretation, was an exemplary case (Sebesta 1991, Selva 2012). The case of the F86D all-weather fighters, produced in 1953 by Fiat to supply either the Italian air force or other NATO member countries, is revealing. The U.S. Air Force financed the Italian plants and paid for the end items that Fiat was to sell (Shuff 1953, May 15, Kindleberger 1953, May 16, Italian

Government 1953, May 13). By the mid-1950s the U.S. dollar was still the currency of rearmament. In fact, the off-shore procurement programs were endorsed by the U.S. Congress and NATO every year throughout the mid-1950s: the corollary of such U.S. financed program was a system of trade and payments among the European members of NATO centered on military productions mostly rewarded in U.S. currency.

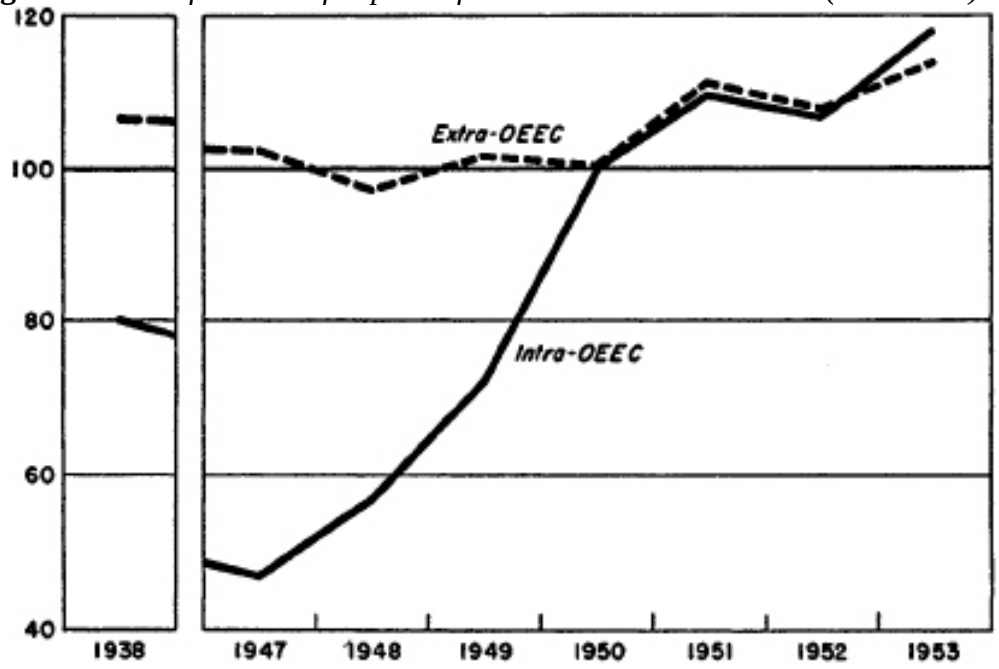
The Linkage between OSP Military Productions, Intra OEEC Trade, European Domestic Growth and Foreign Monetary and Balance of Payments Stability: The Peak Year of 1953

Though they run throughout the first half of the decade, U.S. appropriations to finance OSP contracts reached their peak in 1953, then declined: "Each year since FY 1953 the volume of OSP contract placements has declined. In FY 1956 it amounted to only U.S. $ 62 million, compared with U.S. $ 160 million in 1955 and $1,600 million in FY 1953" (U.S. Office of Secretary of Defense 1956).

Therefore, in order to make a quantitative assessment of the impact that this specific military assistance program had on the three main economic objectives it was devised to target (stimulating domestic economic growth in each European country and intra-European trade through the reactivation of unutilized industrial capacity, the establishment of new production lines and the absorption of unemployed manpower, whilst at the same time fixing up the current and capital account disequilibria, and particularly the dollar deficit that strained the West European countries), the program had a positive impact. In fact, if one focuses attention on the OSP program peak year, 1953, it was exactly by this time that European economies registered a significant macroeconomic performance and a leap forward in their market integration: in 1953, Western Europe's GNP rose about 4%, a rate faster than the 2% increase of 1952; industrial production increased an estimated 5%, with a main rise in production occurring in the last three-quarters of 1953, when the implementation of the largest amount of the OSP programs across Western Europe took stage. At the same time unemployment fell slightly in Western Europe as a whole during 1953. Besides, in the European member states of NATO, as noticed by the Foreign Operations Administration (FOA), the U.S. federal agency charged with coordinating foreign assistance aid under Eisenhower, "inflationary pressures were in general contained during 1953 and prices stabilized; despite the fact that consumer demand expanded appreciably, along with increased defense expenditures and higher investments. With the generally improved economic situation, some countries were able to take additional steps to encourage investments without creating new inflationary pressures" (Foreign Operations Administration 1954).

Concerning trade integration and trade exchange with the world, to the OEEC nations the year 1953 marked a leap forward as well: as shown in Figure 1, the volume of imports of OEEC countries combined, on an upward trend since 1947, peaked in 1953, whereas total import, total exports and intra-OEEC trade peaked from 1952 to 1953 (Boyer and Sallé 1955).

Figure 1. *Index of Volume of Imports of OEEC Countries Combined (1950 - 100)*



Source: IMF Staff paper 1955, 001, and *OEEC Statistical Bulletins.*

Finally the year 1953 marked a tellingly significant improvement in the foreign exchange reserves, balance of payment equilibrium, and dollar balance of most West European countries: according to the Bank for International Settlements (BIS) "there was an improvement in the course of 1952 and a still greater improvement in the early months of 1953 in the balance-of-payments position of the non-dollar world"; at the same time the aggregate amount of the net deficits in the settlements of the European Payments Union, which in 1951 reached an average monthly figure equivalent to U.S. $ 207 million, in the last quarter of 1952 and the first quarter of 1953 averaged only U.S. $ 102 million: another indication, did the BIS argue, "of a closer approach to equilibrium in the relationship between the various economies" (Bank for International Settlements 1953).

In its *Annual Report* for the year 1953 the IMF stressed this positive trend in the balance of payments of European countries: in the course of 1952 the West European countries achieved a balance of payments adjustment whereby a deficit in relation to the United States of some U.S. $ 480 million in the first half of the year was followed by a surplus of U.S. $ 260 million in the second half: "This improvement continued in 1953, and Continental Europe not only increased its surplus with the United States but achieved a substantial surplus with the rest of the non-European world" (IMF 1955, p. 29). Moreover, according to the IMF, during 1953 U.S. nonmilitary expenditures abroad in the form of grants had declined, while at the same time U.S. government expenditures, included off-shores purchases, which rose from U.S. $ 75 million in 1952 to $200 million that year, began exceeding nonmilitary aid, thus setting conditions (Table 2) for the disappearance of the dollar gap by the end of 1953 (IMF 1955, pp. 28–29). As for the foreign exchange reserves of European countries, since 1953 throughout the

duration of financial assistance provided by the United States to Western Europe and other OEEC countries in the framework of coordinated military production programs, most European economies enjoyed a steady improvement of their reserves (Southhard 1958, p. 457, Table 5), while at the same time reversing the historical dollar deficit with the United States that plagued Western Europe since the end of WWII. According to data elaborated by the United Nations "in 1953, Western Europe and its dependencies had had an overall payments surplus of 1,000 million dollars in respect of the United States of America. That surplus, combined with United States Government credits and grants, had boosted the monetary reserves of Western Europe by more than 2,000 million dollars in the same year" (United Nations Economic and Social Council 1954, p. 71).

Table 2. *U.S. Government Transactions, 1952 to 1953. Summary of U.S. Balance of Payments 1952-1954 in Millions of U.S Dollars*

	First half of 1952	Second half of 1952	First half of 1953	Second half of 1953
Current expenditures abroad	-0.8	-0.9	-1.1	-1.3
Nonmilitary aid (grants and loans)	-1.4	-1.1	-1.1	-1.0
Net acquisition abroad of gold and dollar assets	-0.1	1.1	1.2	1.2

Source: IMF Annual Report for the Year 1954, and U.S. Department of Commerce, Survey of Current Business, June 1954.

Conclusion

The wave of scholarship on the post-WWII reconstruction of Western Europe that developed from the 1970s to the 1980s registered a wide-ranging and long-lasting debate among historians and economists regarding the economic impact of the Marshall Plan on post-war recovery. That debate revolved around a couple of diverging interpretations about the effect of American economic assistance on the postwar economic reconstruction of Western Europe and the onset of macroeconomic conditions conducive to European economic miracles at the turn-of-the-1950s. On the one side a string of European historians as Abelshauser (1983) and Milward (1984) made the argument that wartime European economies lie at the origins of postwar recovery; on the other, Maier (1977), Hogan (1987) and a few more prominent American economists and historians contended that the Marshall Plan was essential to overcome the wartime collapse of European industrial production capacity, employment, and aggregate demand. With rare few exceptions, this

scholarly debate, as well as the most recent studies on the Marshall Plan as Steil (2018), missed to established a linkage between American strategies to resurrect west European manufacturing and the living condition of Europeans in the light of a mounting Cold War confrontation, and the continuation of this economic relief strategy under the aegis of the Atlantic Alliance soon thereafter in the context of the early steps of the process of European economic and financial integration.

This article situates the multilateral rearmament programs of NATO in the early 1950s against the backdrop of a multiple tangle of economic targets pursued at the time by Washington across Western Europe: in the first instance a pressing urgency to strike a balance between NATO's defence build up target in each of the Alliance's member state; secondly, the painful balance of payments disequilibria and inflation spirals that some West European economies suffered from by the time the Korean War broke out; thirdly, a need to provide Western Europe with continued monetary assistance premised over the unfinished problem of dollar deficit with the U.S. currency area by the end of the ERP; and finally American pressing need to foster the beginning of the process of European economic integration as a follow up to the Marshall Plan objective to bring reconstructed Europe under the sphere of influence of the United States.

The multilateralisation of rearmament through full utilisation of raw material, manufacturing capacity and unemployed manpower served at the same time this set of multiple objectives. The OSP programs became a powerful engine to exploit European industrial capacity and manpower to the full and to stabilize European currencies on the foreign exchange markets as well as aiding European countries to achieve internal monetary stability and to prompt rising domestic demand through the furthering of industrial investments, thus tackling a number of issues in one go. Macroeconomic conditions in the OEEC countries by the year the volume of OSP contracts to European industries peaked in 1953 have demonstrate the linkage between U.S. military assistance to Western Europe after the outbreak of Korean War and steady improvements enjoyed by that year by Europeans in terms of GNP, employment rate, industrial production, export and intra-OEEC trade, as well as balance of payments and foreign exchange reserves. Therefore, this collective military rearmament program became the fly-wheel to link a staggering growth in exchanges in goods and flows in capital among the transatlantic allied nations to a robust and lasting process of improvement in domestic living standards and aggregate demand. This dynamic made post war economic mobilisation for rearmament across the Atlantic Ocean a turning point in the history of economic interdependence as defined in this article.

At the same time, in so far as the off-shore procurement contracts were paid for in U.S. dollars or through the NATO common fund for transfer of raw material, instrumental and consumer goods from a manufacturing member country to any importing ally, it helped Washington strengthen the powerful dominance of U.S. currency on world trade and payments and to make the dollar the pillar of postwar international economic interdependence.

Finally but not less importantly to this article, improvements in domestic growth and external equilibrium achieved by the West European countries during the peak year of OSP programs are also an exemplary case study to test the

theoretical category of international economic interdependence which this contribution aimed at: in so far as coordinated military productions increased GNP, industrial production, export and intra-OEEC trade in the framework of expanded dollar-denominated capital flows across Europe through the mechanics of payments in dollar for military productions in the European member states of NATO for transfer to other member countries of the Atlantic Alliance, the classical theory on economic interdependence elaborated in the Social Sciences aimed at establishing a correlation between transnational capital flows, domestic economic growth and international monetary and financial stability finds full confirmation.

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Optimal Time for Closing a Trading Position

By Reza Habibi[*]

In this paper, trading rules (strategies) on a specified financial asset at some future time are interpreted as contingent claims (financial derivatives). Therefore, their fair values are computable using the binomial tree technique. However, traders pay the price of financial asset at the current time to enter to trading. Clearly, it is a loss for traders. In this paper, first, hedging strategies are proposed. Then, using three procedures the optimal time for closing the trading position are derived. Mentioned procedures are based on optimal stopping time and stochastic dynamic programming, state space and a practical procedure which uses an adds-in of Excel software. Indeed, optimal closing time and related trading strategies are applied in discrete time price processes and in the binomial tree setting. Markov decision process (MDP) solution to the problem is proposed. Simulation results are studied and finally, a conclusion section is given.

Keywords: *binomial tree, fair value, financial derivative, Excel, hedging, MDP, optimal stopping, state space model, stochastic dynamic programming, trading strategies*

Introduction

Trading is action of buying and selling financial assets in any financial markets to gain for himself or for any other person or firm. Some typical financial assets are stocks, equities, shares, exchange rates (forex), derivatives like options, futures, forward, swaps, and recently crypto-currencies such as bit-coin Traders can be considered as an investor which holds asset in a short duration. There are many technical concepts related to trading such as volume, standards, business, account of trading. Also, trading has many formats such as insider, day and intraday, fair, swing, Duluth, online, binary and momentum trading versions. There are many types of orders in trading such as market order, limit order, stop order, stop-limit, day, good-till-cancelled, immediate-or-cancelled, fill-or-kill and all-or-none orders.

Traders bet on future value of financial asset such as stock. Suppose that, in the current time $t = 0$, the price of financial asset is s_0. Traders forecast s_T, the price of financial asset at some future time $T > 0$, and based on their forecasts $\hat{s}_T$, they do their trades including buying or selling. They use trading rule $X = f_T(s_T)$. Indeed, the trading is a kind of betting in future prices of financial assets and therefore it is a kind of contingent claim (financial derivative). However, there is a contradiction, as follows. The fair price of trading rule X at $t = 0$ is

$$f_0 = e^{-rT} E_Q(X|F_0),$$

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where r and Q are the risk free rate and the risk neutral probability measure equivalent to physical measure P which governs on s. Here, the σ-field F_0 contains all information of trader at time zero. Trading strategies usually contain hedging strategies at maturity T, to avoid bad probable events. Thus, it is natural to assume that $f_T = f(s_T) \leq s_T$. Hence, using monotone property of expectation, it is seen that $f_0 \leq s_0$ at which this is the loss of trader. Indeed, the trader pays $s_0 \geq f_0$ to enter the trade but he/she gains $f_T \leq s_T$. Let $L_T = f_T - s_T$ denote the loss of trader at maturity. In this paper, it is interested to find the stopping time τ_*, the minimizer of L_{τ_*}. At τ_*, the trader closes the trading position.

As an example, consider the simple stop-loss strategy at which the trader orders to his/her broker to sell the financial asset at the price of s_T if the trace of price be increasing in time and s_T are bigger than the threshold m. Conversely, if the map of price is decreasing in time and it is expected that s_T will be less than m, then trader orders to his/her broker to sell financial asset at price m. Therefore,

$$f(s_T) = \begin{cases} s_T & s_T > m \\ m & s_T \leq m \end{cases}$$

Equivalently, $f(s_T) = \max(s_T, m) = \max(s_T - m, 0) + m$. The fair price of this trading strategy is the price of a call option with strike price m and a bond with face value m. Here, it is interested to find a stopping time τ_* to minimize

$$min_{0\leq\tau\leq T} E_Q(L_\tau|F_0) = -max_{0\leq\tau\leq T} E_Q(-L_\tau|F_0) =$$
$$-max_{0\leq\tau\leq T} E_Q(s_\tau - f_\tau).$$

The s_0 is kept fixed as a non-random variable. This is a standard problem of optimal stopping techniques; see Shiryaev and Novikov (2008). In this paper, it is aimed to characterize the optimal closing time (stopping time) of a specified trading strategies to reduce the overall loss of trader. This kind of stopping time is derived for discreet time trading strategy. Then, hedging strategies are given. The state space formulation is proposed and the binomial tree version is studied. MDP solutions are given. Finally, a conclusion section is also given.

Optimal Closing Time

In this section, discrete time trading strategy based a binomial tree setting is studied and optimal closing time is obtained in constant and time varying volatilities cases. Assume that $s_k = s_{k-1}x_k$ where x_k's are independent and identically distributed and suppose that there are k days to maturity. Suppose that x_k is u with probability of p and d with probability of $1-p$. Here, to avoid arbitrage opportunities, it is assumed that $d < e^r < u$, at which r is a risk free rate. The risk neutral probability measure is given by $Q: (p_{rn}, 1-p_{rn}), p_{rn} = \frac{e^r - d}{u-d}$, see Bjork

(2009). Here, rn stands for risk neutral probability measure. The main tool for solving optimal closing time (optimal stopping) is the dynamic programming (see Tijms 2012).

Constant Volatility

Here, assuming the constant volatility, the optimal closing time of trading for trader is derived. Let the current price of financial asset be s. Following Shiryaev and Zhitlukhin (2013), the dynamic programming based backward induction implies that

$$V_k(s) = \min\left(s - f, E_Q(V_{k-1}(sx_k)|F_k)\right), k = T, \dots, 1,$$

such that $V_0 = s - f$. The optimal time for closing the trading position is given as follows

$$\tau_* = \inf\{k, V_k(s) = s - f\}.$$

It is seen that τ_* is an early exercise time of an American type of financial derivative with pay-off function $f(s_T)$ at the maturity T which is an interesting result. Indeed, the stopping time τ_* can be determined in a binomial tree. As follows, a theoretical procedure based a stochastic dynamic programming is proposed.

<u>*Procedure 1*</u>. Here, using approach of Ross (1982), pages 4,5, a solution is proposed. First, notice that
$V_k(s) = \min\left(s - f, p_{rn}V_{k-1}(su) + (1 - p_{rn})V_{k-1}(sd)\right), V_0(s) = s - f.$
Let $U_k(s) = V_k(s) - s$. Then,
$U_k(s) = \min(-f, p_{rn}U_{k-1}(su) + (1 - p_{rn})U_{k-1}(sd) + sA), U_0(s) = -f,$
where $A = p_{rn}(u - 1) + (1 - p_{rn})(d - 1) = e^r - 1$. Following Ross (1982), $U_k(s)$ is decreasing in s. The proof is by induction on k. Thus, the optimal policy has the following form. To this end, suppose that the current price is s and there are k days to maturity.
Proposition 1 (Optimal policy). Suppose that there are increasing numbers $s_1 < \cdots < s_n < \cdots$, then one should close the trading if and only if $s_n \leq s$.
In the rest of this section, two other procedures are proposed. The procedure 2 contains a practical solution based on Excel software.
<u>*Procedure 2*</u>. Some adds-in of Excel software such as *DerivaGem*[3] derive the fair price and early exercise time of some specified American type financial derivatives such as call or put options. However, a difficulty of this approach is that sometimes the specific financial derivative (trading strategy) is combination of

[3]See http://www.prenhall.com/mischtm/support_fr.html.

some financial derivatives. The *DerivaGem* software specifies the early exercise for each component separately but the early exercise of combination of financial derivatives is unknown, yet. A natural question is how to modify the *DerivaGem* to value and show the early exercise for every arbitrary derivative? The answer is so simple. It is enough to find the early exercise of each component, separately, and then consider the common early exercises, as early exercise of financial derivative (trading strategy).

State Space Modeling

The discussion of part 2.1 relies on strong assumption of constant volatility, which is not correct in practice. To overcome this difficulty, Liao (2005) considered a GARCH(1,1) series for squared volatility $h_t = v_t^2$ of financial asset. This equation plays the role of state equation in a state space modeling which leads to a Bayes filtering approach. Here, following Liao (2005), assume that $f_t = f_t(s_t, v_t)$ represent the binomial tree (or Black-Scholes, hereafter BS) price of a financial derivative. However, because of wrong assumption of constant volatility, there is a deviation ε_t for price computed using standard BS formula. Thus,

$$f_t = BS(v_t) + \varepsilon_t.$$

Here, ε_t's are independent and identically distributed random variables with common distribution with zero mean and variance σ_ε^2. This equation plays the role of measurement equation of state space model. Let h_t be an GARCH(1,1) series given by

$$h_t = \omega + \alpha r_t^2 + \beta h_{t-1} + \zeta_t.$$

This equation plays the role of state equation. Here, it is assumed that ζ_t's are independent and normally distributed random variables with zero mean and variance σ_ζ^2. It is assumed that ε_t's and ζ_t's are statistically independent. Also, assumed that $\omega, \alpha, \beta > 0$ and $\alpha + \beta < 1$. This section can be considered as the Liao (2005) work in European derivatives to American format. Here, r_t's are returns of financial asset which is underlying asset and derivative is defined basis on it.

As follows, based on Bayes rule, updating procedures are derived. Notice that $f_t = BS(v_t) + \varepsilon_t = BS^*(h_t) + \varepsilon_t$, $\varepsilon_t \sim N(0, \sigma_\varepsilon^2)$, $BS^*(x) = BS(\sqrt{x})$, $h_t = v_t^2$, $\mu_t = BS^*(h_t)$. Also, it is known that $h_t = \omega + \alpha r_t^2 + \beta h_{t-1} + \zeta_t$ and $\zeta_t \sim N(0, \sigma_\zeta^2)$. Thus, $f_t | h_t \sim N(\mu_t, \sigma_\varepsilon^2)$ and given h_{t-1} and r_t, then $h_t \sim N(\theta_t, \sigma_\zeta^2)$, where $\theta_t = \omega + \alpha r_t^2 + \beta h_{t-1}$. Using the Bayes rule, it is seen that
$\pi(h_t | h_{t-1}, f_t) \propto \pi(f_t | h_t) \pi(h_t | h_{t-1}, r_t)$.
Notice that

$$-\log\big(\pi(h_t|h_{t-1},f_t)\big) \propto \frac{(BS^*(h_t)-f_t)^2}{\sigma_\varepsilon^2}+\frac{(h_t-\theta_t)^2}{\sigma_\zeta^2}.$$

By differentiating with respect to h_t, it is seen that the maximum a posteriori (MAP) estimate of h_t satisfies in the following updating equation

$$\Delta(h_t)+\frac{\sigma_\varepsilon^2}{\sigma_\zeta^2}h_t = f_t+\frac{\sigma_\varepsilon^2}{\sigma_\zeta^2}\theta_t,$$

where Δ is the delta Greek letter of financial derivative. The following proposition summaries the above discussion. Numerical methods say Newton-Raphson method may be applied to solve this equation.

Proposition 1. The MAP estimate of h_t satisfies in the following updating equation

$$\Delta(h_t)+\frac{\sigma_\varepsilon^2}{\sigma_\zeta^2}h_t = f_t+\frac{\sigma_\varepsilon^2}{\sigma_\zeta^2}\theta_t,$$

where Δ is the delta Greek letter of financial derivative.

Some Orders

In this section, it is shown that most of trading order strategies can be represented as functions $f(s,c,p,b)$ where c,p,s,b are call and put options, stock, and bond, respectively. A widely used type of $f(s,c,p,b)$ is the linear functions

$$f(s,b) = a_1c + a_2p + a_3s + a_4b,$$

Here, $a_i, i = 1,2,3,4$ are real numbers. For more details about trading orders see Nasdaq trader (2014). In each strategy, m's are suitable thresholds defined in the order type.

a) Market order. A market order is an order to buy or sell a stock at the best available price. Generally, this type of order will be executed immediately. However, the price at which a market order will be executed is not guaranteed. It is important for investors to remember that the last-traded price is not necessarily the price at which a market order will be executed. In fast-moving markets, the price at which a market order will execute often deviates from the last-traded price or "real time" quotes. $f(s_T)$ of this type of order can be written as

$f(s_T) = \min(s_T, m) = s_T - \max(s_T - m, 0).$

That is, this strategy is a combination of a stock and call option on that specified stock.

b) Limit order. A limit order is an order to buy or sell a stock at a specific price or better. A buy limit order can only be executed at the limit price or lower, and a sell limit order can only be executed at the limit price or higher. A limit order is not guaranteed to execute. A limit order can only be filled if the stock's market price reaches the limit price. While limit orders do not guarantee execution, they help ensure that an investor does not pay more than a predetermined price for a stock. Here, $f(s_T) = \max(s_T, m) = \max(s_T - m, 0) + m$.

c) Stop order. A stop order, also referred to as a stop-loss order, is an order to buy or sell a stock once the price of the stock reaches a specified price, known as the stop price. When the stop price is reached, a stop order becomes a market order. A buy stop order is entered at a stop price above the current market price. Investors generally use a buy stop order to limit a loss or to protect a profit on a stock that they have sold short. A sell stop order is entered at a stop price below the current market price. Investors generally use a sell stop order to limit a loss or to protect a profit on a stock that they own. Here, $f(s_T) = \max(s_T, m)$.

d) Stop-limit order. A stop-limit order is an order to buy or sell a stock that combines the features of a stop order and a limit order. Once the stop price is reached, a stop-limit order becomes a limit order that will be executed at a specified price (or better). Te benefit of a stop-limit order is that the investor can control the price at which the order can be executed. In this case,

$$f(s_T) = \begin{cases} \min(s_T, m_2) & s_T > m_1 \\ m_1 & s_T \leq m_1 \end{cases}$$

Let $g(s_T) = \min(s_T, m_2)$. Thus, this order can be considered as a stop order defined on $g(s_T)$.

e) Fill-or-kill order. Another common special order type is Fill-or-Kill (FOK) order. An FOK order is an order to buy or sell a stock that must be executed immediately in its entirety; otherwise, the entire order will be cancelled (i.e., no partial execution of the order is allowed). Here,

$$f(s_T) = \begin{cases} s_{max} & s_T = s_{max} \\ 0 & \text{otherwise} \end{cases}$$

f) Market if touched. An MIT (market-if-touched) is an order to buy (or sell) an asset below (or above) the market. This order is held in the system until the trigger price is touched, and is then submitted as a market order. Again, $f(s_T) = \max(s_T - m, 0) - m$.

Other DP Applications

In this section, other applications of dynamic programming (DP) technique in trading problem are studied.

Hedging Strategy

Although, the main focus of paper is the finding of optimal closing time of a trading position. However, in this section, first, the optimal portion α of financial asset s which is contributed in trading by traders is found. Indeed, we want to find α to minimize $f-\alpha s$ in each time t, under the physical probability measure $P:(p_{phs}, 1-p_{phs})$, where notation phs stands for the physical. Here, it is assumed that the trader is a risk neutral one and $V_0(x)=\log(x)$. Notice that

$$V_k(f-\alpha s)=\min_{0\le\alpha\le 1}\Big(p_{phs}V_{k-1}(f_u-\alpha su)+(1-p_{phs})V_{k-1}(f_d-\alpha sd)\Big).$$

Assuming, $ud=1$, it is seen that

$$\alpha=\frac{1}{s}\{p_{phs}uf_d+(1-p_{phs})df_u\}.$$

Here, f_d, f_u are values of derivatives using upper and lower future values sd, su of future price, of financial asset, in the trading. The following proposition summarizes the above discussion.

Proposition 2. The optimal hedge ratio is given by

$$\alpha=\frac{1}{s}\{p_{phs}uf_d+(1-p_{phs})df_u\},$$

where, f_d, f_u are values of derivatives using upper and lower future values sd, su of future price, of financial asset, in the trading under the physical probability measure $P:(p_{phs}, 1-p_{phs})$.

MDP Modeling

In this section, the MDP modeling and corresponding solution is proposed in a given stock market. Markov decision processes model decision making in stochastic, sequential environments. The essence of the model is that a decision maker, or agent, inhabits an environment, which changes state randomly in response to action choices made by the decision maker. The state of the environment affects the immediate reward obtained by the agent, as well as the probabilities of future state transitions. The agent's objective is to select actions to maximize a long-term measure of total reward. This article describes MDPs, an example application, algorithms for finding optimal policies in MDPs, and useful extensions to the basic model (see Ross 1982).

To this end, consider a specified stock s, which generates cash flow of gains $f(s_i,u_i)$, at time $i\ge 1$, where $u_i=\pi(s_i)$ and π is paying policy. The state equation is given by $s_{i+1}=g(s_i,u_i)$. The present value of stock is given by $E\sum_{i=0}^{\infty}\gamma^i f(s_i,u_i)$ where, $\gamma=1/(1+r)$, is discounted factor and r is discounted

rate. It is interested to maximize $E\sum_{i=0}^{\infty}\gamma^i f(s_i,u_i)$ with respect to policy π. This problem defines a dynamic programming problem defined by value function as a recursive equation

$$V(s_i)=max_{\pi}\{f(s_i,u_i)+\gamma V(g(s_i,u_i))\}.$$

The following proposition summarizes the above discussion.

Proposition 3. The optimal policy is given by the argmax of following value function

$$V(s_i)=max_{\pi}\{f(s_i,u_i)+\gamma V(g(s_i,u_i))\},$$

where $\gamma=1/(1+r)$, is discounted factor and r is discounted rate.

The following practical algorithm summarizes the above theoretical discussions.

Algorithm

1. Derive the $f(s_T)$ using formulas of Section 2.3, for special strategy and compute the over-price that the trader should pay. Choose the minimum over-price order.
2. Assuming constant volatility, Using a binomial tree and based on dynamic programming in backward induction format, compute the optimal stopping as closing time of a specified trading position, using formulas in section 2.1.
3. Assuming volatilities behave as a GARCH series and using the state space filtering technique in section 2.2, repeat the point 2.
4. Hedging strategies can be applied to remove the risk of a specified trading position. As well as, MDP techniques are applicable for finding the optimal dividend policy for policy makers as well as choosing the best stocks with optimal dividend policy for traders, see formulas in section 3.1.

Data Analysis

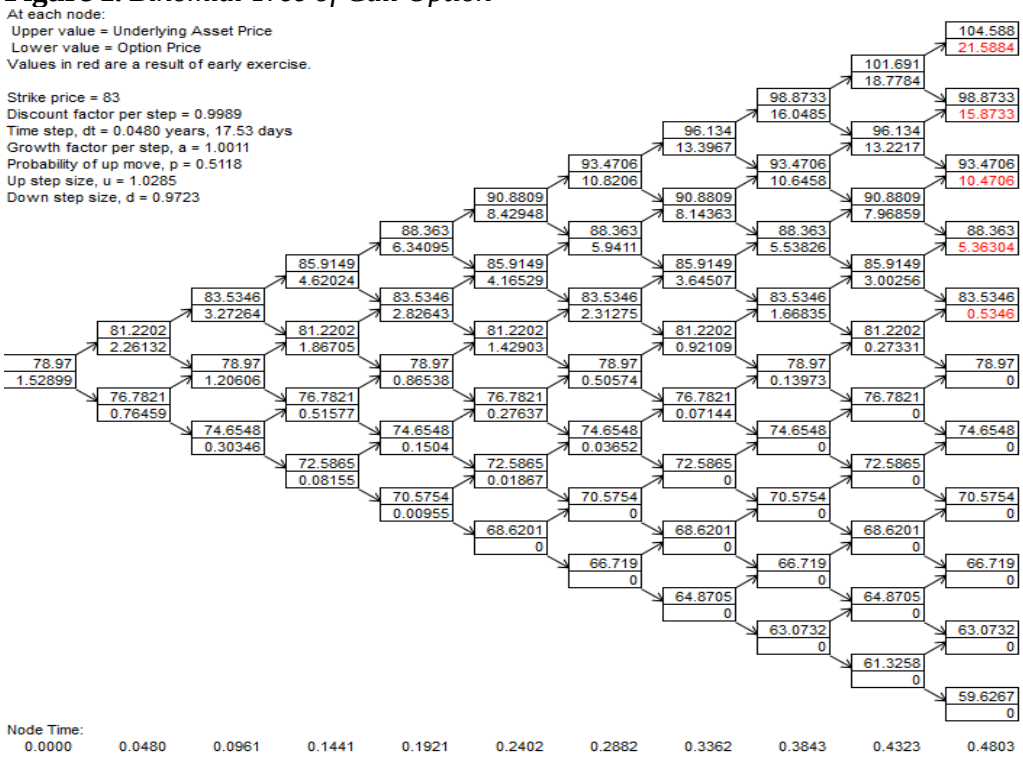
In this section, the above theoretical results are applied for trading strategy orders. Consider the data set of 122 daily stock price of Apple Corporation for time period of 10 August 2017 to 2 February 2018.

Part 1 of algorithm. At the beginning (time zero), a trader buys one share of Apple Co. stock at the price $s_0=78.97$. The daily volatility estimate is $\sigma=0.0080454$. Thus, the volatility per year is $\sqrt{254}\times 0.0080454=0.1282$. The mentioned trader considers a stop loss strategy with $m=83$. The daily risk free rate is $\frac{2.2}{254}\%$. The maturity is $\frac{122}{254}$. Here, $f(s_T)=\max(s_T,m)=\max(s_T-m,0)+m$.

Part 2 of algorithm. Thus, using the binomial tree tool of *DerivaGem* software, the actual price of call option $\max(s_T-m,0)$ at time zero is 1.5289. Also, the price of bond m at time zero is $me^{-rT}=83e^{-\frac{2.2}{100}\times\frac{122}{254}}=82.127$. The fair price of this

trading position is $82.127 + 1.5289 = 83.656$. Hence, the over-price paid for this strategy is -4.686 which produces an arbitrage opportunity. The binomial tree is plotted in Figure 1.

Figure 1. *Binomial Tree of Call Option*



The optimal closing times of this strategy are only at the maturity. The delta of this trading position is 0.3372. So, it is enough to buy 0.3372 shares of stocks to delta neutral hedge.

Part 3 of algorithm. Next, consider a GARCH(1,1) series for the volatility given by

$$\mathrm{h_t} = 0.00087107 + 1.06153194\mathrm{r}_{\mathrm{t-1}}^2,$$

where $r_t = \frac{s_t - s_{t-1}}{s_{t-1}}$. Here, the state space filter is applied. To derive σ_ε^2, the difference between empirical and theoretical (obtained using BS) prices of financial derivative is obtained. Then, the sample variance of these differences is an estimate of σ_ε^2 which is 5.52×10^{-9}. Indeed, m is chosen such that there is a call option for that maturity. Then, to estimate σ_ζ^2, sequential empirical estimates of volatilities are derived by $\frac{1}{t}\sum_{i=1}^{t} r_i^2$ and its differences between $\mathrm{h_t}$obtained by a GARCH series produces ζ_t's. Then, their sample variance is an estimate of σ_ζ^2 which is 6.61×10^{-8}.

Part 4 of algorithm. Here, $\Delta(h_t) = \Phi(d_1)$, where Φ is the cumulative distribution function of standard normal distribution and $d_1 = \frac{\log\left(\frac{s}{m}\right) + (r + 0.5v^2)(T-t)}{v\sqrt{T-t}}$. The

MAP estimate of volatility and the fair price of stop-loss strategy are 1.84, 8.35, respectively, which considerably reduces the arbitrage opportunity.

Conclusions

End users of this paper are market players, academics and financial analysts. This paper is valuable for academics since it relates the fair value of a financial asset such as stock by modern financial engineering such as derivative pricing tools like binomial trees. Financial analysts compute the fair values shares, stocks, financial assets such as gold, and obtain accurate relative prices in each economy. Market users such as traders, hedgers and even gamblers are satisfied since the actual values of assets are found and trading positions are based on better understood prices and robust price equilibriums are proposed. Beside this, optimal exist or entrance of sell or buy positions are given which is too valuable for traders.

In more detail, traders choose strategy to buy or sell at the maturity a financial asset such as stock. Indeed, they choose a financial derivative. Then, the fair price of is computable using Black-Scholes or binomial tree techniques. However, they pay the whole price of financial asset at the zero time. This over-price fee destroys the financial stability. Sometimes, it produces risk free return as an arbitrage opportunity. In this paper, this over-price fee is calculated and some hedging strategies are given. Beside this, using the Bayesian technique, the time varying volatility problems are solved.

Mispricing causes a divergence between the market price of a security and the fundamental value of that security. The law of one price states that the market price of a security is equal to the present discounted value of all cash flows generated by the security. However, it is not always the case as asset prices can sometimes diverge from their fundamental values. The divergence can be due to a financial crisis or a current event in the economy. This paper discusses the mispricing of financial assets, similar ideas in this regard can be found in Binsbergen et al. (2023) and references therein.

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