

**T.C.**  
**İSTANBUL 29 MAYIS ÜNİVERSİTESİ**  
**SOSYAL BİLİMLER ENSTİTÜSÜ**  
**ÇEVİRİBİLİM ANABİLİM DALI**

**CUSTOMIZING A BANKING AND FINANCE FOCUSED  
NMT SYSTEM: AN EMPIRICAL STUDY MEASURING  
THE EFFECT OF CONTROLLED LANGUAGE**

**(YÜKSEK LİSANS TEZİ)**  
**Merve Ceren YÜKSEL**

**Danışman:**  
**Prof. Dr. Işın ÖNER**

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Çeviribilim Anabilim Dalı, Çeviribilim Bilim Dalı'nda 010517YL01 numaralı Merve Ceren Yüksel'in hazırladığı "Customizing a Banking and Finance Focused NMT System: An Emprical Study Measuring the Effect of Controlled Language" konulu yüksek lisans tezi ile ilgili tez savunma sınavı, 17.07.2029 günü 17:00 – 18:00 saatleri arasında yapılmış, sorulan sorulara alınan cevaplar sonunda adayın tezinin başarılı olduğuna oy birliği ile karar verilmiştir.

Prof. Dr. Işın ÖNER

KARADAĞ

İstanbul 29 Mayıs Üniversitesi

(Tez Danışmanı ve Sınav Komisyonu Başkanı)

Prof. Dr. Ayşe Banu

Yıldız Teknik Üniversitesi

Dr. Öğr. Üyesi Nilüfer ALİMEN

İstanbul 29 Mayıs Üniversitesi

## BEYAN

Bu tezin yazılmasında bilimsel ahlak kurallarına uyulduğunu, başkalarının eserlerinden yararlanılması durumunda bilimsel normlara uygun olarak atıfta bulunulduğunu, kullanılan verilerde herhangi bir tahrifat yapılmadığını, tezin herhangi bir kısmının bu üniversite veya başka bir üniversitedeki başka bir tez çalışması olarak sunulmadığını beyan ederim.

Merve Ceren YÜKSEL

17.07.2020



## **ÖZ**

Çeviri sektörü her geçen gün teknolojik yeniliklerle gelişmektedir. Bu teknolojik yenilikler, çeviri zincirinin halkasını oluşturan çevirmenler, editörler, proje yöneticileri ve çeviri hizmetine ihtiyaç duyan kişiler de dahil olmak üzere çeviri hizmeti paydaşlarının hayatını kolaylaştırmaktadır. Nöral makine çevirisi (NMT), çeviri sektöründeki en güncel yeniliklerden biridir ve çeviri sektörünün işleyişini yeniden şekillendiren kilometre taşlarından biridir. NMT sistemlerinin geliştirilmesi çoğunlukla bilgisayar mühendislerine ve yazılım uzmanlarına bırakılmıştır. Çevirmenler genellikle bu sistemleri geliştirmeye yönelik girişimlerden uzak durmaktadır. Bu çalışmanın ilk amacı bir çevirmen olarak günümüz teknolojilerinin avantajını kullanıp bankacılık ve finans metinlerinin çevirisinde kullanmaya yönelik bir NMT sistemi oluşturmaktır. Çalışmanın ikinci bölümünde NMT sisteminde yapılan çevirilerin kalitesini artırmada son yıllarda oldukça popüler olan Kontrollü Dil kurallarının etkili olup olmadığı incelenmektedir.

### **Anahtar Sözcükler:**

Makine Çevirisi, Nöral Makine Çevirisi, Kontrollü Dil, Çeviri Teknolojileri, Bilgisayar Destekli Çeviri

## **ABSTRACT**

The industry of translation is developing day by day with technological innovations. These technological innovations make processes easier for the stakeholders of translation service who form the link of the translation service chain, including translators, editors, project managers and people who need translation services. Neural machine translation (NMT) is one of the most up-to-date innovations in the translation industry and NMT has become one of the milestones reshaping the translation industry. The task of NMT system development is mostly left to computer engineers and software experts. Translators often avoid attempts to improve these systems. The first aim of this study is to create an NMT system for banking and finance texts by using the advantage of today's technologies as a translator. In the second part of the study, it has been investigated whether the Controlled Language rules, which have been very popular in recent years, are effective in improving the quality of translations made in NMT system.

### **Keywords:**

Machine Translation, Neural Machine Translation, Controlled Language, Translation Technologies, Computer Assisted Translation

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## LIST OF ABBREVIATIONS

**BLEU:** Bilingual Evaluation Understudy

**BRSA:** Banking Regulation and Supervision Agency

**CAT:** Computer-Aided Translation

**CBRT:** Central Bank of the Republic of Turkey

**CL:** Controlled Language

**CMB:** Capital Markets Board of Turkey

**ECB:** European Central Bank

**GNMT:** Google Neural Machine Translation

**MT:** Machine Translation

**NMT:** Neural Machine Translation

**QA:** Quality Assurance

**RBMT:** Rule Based Machine Translation

**SMT:** Statistical Machine Translation

**ST:** Source Text

**TBB:** The Banks Association of Turkey

**TM:** Translation Memory

**TMS:** Terminology Management System

**TOBB:** The Union of Chambers and Commodity Exchanges of Turkey

**TT:** Target Text

**TurkStat:** Turkish Statistical Institute

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# **CUSTOMIZING A BANKING AND FINANCE FOCUSED NMT SYSTEM: AN EMPIRICAL STUDY MEASURING THE EFFECT OF CONTROLLED LANGUAGE**

## **INTRODUCTION**

Technological innovations have a huge effect on nearly all industries. It is a non-ignorable fact that modern technological solutions in many industries are rapidly increasing. Translation industry, the place and effect of which is crucial around the globe, is not an exception.

With the advanced technology, many different translator-friendly software and tools, the number of which are increasing day by day, have been developed. Computer-Aided Translation (CAT) tools, Quality Assurance (QA) and Alignment tools and Machine Translation Software stay at the top of most commonly used translation software and tools list. As a result, the quality of translations improves, the productivity of translators rises and the connectivity between translators and clients becomes faster. Besides, technological improvements save time, effort, and money in the long run for the parties involved in translation process.

Apart from CAT tools, Machine Translation (MT) has been recently on the agenda of translation and localization world. MT is a completely automated programming which allows translation from one language into other languages making translation processes faster and easier. MT has been on the scene since the era of information explosion, *i.e.* the late 1940s, and has been evolved since then with different approaches including Rule Based Machine Translation (RbMT), Statistical Machine Translation (SMT) and Neural Machine Translation (NMT).

The latest machine translation approach is NMT which works by converting group of words from a source language to a target language. More detailed information with regards to the processing of NMT will be provided in the first chapter.

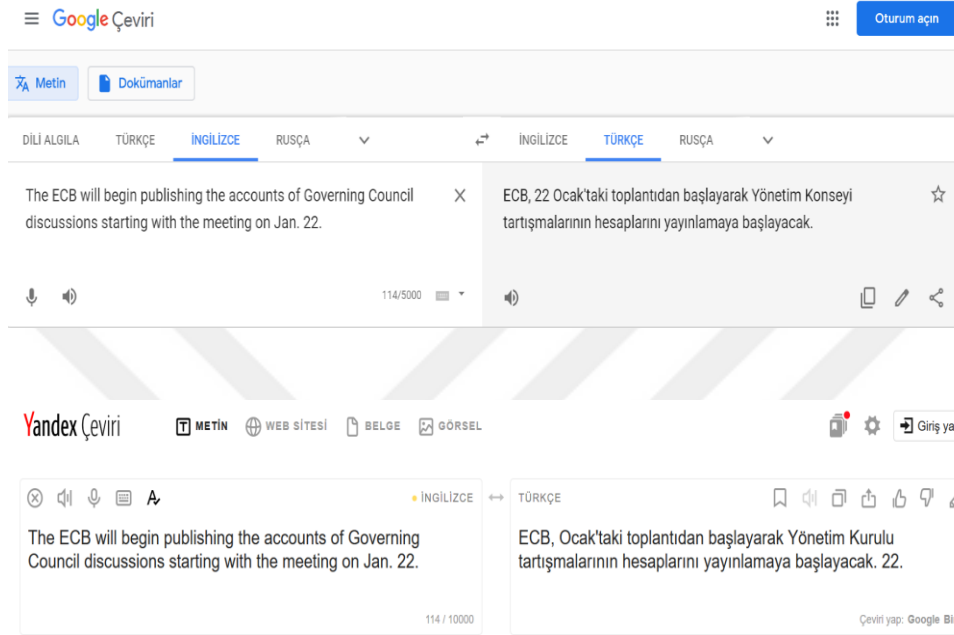
NMT systems gained popularity all over the world especially with Google's launch of Google Neural Machine Translation system (GNMT) in 2016 (Source: <https://ai.googleblog.com/2016/09/a-neural-network-for-machine.html> (accessed on

May 18, 2020)). And since then, GNMT and similar systems are frequently used by almost everyone on daily basis for the translation of any type of texts. It is not wrong to say that the outputs can be very promising. Still, the outputs of NMT systems such as Google Translate, Yandex and Microsoft's Bing may not always be reliable or context-related especially for specialized fields such as legal, marketing, information technologies and banking/finance due to the requirement of area-specific terminology.

For example, the word "account" has three different meanings:

1. an arrangement that somebody has with a bank, etc. to keep money there, take some out, etc.
2. a written or spoken description of something that has happened.
3. an arrangement that somebody has with a company that allows them to use the internet, send and receive messages by email, social media, etc. (Source: [https://www.oxfordlearnersdictionaries.com/definition/english/account\\_1?q=account](https://www.oxfordlearnersdictionaries.com/definition/english/account_1?q=account) (accessed on December 13, 2019)).

In the examples below, Google Translate and Yandex Translate’s translations of a sentence about ECB (European Central Bank) are provided.



**Figure 1** Screenshots of the translations of a banking related sentence in Google Translate and Yandex Translate

Neither Google Translate nor Yandex Translate conveys the actual meaning of the source sentence into Turkish because the meaning of “account” is “report” in this context. Besides, the abbreviation “ECB” (European Central Bank) is not translated. Accordingly, the correct translation should have been as follows:

“AMB, 22 Ocak’taki toplantıdan başlayarak Yönetim Konseyi tartışmalarının raporlarını yayınlamaya başlayacak.”

As a translator who has been working in the field of banking and finance for many years, the issue explained in the example above was the first driving force for me to write this thesis with the aim of creating a Customized Neural Translation System specially designed for the translation of banking and finance texts. The reason for my choice of banking and finance as domain is that the banking field has an overwhelming share on the increasing volume of translations all around the world. Tenders, advertisements, contracts, forms, databases, financial reports, insurance terms and conditions, manuals, information sheets, quarterly, monthly, and annual reports, press

releases, price lists and legal documents are some of the text documents classified under the banking texts.

According to the current statistics of Banking Regulation and Supervision Agency of Turkey (BRSA), there are four Public Investment Banks, two Banks with the management of SDIF (Savings Deposit Insurance Fund), five Private Investment Banks, four Foreign Investment Banks established in Turkey, three Public Commercial Banks, eight Private Commercial Banks, fifteen Foreign Commercial Banks established in Turkey, five Branches of Foreign Banks established outside of Turkey, three Participation Banks and two Public Participation Banks. Additionally, there are 61 Factoring Institutions, 25 Leasing Institutions, 14 Financing Institutions and many Asset Management, Audit Management and Authorized Institutions to Conduct Valuation Services to Banks in Turkey (Source: <https://www.bddk.org.tr/Kuruluslar-Kategori/Bankalar/1>, (accessed on May 3, 2020)).

I would not be wrong in saying that the number of banks around the globe is constantly increasing. In 2018, the applications of 14 new banks were approved for deposit insurance operations by the Federal Deposit Insurance Corporation (Source: <https://www.americanbanker.com/list/new-banks-this-year>, (accessed on May 3, 2020)). And this number only applies to United States. As the number of banks increases, the demand for high quality translations with strict delivery dates also increases. Considering the different text documents under the framework of banking industry and the constant increase in the volume of the documents to be translated in line with the increasing number of banks around the globe as a result of globalization, I believe that a Customized NMT system may help translators working in banking industry by providing domain-specific translation results.

In my opinion, a more focused and customized NMT system may be efficient and may provide context-related results for the translators working in banking and finance industry. Therefore, customizing NMT System designed for banking and finance texts for Turkish – English language pair will be the first aim of this thesis.

The second focus of this thesis will be Controlled Language (CL). “Controlled Language refers to constraints on lexicon, grammar, and style with the objective of improving text translatability, comprehensibility, readability, and usability” (O’Brien, 2010, 1). Recently, there is a growing interest towards CL in terms of its positive

impacts on machine translation. There have been numerous studies to investigate constructive outcomes of CL on different MT architectures including Statistical, Rule-based and Neural Machine systems for different language pairs up to now. However, as far as we know, no previous research has investigated the effect of pre-editing on a customized NMT system with certain CL rules in Turkish – English language pair for banking and finance domain so far. Accordingly, this thesis will delve into CL and examine its effects on the NMT system which will be customized within the scope of the current thesis.

With this aim in mind, two banking and finance focused NMT systems will be customized with same training data. However, one of the two NMT systems will be pre-edited with specific CL rules to see the effects of CL by measuring differences of outcomes between two NMT systems.

Therefore, the main hypothesis I will attempt to demonstrate is that the outputs of NMT tend to be more accurate if specific CL rules are applied to source data before training NMT system.

I hope my thesis will be a helpful reference for the translators, translation students and companies or any other parties who want to customize their own NMT system from scratch and to improve the quality of an existing NMT system by decreasing the number of issues that might be found in outputs.

## **GENERAL SCOPE**

In the first chapter, I will basically focus on Computer-Aided Translation and its basic concepts which are commonly used in localization industry such as Translation Memory (TM), Terminology Management System (TMS), Alignment Tools and Quality Assurance Tools.

In the second chapter, different approaches of Machine Translation – Rule-based Systems, Statistical Systems and Neural Systems – will be explained upon positioning Machine Translation in a historical perspective.

In the third chapter, the steps to customize an NMT system in Custom Translator, which is a feature of Microsoft Azure Cloud Services, will be provided. The related steps are Data Preparation, Training and Deployment and Using the Deployed Model in Production. Data Preparation chapter, which focuses on preparing training data for customization, will be categorized into Corpus, Alignment and Post-Alignment processes. Upon providing necessary information about data preparation for training, key information about Training, Deployment and Using Deployed Model in Production will be touched upon, respectively.

In the fourth chapter, I will concentrate on Controlled Language, which is a rising trend in MT in recent years. After a historical review of CL, I will deal with specific rule sets of CL that I applied to training corpus for the second NMT. These rules will be explained in detail by providing examples.

In the fifth chapter, the outputs of the first NMT system that I customized, namely the NMT1 that I trained only with aligned bilingual corpus without applying CL rules on training corpus, and the second NMT system, namely the NMT2 that I trained by applying CL rules on training corpus will be compared in terms of grammar, accuracy and terminology.

In the sixth and final chapter, all chapters will be summarized, and outputs of the study will be concluded with recommendations for future work on the CL's contribution to NMT systems.

## **1 TRANSLATION TECHNOLOGIES**

Today, we see the effects of technology no matter what we look at. The working principles and processes of many industries such as medicine, finance, fashion, and education have transformed together with the technology and translation industry is not an exception. Nowadays, many translators use translation technologies which help to ensure that translations are performed in a consistent and cost-efficient way. Besides, translation technologies speed up translation process which is welcomed by all parties involved in translation. In this chapter, I will briefly provide information in relation to the translation technologies which are the supporters and keystones of today's translation industry.

### **1.1 Computer-Aided Translation Tools**

Computer-Aided Translation tools, also known as CAT tools, are software applications that assist translators in translating texts by increasing the efficiency of translators and consistency of the translated texts to reach high quality outputs. So as to meet the companies' rising requirement of localization, CAT tools were developed. And since then, the number and features of CAT tools have been gradually rising. In the following chapter, I will touch on the most common concepts of CAT tools.

#### **1.1.1. Translation Memory**

Translation memories are the databases containing previously completed translations at sentence level. Thanks to TMs, translators can use and take advantage of the previously translated sentences while working in new projects.

CAT tools compare new segments to the previously translated segments in TM. Identical source segments in a TM are called "100% matches". If the sentences before and/or after the related source segment are exactly same, these matches can be called as "101%, 102% ICE, Perfect and Context Match matches" depending on the preference of CAT tool. Other matches which are between 50% - 100% matches are called "Fuzzy Matches". The percentages of the fuzzy matches change depending on the similarity between the related segment and similar segment in TM. And, if a segment does not have an equivalent translation in TM although it has more than one identical match, it is called "Repetition".

One of the most important features of TMs is Concordance Search which allows translators to search manually for the specific sentences or words in TMs. As a result, consistency is ensured; turnaround times and costs are reduced.

### **1.1.2. Terminology Management Systems**

Terminology management can be defined as the study of structure, arrangement, improvement, utilization, and administration of terminology in different subject areas. Similar to TMs which store bilingual segments (sentences or paragraphs), terminology management software helps to store terms according to various subject fields such as law, life sciences, finance and engineering and makes stored terms re-usable. In addition to different subject fields, organization or company specific terminologies can also be built depending on demands and requirements. Thanks to terminology management software, terminology is used consistently for each project and translation quality improves accordingly.

### **1.1.3. Alignment Tools**

In order to create a TM, translated texts in both languages should be divided into sentences, and then, each segment in source text should be matched with the corresponding segment in target text. Alignment tools perform this task. During alignment, parallel documents are paired, segmented, and coded appropriately for import into the designated memory database.

### **1.1.4. Quality Assurance Tools**

After translation and review processes are completed, the final versions of the translations are checked in terms of terminology, spelling, and grammar. Automated QA tools perform these checks. By virtue of QA tools, untranslated segments or tag matching issues are detected. Besides, the issues which cannot be recognized easily such as the rendering of numbers, measurements, abbreviations, or decimal separators can be easily found out. Another important feature of the QA tools is that they can detect when the same source segment is rendered in a different way or if the same translation is used for different source segment. Therefore, translators ensure consistency. Although many CAT tools have their own QA functions; there are also many other stand-alone QA tools.

## 2 MACHINE TRANSLATION

Machine Translation is a technology that enables automatic translation of documents by using translation memories, term bases and advanced analysis techniques. The history of machine translation dates back to the emergence of computers.

But how? Why did people head towards to MT? The first reason was the expanding significance for translation in the late 1940s with the explosion of information. It was believed that effectiveness would be expanded with mechanization. Secondly, since translation started to gain significance during that period, it was a regular task. Thus, the theoretical structure of a potential MT framework could be designed according to the organization of the translation process which was being performed by people. Thirdly, looking up the target language equivalents of words in dictionaries was very tedious and this time-consuming task could be significantly compensated thanks to online dictionaries. Finally, the role of translation could not be denied during the Second World War. Translation was being utilized like a code-breaking task in those years. Hence, these four points were the underlying explanations behind the research of Machine Translation (Nirenburg et al. 1992, 2-3).

The first trial of MT was the Georgetown experiment for the Russian-English language pair in 1954. Chemistry related 50 sentences in Russian were translated into English by the collaboration of IBM and Georgetown University. This trial led to a great deal of public interest in spite of the fact that it was just a 250-word experiment. As a result of this investigation, MT projects began to gain popularity outside of the USA (Hutchins 2004, 1).

Then, US subsidizing agencies commissioned the ALPAC (Automatic Language Processing Advisory Committee) to do an investigation of a study of the realities of MT and a report was issued in 1966. As per the report, post-editing of machine translation output was not less expensive or quicker than human translation and it was suggested that there was no advantage in utilizing machine translation frameworks. Eventually, subsidizing for MT in the US nearly stopped (Koehn 2009, 15-16).

However, research proceeded in France, Germany, Soviet Union, Italy and Canada and the interest in MT continued to expand. With the increasing accessibility to PCs and data processing, the examinations and results began to increment.

Consequently, University of Montreal developed TAUM-METEO, known as the first successful MT system. It was utilized to translate meteorological forecasts from English into French starting in 1977. And in 1978, MT efforts continued with Eurotra Project of the European Economic Community (EEC). The point of this project was providing MT capability among all official EEC languages (Danish, Dutch, English, French, German, Greek, Italian, Portuguese and Spanish). All through the 1980s, research on further developed strategies and methods continued including Japanese MT efforts bolstered by the government and industry. Consequently, MT research started to gain its past significance in United States (Nirenburg et al. 1992, 5-6).

From the beginning to present day, machine translation has developed three different approaches: RbMT, SMT and NMT. In the following chapter, I will basically touch upon them.

### **2.1. Rule-based Machine Translation**

The systems of Rule-based Machine Translation, also known as Knowledge-based Machine Translation and Classical Approach of Machine Translation, work based upon the determination of rules for morphology, sentence structure, lexical choice, and formation.

RbMT, aiming to convert source language structures into the target language structures, is considered as the first commercial MT system. Systran, Reverso, Prompt and LOGOS are most famous examples of RbMT systems.

RbMT systems rely on dictionaries including millions of bilingual word pairs and linguistic rules which are generated by linguists and software developers for language pairs by analyzing and mapping the morphological, syntactic, and semantic information of two different languages. These linguistic rules are used to transfer the grammatical structure of the source language into the target language. Thousands of dictionaries are also used to improve quality of the outputs.

There are different models classified under RbMT such as Direct, Transfer-based and Interlingual models. These models differ from each other in terms of SL and TL analysis.

In today's high-tech world, RbMT systems are not preferred since editing process of the translations is very time consuming as the quality of translations can be low, and sentences may not always comply with the rules of target language. The reason

is that translations are based on dictionaries and grammar rules which have many exceptions. (Source: <https://www.systransoft.com/systran/translation-technology/what-is-machine-translation/> (accessed on May 1, 2020))

## **2.2. Statistical Machine Translation**

The systems of Statistical Machine Translation, also known as Phrase-based systems, work based upon statistical models whose parameters are determined from the investigation of bilingual content corpora in contrast to RbMT system which essentially relies on words and grammar rules.

Statistical models, which are generated by analyzing bilingual and monolingual corpora, transfer source texts to target language with the statistical weights are utilized to choose the most probable translation. To make it clear, the machine analyses an existing corpus and counts each word and its translation, for example, how many times the word “plant” translated as “fabrika”, “bitki” or “tesis” in an English-Turkish bilingual corpus. And accordingly, the system of SMT reaches a conclusion based on the most common used equivalent.

To reach translation results of high quality with SMT is not easy but it is still possible by utilizing large amounts of corpora. The quality increases in line with the number of sentences in corpora.

As SMT utilizes existing corpora translated by human, its output quality is better, and translations are more fluent in contrast to Rule-based Machine Translation. However, the feature of the corpora used in SMT plays a major role. If the corpora are specialized in a domain with consistent terminology and usages, the result can be very reliable. On the other hand, general corpora without any specific field may lead to poor results in SMT.

### 2.3. Neural Machine Translation

NMT is the latest approach to machine translation and NMT systems work by training huge corpora of bilingual segments, that is, huge translation memories containing thousands of translation units. NMT systems utilize neural networks, which can be defined as machine learning techniques, to obtain much more reliable and context-related results. “Neural networks include thousands of artificial units resembling neurons in that their output or activation depends on the stimuli they receive from other neurons and the strength of the connections along which these stimuli are passed” (cf. Forcada 2017, 292).

Neural network models belong to a family of encoder-decoders. The encoder extracts a representation or relation from a variable-length input sentence. But how? The words of the source documents are encoded as a sequence of vectors that represent the meaning of the words. A context is generated for each word, based on the representations, *i.e.* relation between the word and the context of the previous word. Then, using this new context, the correct translation for the word is selected among all the possible translations the word could have.

In the next phase, the decoder generates a correct translation from this representation. The representations of the source words within the sentence context are translated in its most appropriate target language equivalent.

NMT has become the new trend in machine translation. Nowadays, it is very difficult to catch up with its improvements which is very rapid indeed.

### **3 CUSTOMIZING A NEURAL MACHINE TRANSLATION SYSTEM**

There are several machine translation providers producing professional level translation results. Google Translate, Microsoft Translator / Bing, SDL BeGlobal, Yandex Translate, Amazon Web Services translator, IBM - Watson Language Translator and KantanMT are some of the best-known MT service providers.

I preferred to use Microsoft Custom Translator to customize NMT system. The reason for my choice is that the training documents can be uploaded to the system in many different formats including TMX, XLIFF, TXT, DOCX, and XLSX without character limitation for sentences. Besides, the system also accepts data that is parallel at the document level but is not yet aligned at the sentence level. Custom Translator automatically matches sentences across documents, which will make data collection and preparation more effective. The system also allows to use monolingual data (in .TXT, HTML, HTM, PDF, DOCX, ALIGN formats) in either or both languages to complement the parallel training data to improve the translations. And finally, the process of customizing NMT system is run on cloud, which is a very advantageous feature without the need of downloading many additional software to computer (Source: <https://www.microsoft.com/en-us/translator/business/customization/> (accessed on September 5, 2019)).

#### **3.1. Data Preparation**

In this chapter, I will focus on the procedures that I followed to make data ready to be used in customizing NMT:

##### **3.1.1. Corpus**

A corpus including at least 10.000 bilingual segments is required for training models in order to customize an NMT system in Microsoft Custom Translator. I compiled online resources which have both Turkish and English version from the official websites of the BRSA, CBRT (The Central Bank of the Republic of Turkey), TurkStat (Turkish Statistical Institute), TBB (The Banks Association of Turkey), CMB (Capital Markets Board of Turkey) and TOBB (The Union of Chambers and Commodity Exchanges of Turkey).

As Turkish texts and their English version are not always same in terms of content, I paid attention and made sure that each sentence has its own English equivalent. Then, I copied Turkish and English contents in Microsoft Word files by giving the same name to be on the safe side. After completing data collection, alignment process began.

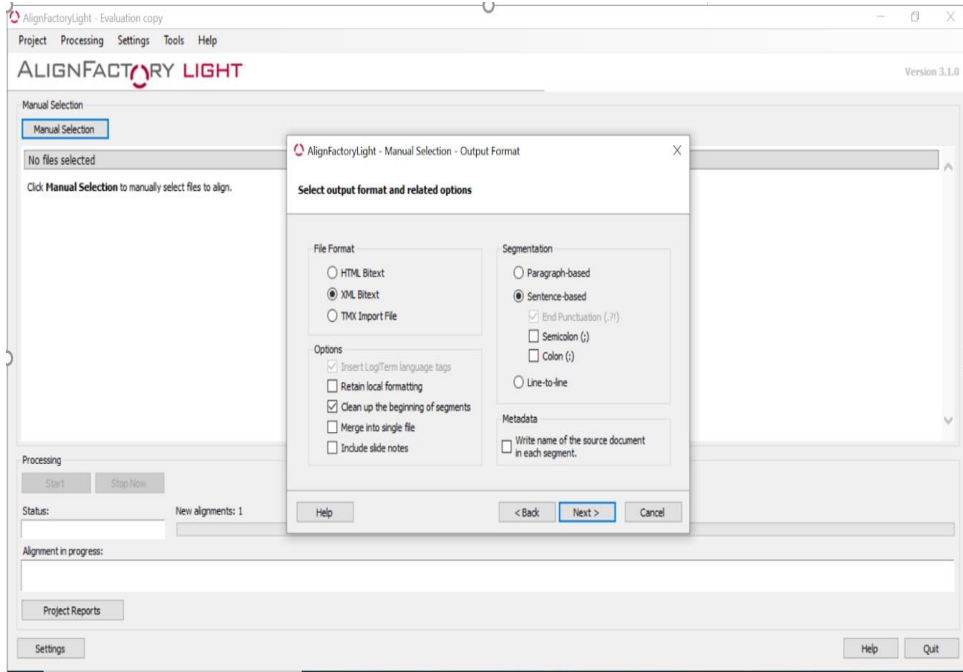
### **3.1.2. Alignment**

Alignment is the course of action where at least two things are situated in a straight line or parallel to one another. In translation and localization industry, alignment refers to matching source and its translated segments so as to create a Translation Memory.

As mentioned before, aligned TMX, XLIFF, TXT, DOCX, and XLSX documents are required to customize an NMT system in Microsoft Custom Translator. However, as I did not have aligned source and target texts on the sentence level, I had to align all content that I compiled.

There are many alignment tools that help the alignment process including – but not limited to WinAlign, SDL Align, AlignFactory Light, MemoQ's built-in aligner, Abbyy Aligner, LF Aligner, Hunalign, Transit NXT aligner and Bligner.

I preferred to use AlignFactory Light which is free downloadable and has a very user-friendly interface. After adding source and target documents, output file format can be selected among HTML Bitext, XML Bitext and TMX Import File. Segmentation can also be selected as paragraph-based or sentence-based as seen below.



**Figure 2.** Screenshot of the interface of AlignFactory Light.

After selecting all necessary options (I selected XML Bitext file format, Sentence based segmentation, Clean up the beginning of segments option), output is created automatically in the selected format. Below, a screenshot of the output xml file I created is seen.

| Para Politikası Kurulu Kararı_TUR-ENG_BT.xml                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Para Politikası Kurulu Kararı.docx</b>                                                                                                                                                                                                                                                                     | <b>Para Politikası Kurulu Kararı_EN.docx</b>                                                                                                                                                                                                                        |
| Para Politikası Kurulu Kararı                                                                                                                                                                                                                                                                                 | Decision of the Monetary Policy Committee                                                                                                                                                                                                                           |
| Toplantıya Katılan Kurul Üyeleri                                                                                                                                                                                                                                                                              | Participating Committee Members                                                                                                                                                                                                                                     |
| Murat Uysal (Başkan), Murat Çetinkaya, Ömer Duman, Uğur Namık Küçük, Oğuzhan Özbaş, Emrah Şener, Abdullah Yavaş.                                                                                                                                                                                              | Murat Uysal (Governor), Murat Çetinkaya, Ömer Duman, Uğur Namık Küçük, Oğuzhan Özbaş, Emrah Şener, Abdullah Yavaş.                                                                                                                                                  |
| Para Politikası Kurulu (Kurul), politika faizi olan bir hafta vadeli repo ihale faiz oranının yüzde 16,50'den yüzde 14'e indirilmesine karar vermiştir.                                                                                                                                                       | The Monetary Policy Committee (the Committee) has decided to reduce the policy rate (one-week repo auction rate) from 16.50 percent to 14 percent.                                                                                                                  |
| Son dönemde edinilen veriler iktisadi faaliyetteki ılımlı toparlanma eğiliminin devam ettiğini göstermektedir.                                                                                                                                                                                                | Recently obtained data indicate that moderate recovery in economic activity continues.                                                                                                                                                                              |
| Öncü göstergeler iktisadi faaliyetin sektörel yayılımındaki iyileşmenin devam ettiğine işaret etmekle birlikte yatırımlar zayıf seyrini sürdürmektedir.                                                                                                                                                       | Leading indicators point to continuing improvement in the sectoral diffusion of economic activity. However, investment demand remains weak.                                                                                                                         |
| Sanayi üretimi, son aylarda resmi tatillerle ilişkili çalışma günü etkilerine bağlı olarak yüksek bir oynaklık sergilemekle birlikte, ana eğilim itibarıyla ılımlı artışını korumaktadır.                                                                                                                     | While industrial production has been highly volatile due to working day effects associated with official holidays in recent months, its underlying trend has maintained a moderate pace of growth.                                                                  |
| Rekabet gücündeki gelişmelerin olumlu etkisi sürerken küresel büyüme görünümündeki zayıflama dış talebi kısmen yavaşlatmaktadır.                                                                                                                                                                              | While favorable effects of improved competitiveness prevail, weakening global economic outlook tempers external demand.                                                                                                                                             |
| Önümüzdeki dönemde net ihracatın büyümeye katkısının azalarak da olsa süreceği, enflasyondaki düşüş eğilimi ve finansal koşullardaki iyileşmeyle birlikte ekonomideki kademeli toparlanmanın devam edeceği öngörülmektedir.                                                                                   | Looking forward, net exports are expected to contribute to economic growth, although to a lesser extent, and the gradual recovery is likely to continue with the help of the disinflation trend and improvement in financial conditions.                            |
| Son dönemde büyüme kompozisyonunun etkisiyle belirgin bir iyileşme kaydeden cari işlemler dengesinin önümüzdeki dönemde ılımlı bir seyriz izlenmesi beklenmektedir.                                                                                                                                           | Current account balance, which has recently recorded significant improvement due to the composition of growth, is expected to maintain a moderate course.                                                                                                           |
| Yakın dönemde küresel iktisadi faaliyetteki zayıf seyriz ve enflasyona dair aşağı yönlü riskler belirginleşirken gelişmiş ülke merkez bankaları para politikaları genişleyici yönde şekillenmektedir.                                                                                                         | Recently, advanced economy central banks have been pursuing more expansionary policies as weakening global economic activity and downside risks to inflation became more evident.                                                                                   |
| Bu durum gelişmekte olan ülke finansal varlıklarına yönelik talebi ve risk iştahını desteklemekle birlikte, korumacılık önlemlerinin ve küresel ekonomi politikalarına dair diğer belirsizliklerin gerek sermaye akımları gerekse dış ticaret kanalıyla oluşturabileceği etkiler yakından takip edilmektedir. | While these developments support the demand for emerging market assets and the risk appetite, rising protectionism and uncertainty regarding global economic policies are closely monitored in terms of their impact on both capital flows and international trade. |

**Figure 3.** Screenshot of xml output created by using AlignFactory Light

Although AlignFactory Light made alignment easier, the process did not run smoothly via software, and it required manual intervention for some of the sentences. For example, if source sentence includes an abbreviation ending with (.) full stop, the software detects it as the end of sentence and splits sentence into two or more than two sentences, which leads to segmentation problems. In those circumstances, I re-aligned the relevant segments manually.

### **3.1.3. Post-Alignment Process**

After Alignment, all segments were checked to ensure that all segments were matching and there were not any segmentation issues. In the meantime, item numbers, bullets and proper names that are not necessary to include in the source data were eliminated. This way, I tried to make sentences as simple as possible and avoid misinterpretation of the source sentence by the NMT. Some examples are provided below.

#### **Example:**

19. Para politikası duruşu oluşturulurken, maliye politikasına dair esas alınan görünüm fiyat istikrarı ve makroekonomik dengelenmeye odaklı, para politikasıyla eşgüdüm arz eden bir politika duruşu içermektedir (Source 1)

#### **Example:**

1. Tüketici fiyatları Eylül ayında yüzde 0,99 oranında artarken yıllık enflasyon 5,75 puan azalarak yüzde 9,26'ya gerilemiştir (Source 1)

#### **Comment:**

Item numbers at the beginning of the sentences were removed to avoid misinterpretation because in Turkish, a dot is used as a generic ordinal maker after the number. Therefore, the source “19. Para politikası duruşu” can be mistakenly translated as “19<sup>th</sup> money policy stance” or the source “1. Tüketici fiyatları” can be translated as “First consumer prices”.

#### **Example:**

Murat Uysal (Başkan), Murat Çetinkaya, Ömer Duman, Uğur Namık Küçük, Oğuzhan Özbaş, Emrah Şener, Abdullah Yavaş (Source 2)

**Comment:**

After alignment, I found out that some of the segments include only proper names that should not be translated and unnecessary to include in the corpus. Therefore, above segment and other similar segments were removed from the corpus.

**Example:**

- Halka açık anonim ortaklıkların taraf oldukları tüm bölünme işlemlerinde Kurulumuza başvurma zorunluluğu getirilmiştir. (Source 3)

Halka açık bankalar için bağımsız yönetim kurulu üye sayısı üç olarak belirlenmiştir. (Source 4)

**Comment:**

Above bullets and all similar bullets at the beginning of the sentences were removed.

**3.2. Training and Deployment**

Training and Deployment steps come after preparing data. Neither Training nor Deployment requires any programming skills. Uploading training data, training, testing, and deployment systems are performed in the same portal with simple steps.

Training is the step in which NMT goes through a ‘learning’ process. Training a model is a must to build a translation model. In order to start training, the documents which will be included in the training set should be uploaded to Microsoft Custom Portal. The system allows to upload aligned bilingual data (archive or translation memory file in TMX, XLF, XLIFF, LCL, XLSX, ZIP formats) and parallel data (source and target files in TXT, HTML, HTM, PDF, DOCX, ALIGN formats). Besides, phrase or sentence dictionary can also be uploaded to increase consistency. Maximum file size allowed is 100 MB for each document and training may take a few hours depending on the size of documents.

Deployment, which is the final step in customizing NMT, follows Training. Deployment is the method for integrating a machine learning model into an existing production environment, also called as server location, to make use of the data (Source: <https://www.datarobot.com/wiki/machine-learning-model-deployment/>, (accessed on January 17, 2020)). In Microsoft Custom Translator, there are three options of environment: Asia Pacific, Europe, and North America. It is important to note that there

are no differences in terms of usage and output quality between them, and the model can be deployed to more than one server location.

### **3.3. Using the Deployed Model in Production**

After model deployment process was completed, customized system required a regular call to the Microsoft Translator Text API (Application Programming Interface) using certain information such as category ID and API version for coding. This way, the prepared system became available to use for translation. In this chapter, I will briefly explain which programming language and IDE I used and why I chose to use them.

#### **3.3.1. Node.js**

To make required API call to our deployed model, a request URL and several parameters are needed. These parameters are ‘api-version’ (3.0 in our case), ‘to’ (the target language), ‘from’ (the source language) etc.

Firstly, a programming language is needed for writing required parameters. Java, JavaScript, Go, C++ and Node.js are some of the programming languages that can be used in this process. I preferred to use Node.js programming language.

It is important to note that there are different download options for Node.js depending on the operating system of the computer to which Node.js will be downloaded. In my case, I downloaded and installed Windows Installer.

The reason for my choice of Node.js is that it is easy to use and does not require any additional installations. We just need to download two modules, which will be provided in “Running Deployed NMT System” chapter, before writing codes by using parameters, ID, request body, response body, etc.

#### **3.3.2. Visual Studio Code**

In order to execute Node.js, an IDE (Integrated Development Environment), such as Visual Studio Code and PyCharm, is required. I preferred to use Visual Studio Code. The reason for my choice of using Visual Studio Code is that it is a lightweight but powerful source code editor which runs on desktop and is available for Windows, macOS and Linux. Also, Visual Studio Code is easy to use and requires no other dependency files to make an API Call or create an application. It comes with built-in support for JavaScript, TypeScript and Node.js and has a rich ecosystem of extensions for other languages such as C++, C#, Java, Python, PHP, Go and runtimes such as .NET and Unity (Source: <https://code.visualstudio.com/docs>, (accessed on May 4, 2020)).

### 3.3.3. Running Deployed NMT System

After completing Node.js and Visual Studio Code installations, I opened Visual Studio Code and run the following commands one by one. Therefore, two modules that mentioned before are downloaded:

- `const request = require('request');`
- `const uuidv4 = require('uuid/v4');`

Secondly, I created a JavaScript file, involving scripts to use my custom-built model deployed in Microsoft Europe Server. The necessary scripts are as follows:

- `var key_var = 'TRANSLATOR_TEXT_SUBSCRIPTION_KEY';`
- `process.env.TRANSLATOR_TEXT_SUBSCRIPTION_KEY='this field will be filled with unique subscription key';`
- `var subscriptionKey = process.env[key_var];`
- `var endpoint_var = 'TRANSLATOR_TEXT_ENDPOINT';`
- `process.env.TRANSLATOR_TEXT_ENDPOINT='https://api-eur.cognitive.microsofttranslator.com';`
- `var endpoint = process.env[endpoint_var];`

(Source: <https://docs.microsoft.com/tr-tr/azure/cognitive-services/translator/quickstart-detect?pivot=programming-language-javascript>, (accessed on May 23, 2020)).

For `TRANSLATOR_TEXT_SUBSCRIPTION_KEY`, a unique subscription key should be written which is provided by the platform of Microsoft Custom Translator upon registration. This unique key should be written to the field written 'this field will be filled with unique subscription key'.

For `TRANSLATOR_TEXT_ENDPOINT`, I used the following URL: “api-eur.cognitive.microsofttranslator.com”. As I deployed my model in Europe I used ‘api-eur’ here, this changes according to deployment environments which are Asia Pacific, Europe and North America.

Thirdly, I created a `translateText` function, and wrote necessary codes in order to get translation. These codes are provided below. The fields that need to be filled by the developer -api version, category, from, to- are written in bold.

```

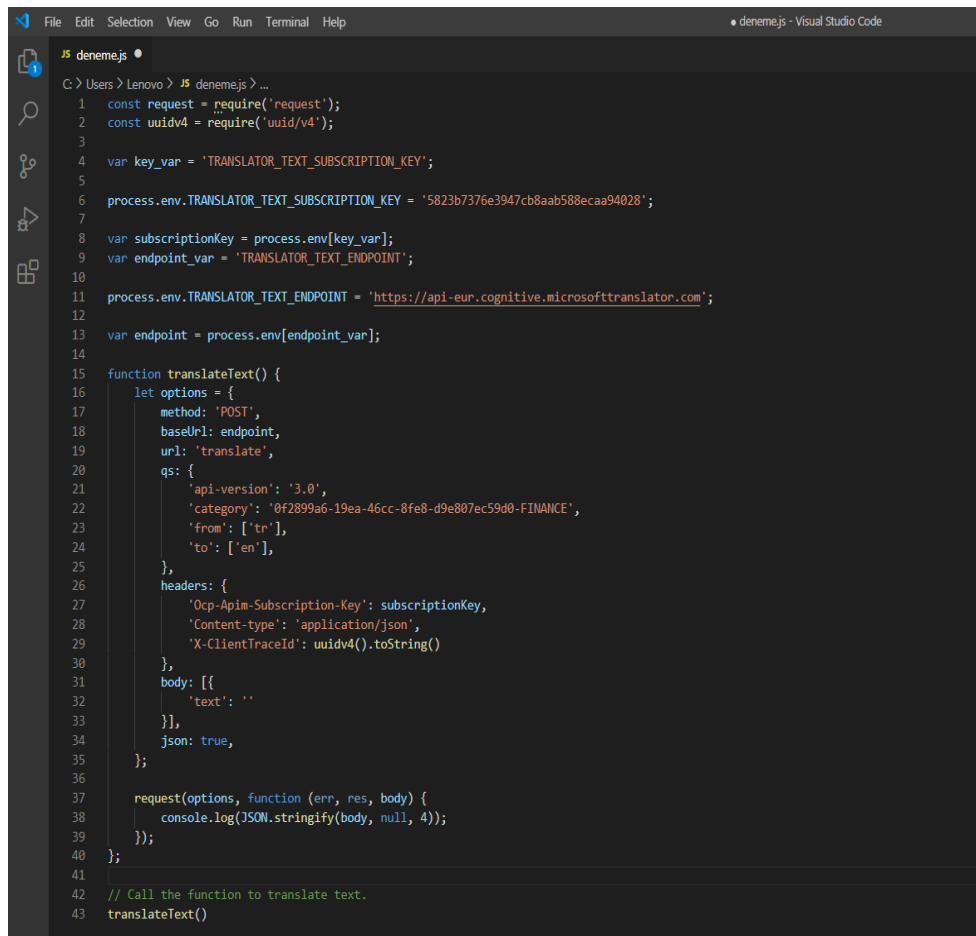
function translateText() {
  let options = {
    method: 'POST',
    baseUrl: endpoint,
    url: 'translate',
    qs: {
      'api-version': 'this field will be filled according to the api version being used',
      'category': 'this field will be filled according to category',
      'from': ['this field will be filled with source language code'],
      'to': ['this field will be filled with target language code'],
    },
    headers: {
      'Ocp-Apim-Subscription-Key': subscriptionKey,
      'Content-type': 'application/json',
      'X-ClientTraceId': uuidv4().toString()
    },
    body: [{
      'text': 'the sentence to be translated is written here'
    }],
    json: true,
  };

  request(options, function (err, res, body) {
    console.log(JSON.stringify(body, null, 4));
  });
};

// Call the function to translate text.
translateText()

```

After writing above codes and fill necessary fields, the system gets ready for translation.



```
1  const request = require('request');
2  const uuidv4 = require('uuid/v4');
3
4  var key_var = 'TRANSLATOR_TEXT_SUBSCRIPTION_KEY';
5
6  process.env.TRANSLATOR_TEXT_SUBSCRIPTION_KEY = '5823b7376e3947cb8aab588ecaa94028';
7
8  var subscriptionKey = process.env[key_var];
9  var endpoint_var = 'TRANSLATOR_TEXT_ENDPOINT';
10
11 process.env.TRANSLATOR_TEXT_ENDPOINT = 'https://api-eur.cognitive.microsofttranslator.com';
12
13 var endpoint = process.env[endpoint_var];
14
15 function translateText() {
16   let options = {
17     method: 'POST',
18     baseUrl: endpoint,
19     url: 'translate',
20     qs: {
21       'api-version': '3.0',
22       'category': '0f2899a6-19ea-46cc-8fe8-d9e807ec59d0-FINANCE',
23       'from': ['tr'],
24       'to': ['en'],
25     },
26     headers: {
27       'Ocp-Apim-Subscription-Key': subscriptionKey,
28       'Content-type': 'application/json',
29       'X-ClientTraceId': uuidv4().toString()
30     },
31     body: [{
32       'text': ''
33     }],
34     json: true,
35   };
36
37   request(options, function (err, res, body) {
38     console.log(JSON.stringify(body, null, 4));
39   });
40 };
41
42 // Call the function to translate text.
43 translateText()
```

**Figure 4** Visual Studio Code Screen with Necessary Codes

As the language pair of my model is from Turkish into English, I wrote 'tr' in 'from' part and 'en' in 'to' part. Words, sentences, or paragraphs to be translated are written in body chapter as shown above. It is important to write text to be translated within apostrophes. Otherwise, the system will not translate. In order to get translation, the page is required to be saved by clicking File > Save in the toolbar or Ctrl+S shortcut can also be used. Then, a new Terminal is opened from the toolbar and a simple code is written and run:

- node [this field will be filled with file name.js]

```
30 },
31 body: [{
32   'text': 'Merkez Bankasının temel amacı fiyat istikrarını sağlamaktır.'
33 }],
34 }
```

OUTPUT TERMINAL DEBUG CONSOLE PROBLEMS

Windows PowerShell  
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell <https://aka.ms/pscore6>

PS C:\Users\Lenovo> node deneme.js

**Figure 5.** Visual Studio Code with Necessary Code for Getting Translation

After writing the above-mentioned code, we press Enter and after processing, we get the translation in “translations” chapter as shown below:

```
30 },
31 body: [{
32   'text': 'Merkez Bankasının temel amacı fiyat istikrarını sağlamaktır.'
33 }],
34 }
```

OUTPUT TERMINAL DEBUG CONSOLE PROBLEMS

```
{
  "language": "tr",
  "score": 1,
  "translations": [
    {
      "text": "The main aim of the central bank is to ensure price stability.",
      "to": "en"
    }
  ]
}
```

**Figure 6.** Visual Studio Code’s Translation

To sum up, the steps to follow for customizing NMT and using customized NMT system have been provided in above chapters from Data preparation to Using Deployed Model in Production. Firstly, I created training data from the scratch, and I did not use any ready-to-use TMs or bilingual documents. Thus, data preparation process required too much manual works except for alignment process in which I used an Alignment tool. Nevertheless, all the training data were revised to ensure that there were not any segmentation issues. Secondly, Training and Deployment steps were easily completed in Microsoft Custom Translator thanks to the provided opportunities of the system without any coding requirement.

Finally, necessary installments and steps to follow for using deployed model in production were provided. Although it is not necessary to have advanced level computer engineering knowledge, some basic coding skills are necessary in this step and they have been provided subsequently above.

## 4 CONTROLLED LANGUAGE

Recently, the interest towards using CL in MT has been increasing and CL has become more prevalent in translation industry. “Controlled Language, referring to constraints on vocabulary, grammar, and text structure, is utilized to reach consistent authoring of source texts and to achieve concise writing; CL is also applied to obtain high quality translations” (cf. Mitamura, 1999, 46).

CL has been used in technical documentation for many years. In heavy-equipment machinery industry, Caterpillar developed Caterpillar Fundamental English, now called Caterpillar Technical English to write their expanding technical support libraries in 1970. Caterpillar launched a global campaign to use CTE for manuals, service bulletins and other publications (cf. Smart 2006, 2). In aircraft industry, Controlled Language of European Association of Aerospace Industries Simplified English (AECMA SE) was first used in 1986 to deal with the increasing size and complexity of technical documentation (cf. Poppy Quintal, 2002). In automotive industry, General Motors began to use CASL (Controlled Automated Service Language) in their existing authoring processes and the management of General Motors declared the CASL project as a success in 1999 (cf. Godden 2000, 14). And in IT industry, Attempto Controlled English (ACE) was used to translate software specifications.

“Controlled Languages have been utilized in various fields such as air transportation, heavy machinery, automotive and IT industries with the aim of producing texts easily understood by target audience and easily translated” (cf. O’Brien 2006, 10). By applying CL rules to source text, (i) the readability and comprehensibility of the documents is improved, (ii) and the translatability of the text is increased (cf. 10 - 12).

### 4.1. Controlled Language Design

In order to measure the effect of CL on NMT1, I customized a second NMT, which will be called NMT2, with the same training data by applying certain CL rules to the source texts. The use of CL falls into three broad categories: Lexical Rules, Text Structure Rules and Syntactic Rules. In this chapter, three rule sets in developing controlled language will be explained in detail.

#### **4.1.1. Lexical Rules**

“A key element in controlling a source language is to restrict vocabulary size and meaning for a particular application domain” (Mitamura 1999, 46). Therefore, the correctness of NMT outputs is expected to be improved by limiting lexical ambiguity. I created and applied two rules under Lexical Rules category for NMT2.

##### **4.1.1.1. Create a glossary including key abbreviations, words, and phrases in the subject field that you will customize NMT**

Although the domain of NMTs that I customized had already been restricted as Banking and Finance, a glossary consisting of 350 words and phrases, which are commonly used, was created in Excel format. It is important to include different spellings of the words or abbreviations to the glossary. For example, both “GSYH” and “GSYİH” are used as abbreviations in Turkish for the English equivalent GDP (See Annex 2 for full list of words and phrases). However, it should be noted that it is not useful to add two different equivalents in target, as the system will define only one of them as the equivalent of the source.

##### **4.1.1.2. Fix any misspelling error according to Turkish orthography**

All source data was checked in terms of spelling and errors were corrected by using spell check feature of Microsoft Word (Version. 2016 18.2002.1101.0).

#### **4.1.2. Text Structure Rules**

Under the framework of the second set of rules, the source text was harmonized in terms of beginning and ending sentences.

##### **4.1.2.1. Use punctuation marks when necessary**

“Proper manipulation of punctuation can help MT achieve correct structural analyses” (Shei 2002, 5). Accordingly, required punctuation marks were used when necessary and at the end of each source segment.

**Example:****Raw:**

Yıllık enflasyondaki düşüş tüm ana alt gruplara yayılırken temel sürükleyici temel mal ve gıda grupları oldu (Source 5).

**Post-CL:**

Yıllık enflasyondaki düşüş tüm ana alt gruplara yayılırken temel sürükleyici, temel mal ve gıda grupları oldu.

**Comment:**

The sentence is not clear and understandable. A comma (,) was added after the first “temel” to avoid ambiguity.

**4.1.2.2. Start sentences with capital letters**

All source sentences were checked to ensure that they all begin with capital letters.

**4.1.3. Syntactic Rules**

In the third set of rules, the ambiguity of the source text was tried to be minimized. Three rules were categorized under Syntactic Rules: Avoid long sentences, Eliminate redundant words and phrases and Avoid passive voice if possible.

**4.1.3.1. Avoid long sentences**

Source sentences were kept as concise as possible in order to avoid ambiguity. Accordingly, the number of characters in each segment was limited to 250 characters including spaces which is around 20 – 25 words. This way, I tried to ensure that each sentence has only one or two clauses.

**Example:****Raw:**

2018 yılı Ocak–Mart döneminde para politikasındaki sıkı duruş korunurken, Nisan ayında fiyat istikrarını desteklemek amacıyla ölçülü bir parasal sıkılaştırma yapılmış; Mayıs ayında ise piyasalarda gözlenen sağlıksız fiyat oluşumları ve enflasyon beklentilerinde süre gelen yükselişin genel fiyatlama davranışlarına dair oluşturduğu riskler ışığında para politikasındaki sıkı duruş güçlendirilmiştir. (Source 6).

**Post-CL:**

2018 yılı Ocak–Mart döneminde para politikasındaki sıkı duruş korunmuştur.

Nisan ayında fiyat istikrarını desteklemek amacıyla ölçülü bir parasal sıkılaştırma yapılmıştır.

Mayıs ayında piyasalarda sağlıklı fiyat oluşumları gözlenmiştir.

Enflasyon beklentilerinde süre gelen yükseliş, genel fiyatlama davranışlarında riskler oluşturdu.

Bu riskler ışığında para politikasındaki sıkı duruş güçlendirilmiştir.

**Comment:**

The character count of Raw is 237 and its word count is 47. As seen above, there are at least five main clauses in the source sentence. Therefore, I divided the raw sentence into five different sentences to avoid ambiguity.

**4.1.3.2. Eliminate redundant words and phrases**

In order to make source sentences as plain as possible, redundant words and phrases, which do not affect the meaning of the sentence, were eliminated. This way, I tried to make sentences less ambiguous.

**Example:****Raw:**

Para politikası kararı ile kısa gerekçesi, İngilizce çevirisi ile birlikte, toplantı ile aynı gün saat 14.00’te; Kurul’un ayrıntılı değerlendirmelerini içeren toplantı özeti ise toplantıyı takip eden beş iş günü içinde TCMB internet sayfasında yayımlanacaktır (Source 6).

**Post CL:**

Para politikası kararı ve İngilizce çevirisi, toplantı gününde saat 14.00’te yayımlanacaktır. Para politikası kararının kısa gerekçesi yayımlanacaktır. Kurul’un ayrıntılı değerlendirmelerini içeren toplantı özeti toplantıdan sonra beş iş günü içinde TCMB internet sayfasında yayımlanacaktır.

**Comment:**

The same word “ile” is used 3 times in a row in the raw sentence, which is redundant and hinders readability. Besides, raw sentence is too long, and more than 2 main ideas are crammed in one sentence. Thus, I divided raw sentence into three sentences eliminating unnecessary “ile” to make the sentence more concise.

**Example:****Raw:**

Britanya’da kısa bir seçim kampanyası sürecinin ardından tarihler 12 Aralık’ı gösterdiğinde İngiliz vatandaşları sandık başına gitti.

**Post-CL:**

Britanya’da kısa bir seçim kampanyasının ardından 12 Aralık’ta İngiliz vatandaşları sandık başına gitti.

**Comment:**

The redundant expression for the date “tarihler 12 Aralık’ı gösterdiğinde” has been replaced with “12 Aralık’ta” to avoid metaphorical expression.

**4.1.3.3. Avoid passive voice if possible**

If the subject is explicit, I avoided using passive voice and wrote the sentence in active form to ensure clarity.

**Example:****Raw:**

Enerji ithalatçısı kamu iktisadi teşebbüslerinin döviz ihtiyacının gerekli görülen kısmı Hazine ve Maliye Bakanlığı ile TCMB tarafından doğrudan karşılanacaktır (Source 7).

**Post-CL:**

Hazine ve Maliye Bakanlığı ile TCMB, enerji ithalatçısı kamu iktisadi teşebbüslerinin döviz ihtiyacının gerekli görülen kısmını doğrudan karşılayacaktır.

**Comment:**

As the subject (*Hazine ve Maliye Bakanlığı ile TCMB*) is explicit in the raw sentence, I have re-written the sentence in active form.

## 5 EVALUATION

This chapter will briefly compare two deployed NMTs, i.e. NMT1 and NMT2. In this chapter, my aim is twofold: (i): to provide information about BLEU score and share final BLEU scores of NMT1 and NMT2, (ii) to compare outputs of NMT1 and NMT2 in terms of accuracy, language, and terminology. The sub-categories of these three categories will be explained in detail in respective chapters. As a result, the effect of applying CL rules on NMT (if any) will be reflected.

### 5.1. BLEU Score

BLEU, Bilingual Evaluation Understudy, is a Method for Automatic Evaluation of Machine Translation developed by Kishore Papineni *et al.* in 2002. The starting point of Papineni *et al.* was to find a language independent and an automated method for evaluation of MT results which can be an alternative to human evaluations of MT that are quite expensive and time consuming. The main idea of BLUE Score is that “The closer a machine translation is to a professional human translation, the better it is” (Papineni and *et al.*, 2002, 311). In order to measure the closeness of MT outputs to professional human translation, a numerical metric and a corpus of good quality human reference translations are used. This numerical metric works by measuring word choice and word order differences between human reference translation and MT translations (cf. 311).

BLEU scores are calculated by comparing translations of MT system with previous translations of high quality. Then, the average of BLEU scores is found over the entire corpus to arrive at a gauge of translations general quality.

The BLEU metric ranges from 0 to 1. Each output of MT receives a score of BLEU between 0 and 1, if outputs are close to reference translation, BLEU score will also be close to 1. On the other hand, if outputs are not close or similar to reference translation, BLEU score will be close to 0. Besides, the number of reference translations affects the score. If there are more reference translations for sentences, BLEU score will be higher (cf. 315).

Therefore, I used the same corpus including same number of reference translations for NMT1 and NMT2 so as to get objective scores on evaluations.

After training step is completed in Microsoft Custom Translator, the system automatically calculates the BLEU score of the related model. Accordingly, the BLEU Score of NMT1, i.e. NMT which trained with aligned corpus without applying CL rules, is 32.79 and that of NMT2, i.e. NMT which trained with aligned corpus by applying CL rules, is 37.96. Thus, it is possible to say that there is a meaningful difference between NMT1 and NMT2 in terms of BLEU Scores and considering that both NMT1 and NMT2 were customized with the same corpus, 5 points difference between them can be attributed to CL rules that were applied to NMT2.

## **5.2. Comparison of NMT1 and NMT2 Outputs**

As mentioned before, two different NMT systems (NMT1 and NMT2) were customized with the same training data. NMT1 was trained with aligned bilingual corpus, while NMT2 was trained with bilingual corpus to which some specific Controlled Language rules (provided in Chapter 4.1.) were applied.

The difference between the BLEU Scores of NMT1 and NMT2 were provided in Chapter 5.2. This chapter will analyze the test results of comparison between NMT1 and NMT2 outputs. For the analysis, a test corpus was created consisting of 500 source sentences extracted from the website of CBRT and investing.com. The reason for my choice of these websites is that similar contents were included in the training data and I wanted to perform the test with parallel data. While the contents extracted from the CBRT mostly consists of the reports, speeches, and announcements of the Governor of CBRT, the contents from investing.com include daily news and bulletins.

Each sentence was translated in NMT1 and NMT2, resulting in a data set of 1000 NMT sentences (500 source sentences for each NMT system). Translations were copied in an excel sheet together with the relevant source segments. Then, the differences between the outputs (if any) were written down in another column. After completing comparison, common differences were categorized.

Among 500 test sentences, the translations of 50 sentences were exactly same, which constitutes 10% of the data set. While 44 of 50 same translations were correct in terms of grammar, accuracy, and terminology, the rest of the translations was incorrect.

On the other hand, the translations of 170 sentences were nearly same with minor differences. While 63% (107 sentences) of 170 sentences were correct in terms of grammar, accuracy, and terminology; 37% (63 sentences) of 170 sentences were false.

The comparison results of NMT1 and NMT2 will be categorized under three main categories which are Accuracy, Language and Terminology. The following chapters briefly explain the sub-categories of the main categories and provide example comparison results.

### 5.2.1. Accuracy

This category will compare the translations of NMT1 and NMT2 with regards to completeness and precision. Translations were compared in terms of accuracy under the sub-categories of Mistranslation, Omission and Addition.

#### 5.2.1.1. Mistranslation

Mistranslation is an error that occurs when a word, phrase or syntax of the source sentence are misinterpreted in translation. Under Mistranslation chapter, the examples of incorrect interpretation of source text in NMT1 will be provided. Among 500 test sentences, 31 sentences were mistranslated in NMT1, which constitutes 6.1% of the data set.

#### Example:

| Source Sentence                                                                                                                                                                                             | NMT1                                                                                                                                                                             | NMT2                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TCMB ise swap limitini yüzde 30'dan yüzde 40'a yükselterek yine kendi rezervlerini artırmaya yönelik bir adım atarken bu hamleyle bankaların da likidite ihtiyacının karşılanması bekleniyor.<br>(Source 8) | The CBRT is expected to meet the liquidity needs of its banks by increasing the swap limit from 30 percent to 40 percent and also taking a step towards increasing its reserves. | The liquidity requirement in banks is expected to be met with this move, as the CBRT raises the swap limit from 30 percent to 40 percent and also takes a step toward boosting its reserves. |

#### Comment:

There are two adverbial clauses in the above source sentence. While NMT2 correctly renders the source sentence into English, it is seen that the subject of the adverbial clause, which is CBRT, is confused with the subject of the main clause and translated in

a totally different way. As the meaning is totally changed in NMT1, a critical error occurs. On the other hand, we do not see this issue in NMT2.

**Example:**

| Source Sentence                                                                                                                                                                                      | NMT1                                                                                                                                                                                                        | NMT2                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Devamında ise, belirsizliklerdeki artış, finansal koşullardaki sıkılaşma, hanhalklarının gelir kaybı ve firmaların nakit akışındaki bozulma talepte de belirgin bir zayıflamaya yol açtı. (Source 9) | On the other hand, the increase in uncertainty, tightening in financial conditions, the loss of income of households, and the demand for deterioration in the cash flow of firms led to a marked weakening. | On the other hand, the increase in uncertainty, the tightening in financial conditions, the loss of income of households and the deterioration in the cash flow of firms led to a marked weakening in demand. |

**Comment:**

While NMT2 accurately translates source sentence, there is a certain translation mistake in NMT1. As seen above, the first part of the translations of NMT1 and NMT2 systems are nearly same till the phrase “income of households”. However, the rest of the source sentence “firmaların nakit akışındaki bozulma talepte de belirgin bir zayıflamaya yol açtı” is incorrectly rendered into English in NMT1 as “the demand for deterioration in the cash flow of firms led to a marked weakening”. This part is correctly translated in NMT2 as “the deterioration in the cash flow of firms led to a marked weakening in demand”. This difference leads to a critical mistake.

**Example:**

| Source Sentence                                                                                                                                                                                            | NMT1                                                                                                                                                                                                                  | NMT2                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mal ve hizmet ihracatında beklenen yavaşlamaya rağmen, emtia fiyatları ve ithalatın sınırlayıcı etkisiyle cari işlemler dengesinin yıl genelinde ılımlı bir seyir izleyeceğini tahmin ediyoruz. (Source 9) | Despite the expected slowdown in goods and services exports, we estimate that the current account balance will follow a moderate course throughout the year with commodity prices and the limiting impact of imports. | Despite the expected slowdown in exports of goods and services, we expect that the balance of current transactions will follow a moderate course throughout the year due to the limiting effects of commodity prices and imports. |

**Comment:**

The first parts of both translations are nearly same and acceptable despite there are some minor differences in terms of terminology between NMT1 and NMT2. However, the adverbial phrase of the sentence “emtia fiyatları ve ithalatın sınırlayıcı etkisiyle” is translated differently. While NMT2 translates this adverbial phrase as “due to the limiting effects of commodity prices and imports”, which is the correct translation, NMT1 translates it as “with commodity prices and the limiting impact of imports”, which leads to mistranslation.

**5.2.1.2. Omission**

Omission is a critical error that occurs when an essential element in the source text is missing in the translation. In NMT1, there are 45 omission errors in the translations among 500 sentences, which constitutes 9% of the data set. In the examples below, some of the omission errors are provided.

**Example:**

| Source Sentence                                                                                                                                                                                   | NMT1                                                                                                                                 | NMT2                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bununla birlikte, uluslararası ticaret alanında yapılan çalışmalar, <b>giriş maliyetini üstlenebilecek</b> verimli firmaların ihracat piyasalarına girebildiği sonucuna ulaşmaktadır. (Source 10) | However, studies conducted in the field of international trade have concluded that efficient companies can enter the export markets. | However, the studies conducted in the field of international trade reach the conclusion <b>that the efficient firms that can undertake the cost of admission</b> are able to enter the export markets. |

**Comment:**

While NMT2 translates source sentence without any omission, adjectival phrase “giriş maliyetini üstlenebilecek” is omitted in the translation of NMT2, which creates an important failure.

**Example:**

| Source Sentence                                                                                                                                                                                                                                                                         | NMT1                                                                                                                                                                                                                                           | NMT2                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bu çerçevede, kredi hedeflerini gerçekleştiren bankalara yabancı para <b>zorunlu karşılık oranlarında</b> indirim yapılması ve limitler dâhilinde uzun vadeli ve daha düşük faizli ilave <b>Türk lirası</b> likidite imkânları sağlanması gibi uygulamaları hayata geçirdik. (Source 9) | In this context, we have implemented applications such as reductions in foreign currency <b>compulsory exchange rates</b> to banks fulfilling credit targets and providing long-term and lower-rate liquidity opportunities within the limits. | In this context, we have implemented applications such as the reduction in foreign currency <b>reserve requirement rates</b> to the banks that fulfil the credit targets and the provision of additional <b>Turkish lira</b> liquidity opportunities within the limits. |

**Comment:**

In NMT1, there are two critical errors in the translation of the source sentence that we do not see in the translation of NMT2. The first one is the omission of “Türk Lirası” (“Turkish Lira”) in the translation, which is a critical element in the sentence. Secondly, the term “zorunlu karşılık oranı” (“reserve requirement”) is translated as “compulsory exchange rates” which has a totally different meaning. More detailed information and statistics regarding terminology errors will be provided in the following chapters.

**Example:**

| Source Sentence                                                                                                                                                                                                                                                               | NMT1                                                                                                                                                                                                                                       | NMT2                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bir önceki Rapor sonrasında Türk lirasında görülen değer kaybına karşın, ham petrol fiyatlarındaki keskin düşüşe bağlı olarak Türk lirası cinsinden ithalat fiyatlarının yıl sonu enflasyon tahminine <b>katkısının</b> 0,2 puan ile sınırlı kalmasını bekliyoruz. (Source 9) | Despite the depreciation of the Turkish lira after the previous report, we expect <b>import</b> prices in Turkish lira to be limited to 0.2 points in the year-end inflation forecast, depending on the sharp decline in crude oil prices. | Despite the depreciation in Turkish lira after the previous report, we expect <b>the contribution of imports</b> in Turkish lira to be limited to 0.2 points in the year-end inflation estimation due to the sharp decline in crude oil prices. |

**Comment:**

In NMT1, there is an omission of a critical element in the source text. It is seen that the phrase “ithalat fiyatlarının katkısı” (“the contribution of import prices”) is translated as “import prices” omitting “contribution”. This error totally changes the meaning in the translation. On the other hand, we do not see the same omission error in the translation of NMT2. NMT2 translates the same phrase as “the contribution of imports” omitting “prices”. However, the phrase “the contribution of imports” actually implies “the contribution of import prices” and this is evident from the context. Therefore, lacking “prices” in the translation is not an omission error here.

### 5.2.1.3. Addition

Addition is an error which occurs if there are unnecessary elements in translation that do not exist in the source text. In NMT1, there are 8 addition errors in the data set of 500 sentences, which constitutes around 2% of the data set. While there is no addition error in NMT2. In the examples below, some of the addition errors are provided.

#### Example:

| Source Sentence                                                                                                                                         | NMT1                                                                                                                                                     | NMT2                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Ürün-ülke kesişimi olarak daha geniş bir şekilde tanımladığımız pazar sayısı <b>2006-2018</b> yılları arasında yüzde 56 oranında artmıştır. (Source 10) | The number of markets, which we defined more broadly as the interchapter of the product-country, increased 56 percent between <b>2006-2018 and 2008.</b> | The number of markets, which we defined more broadly as the interchapter of the product-country, increased 56 percent between <b>2006-2018.</b> |

#### Comment:

It is seen that “2008” which is not present in the source sentence is added in the translation of NMT1. On the other hand, there is not such an addition issue in NMT2.

#### Example:

| Source Sentence                                                                                                                                                                     | NMT1                                                                                                                                                                                                    | NMT2                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enflasyon görünümünü etkileyen tüm unsurları dikkate alarak, Temmuz ayındaki 425 baz puanlık indirimin ardından Eylül ayında da politika faizini 325 baz puan indirdik. (Source 11) | Taking into account all the factors affecting the inflation outlook, we also lowered the policy interest rate by 325 basis points in September, after the 425 basis <b>percentage</b> discount in July. | Taking into account all the factors affecting the appearance of the inflation, we also lowered the policy interest rate by 325 basis points in September, following the 425 basis point reduction in July. |

### Comment:

It is observed that “percentage” is irrelevantly used in NMT1 creating a failure although there is no equivalent word in the source sentence. However, there is no such an addition in the translation of NMT2.

### 5.2.2. Language

This category will compare the translations of NMT1 and NMT2 in the sense of compliance with target language rules. Translations were compared in terms of language under the sub-categories of Grammar and Spelling. More detailed information as well as examples will be provided in the following chapters.

#### 5.2.2.1. Grammar

Under Grammar chapter, some of the examples of grammar issues which were spotted in NMT1 will be provided with further explanations. While there are only 3 grammar issues in NMT2, there are 25 grammar issues in the data set of 500 sentences constituting 5% of the data set.

### Example:

| Source Sentence                                                                                                                                                       | NMT1                                                                                                                                                                             | NMT2                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Eşgüdüm içerisinde uygulanan basiretli makro politikaların etkisiyle 2019 yılında enflasyon, iktisadi faaliyet ve dış dengede önemli kazanımlar sağlandı. (Source 10) | <b>In 2019</b> , significant gains in inflation, economic activity and external balance <b>have been achieved</b> due to the prudent macro policies implemented in coordination. | Due to the cautious macro policies implemented in coordination, significant gains <b>were achieved</b> in inflation, economic activity, and external balance <b>in 2019</b> . |

### Comment:

It is seen that tense is not correctly used in the translation in NMT1. As there is a year (“2019”) in the source sentence and the source sentence is in Simple Past Tense, translation should also be written in the past tense. However, NMT1 uses Present Perfect Tense. This tense issue is not seen in the translation of NMT2.

**Example:**

| Source Sentence                                                                                                                                                                                      | NMT1                                                                                                                                                                                                         | NMT2                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dayanıklı mal grubu fiyatları Nisan ayında yüzde 2,05 oranında artmış, bu gelişmede otomobil (yüzde 3,38) ve mobilya (yüzde 3,63) fiyatlarında görülen yükselişler belirleyici olmuştur. (Source 12) | <b>The prices</b> of the durable goods group increased by 2.05 percent in April, and in this development, the rise in prices of automobiles (3.38 percent) and furniture (3.63 percent) <b>was</b> decisive. | <b>The prices</b> of the durable goods group increased by 2.05 percent in April, in this development, the rises in prices of automobiles (3.38 percent) and furniture (3.63 percent) <b>were</b> decisive. |

**Comment:**

In NMT1, there is a subject-verb agreement issue. While the subject of the sentence is in plural form (“the prices”), the verb is used in singular form (“was”). This error is not the case in NMT2.

**Example:**

| Source Sentence                                                                                                                                             | NMT1                                                                                                                                                | NMT2                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Yurt içi gelişmelere bakıldığında, iktisadi faaliyetin <b>2018 yılının ikinci çeyreğinden itibaren dengelenme sürecine girdiğini</b> görüyoruz. (Source 11) | Looking at domestic developments, we see that economic activity <b>is entering</b> the process of balancing <b>from the second quarter of 2018.</b> | Looking at the domestic developments, we see that the economic <b>activity has entered</b> the process of balancing <b>since the second quarter of 2018.</b> |

**Comment:**

In NMT1, the tense is used in Present Continuous Tense although the source sentence is about a situation that has happened in the past but is continuing today. In this case, the tense of the translation should be Present Perfect Tense as it is in NMT2.

### 5.2.2.2. Spelling

Under Spelling chapter, some of the examples of spelling and capitalization issues which were spotted in NMT1 will be provided with further explanations. There are 5 spelling issues among 500 sentences. 4 of 5 spelling issues were spotted in NMT1.

#### Example:

| Source Sentence                                                                                                                                                                                                                                                            | NMT1                                                                                                                                                                                                                                                   | NMT2                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Konuřmama burada son verirken, bařta <b>Para Politikası Kurulu</b> üyeleri ve Arařtırma ve Para Politikası Genel Müdürlüğümüz çalışanları olmak üzere, Raporun hazırlanmasında emeęi geen tüm alıřma arkadaşlarıma ve katılımcılara teřekkürlerimi sunuyorum. (Source 9) | I would say thanks to all of my colleagues and participants who contributed to the preparation of the report, especially the members of <b>the Monetary policy board</b> and the employees of the General Directorate of Research and Monetary policy. | I would say thanks to all of my colleagues and participants who contributed to the preparation of the report, especially the members of the <b>The Monetary Policy Board</b> and the employees of the General Directorate of Research and Monetary policy. |

#### Comment:

It is seen that capitalization in the source sentence is followed in NMT2, while it is not followed in NMT1.

**Example:**

| Source Sentence                                                                                                                                                                                                                | NMT1                                                                                                                                                                                                                  | NMT2                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BOE ayrıca İngiliz ekonomisinin bu yıl yüzde 14 seviyesine kadar daralma gösterebileceğini belirtirken, <b>korona virüs</b> salgınının ikinci çeyrekte yüzde 25 gibi bir oranda daralmaya neden olması bekleniyor. (Source 13) | The BOE further states that the British economy may be shrinking to 14 percent this year, while the <b>Korona virus</b> outbreak is expected to lead to a contraction in the second quarter, at a rate of 25 percent. | BOE also stated that the British economy could show contraction up to 14 percent this year, while the <b>coronavirus</b> virus outbreak is expected to cause a contraction of as much as 25 percent in the second quarter. |

**Comment:**

In the example above, there are both capitalization and spelling errors. Firstly, “Korona virüs” is written in lower cases in the source text, however this is not followed in NMT1. Secondly, “Corona” is written with the letter “K” at the beginning of the word, instead of “C”. Both issues are not seen in the translation of NMT2.

**Example:**

| Source Sentence                                                                                            | NMT1                                                                                            | NMT2                                                                                |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Kredilerde, Temmuz 2019’den itibaren tarihsel ortalamaların üzerinde bir ivmelenme kaydedildi. (Source 10) | <b>The Kreme</b> recorded an acceleration above the historical averages from July 2019 onwards. | The credits recorded an acceleration above the historical averages since July 2019. |

**Comment:**

In this example, there is a spelling error in NMT1. The word “Credits” is written as “Kreme”, which is a meaningless word. This issue does not exist in the translation of NMT2.

### 5.2.3. Terminology

Terminology is the most common seen error category in the translations among the data set with the ratio of 13,8%, i.e., 71 sentences. While 9 terminology issues are seen in NMT2, 62 terminology issues are seen in NMT1. In the following examples, the errors resulting from misunderstanding of technical concept are provided.

#### Example:

| Source Sentence                                                                             | NMT1                                                                                   | NMT2                                                                                     |
|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Bu doğrultuda kredi büyümesi 2019 yılının üçüncü çeyreğinden itibaren ivmelendi. (Source 9) | <b>Credit</b> growth in this direction was accelerated from the third quarter of 2019. | In this respect, the growth of the <b>loan</b> increased from the third quarter of 2019. |

#### Comment:

In NMT1, the word “kredi” in the source text is translated into English as “credit”. However, in the context of this sentence, the correct word should be “loan”, which is the case in NMT2.

#### Example:

| Source Sentence                                                                     | NMT1                                                                           | NMT2                                                                               |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>Kur</b> için aşağı yönlü hareketlerde ilk destek 7.6130 seviyesinde. (Source 14) | The initial support for downward movements in <b>Setup</b> is at 7.6130 level. | Initial support for downward movements in <b>exchange rate</b> is at 7.6130 level. |

#### Comment:

The word “Kur” in the source sentence is a homonymous word with more than one meaning in Turkish. The correct translation of “Kur” should be “Exchange rate” as it is the case in NMT2 in this context. However, it is translated as “Setup” in NMT1, which is out of context here.

**Example:**

| Source Sentence                                                                                                                                                         | NMT1                                                                                                                                      | NMT2                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Mevsimsellikten arındırılmış</b> veriler, işlenmemiş gıda fiyatlarında hem taze meyve ve sebze hem de diğer gruplarda yüksek bir artışa işaret etmiştir. (Source 12) | <b>Unseasonally adjusted</b> data indicated a high increase in raw food prices, both fresh fruit and vegetables, as well as other groups. | <b>Seasonally adjusted</b> data indicated a high increase in raw food prices for both fresh fruit and vegetables and other groups. |

**Comment:**

The adjective of the source sentence “mevsimsellikten arındırılmış” which should be translated into English as “seasonally adjusted” is translated as “unseasonally adjusted” in NMT1 creating a critical meaning error. However, NMT2 correctly renders the relevant term.

**Example:**

| Source Sentence                                                                                                                                          | NMT1                                                                                                                                   | NMT2                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| İktisadi faaliyetin toparlanmasına bağlı olarak son çeyrekte <b>tarım dışı istihdam</b> artmış ve işsizlik oranları bir miktar gerilemiştir. (Source 10) | Due to the recovery of economic activity, <b>non-farm jobs</b> increased in the last quarter and unemployment rates declined somewhat. | Due to the recovery of the economic activity, the last quarter increased <b>non-farm payrolls</b> and the unemployment rates declined slightly. |

**Comment:**

While NMT2 uses “non-farm payrolls” as the translation of “tarım dışı istihdam” in NMT2, the same term is translated as “non-farm jobs” which is a word for word translation and is not acceptable. Thus, NMT2 is better in terms of terminological choice in this example.

**Example:**

| Source Sentence                                                                                                                 | NMT1                                                                                                                                     | NMT2                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bu çeyrekte</b> enerji ve gıda grupları enflasyonu aşağı çekerken, temel mal ve hizmet gruplarının katkısı arttı. (Source 9) | <b>In this quadrant</b> , energy and food groups increased the contribution of basic goods and services groups while downward inflation. | <b>In this quarter</b> , the contribution of the main goods and services groups increased as energy and food groups took down the inflation. |

**Comment:**

The meaning of the adverb in the source sentence “çeyrek” is “a quarter of year”. While this is correctly rendered in NMT2, NMT1 translates “çeyrek” as quadrant which means a quarter of a circle in mathematics. Therefore, the translation of NMT1 is wrong in this context.

**5.2.4. Others**

This chapter provides two additional sub-categories of common differences between NMT1 and NMT2. These differences are not categorized in above chapters because there are not any actual errors in NMT1 and NMT2. The names of sub-categories are Word Economy and Use of Abbreviations. Examples are provided below.

**5.2.4.1. Word Economy**

When we examine correct and nearly same outputs of NMT1 and NMT2, it is seen NMT2 tends to translate same sentences with less words. This makes translation free of redundant words without degrading meaning. There are 10 cases in which NMT2 uses fewer words to translate same source word or group of words. Below, some examples are provided.

**Example:**

| Source Sentence                                                                                                                                                    | NMT1                                                                                                                                                 | NMT2                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Dünya genelinde uygulamaya konulan sosyal yalıtım tedbirleri, <b>Mart ayı içerisinde</b> hizmetler sektörü faaliyetinin hızla zayıflamasına neden oldu. (Source 9) | Social isolation measures implemented around the world have led to rapid weakening of the services sector activity <b>within the month of March.</b> | Social isolation measures implemented around the world led to the rapid weakening of the services sector activity <b>in March.</b> |

**Comment:**

Translations of NMT1 and NMT2 are nearly same except adverb of the sentences. “Mart ayı içerisinde” is translated as “in March” in NMT2. However, NMT2 translates same adverb as “within the month of March”. While “Mart ayı içerisinde” is expressed with two words in NMT2, NMT1 uses five words for the same adverb. Although there is no difference in the meaning of the translations, NMT2 is better here in terms of word economy.

**Example:**

| Source Sentence                                                                                                                                                        | NMT1                                                                                                                  | NMT2                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Bu değişiklik, başlangıçta <b>kamu bankaları öncülüğünde</b> olmak üzere, bankaların kredi koşullarını daha destekleyici hale getirmelerine yardımcı oldu. (Source 10) | This change helped banks make loan conditions more supportive, initially <b>under the leadership of public banks.</b> | This change helped banks to make the loan conditions more supportive, initially <b>led by public banks.</b> |

**Comment:**

Although the intended meaning of the source sentence is correctly transferred to target language in NMT1 and NMT2, another word economy case is seen in NMT2. While NMT1 translates the adverbial clause of the source sentence “kamu bankaları öncülüğünde” as “under the leadership of public banks”, NMT2 translates the same adverbial clause as “led by public banks”. Accordingly, NMT2 uses fewer words to express the same words in English in this example.

**Example:**

| Source Sentence                                                                                                                                                                                  | NMT1                                                                                                                                                             | NMT2                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Şubat ayından bu yana bölge hem acil sağlık krizi hem de <b>küresel pandeminin getirdiği uzun vadeli zorluklar</b> ile baş edebilmek için giderek yoğunlaşan bir mücadele yürütüyor. (Source 15) | Since February, the region has been struggling to cope with both the emergency health crisis and <b>the long-term challenges imposed by the global pandemic.</b> | Since February, the region has been struggling to cope with both the emergency health crisis and <b>the long-term challenges of the global pandemic.</b> |

**Comment:**

While NMT1 translates the adverbial clause of the source sentence “küresel pandeminin getirdiği uzun vadeli zorluklar” as “the long-term challenges imposed by the global pandemic”, NMT2 translates the same adverbial clause as “the long-term challenges of the global pandemic”. Therefore, NMT2 does not use “imposed by” in translation as it does not make any difference in the meaning, *i.e.* redundant.

#### 5.2.4.2. Use of Abbreviations

Another frequent difference between NMT1 and NMT2 is use of abbreviations in translations. It is seen that NMT2 tends to follow source to use or not to abbreviations in translations, i.e., if an abbreviation is used in source sentence, NMT2 also uses translation of relevant abbreviation. However, there are 10 cases in which NMT1 does not follow source in terms of using abbreviations. Although this is not a critical error, following source style is important in the sense of consistency between source and target sentences.

##### Example:

| Source Sentence                                                                                | NMT1                                                                                          | NMT2                                                                            |
|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Diğer yandan <b>ABD</b> tarafından açıklanacak istihdam verilerini takip edeceğiz. (Source 15) | On the other hand, we will follow the employment data announced by the <b>United States</b> . | On the other hand, we will follow the employment data announced by <b>USA</b> . |

##### Comment:

NMT2 follows source sentence and uses translated abbreviation of “ABD” while NMT1 does not use abbreviation in the translation.

##### Example:

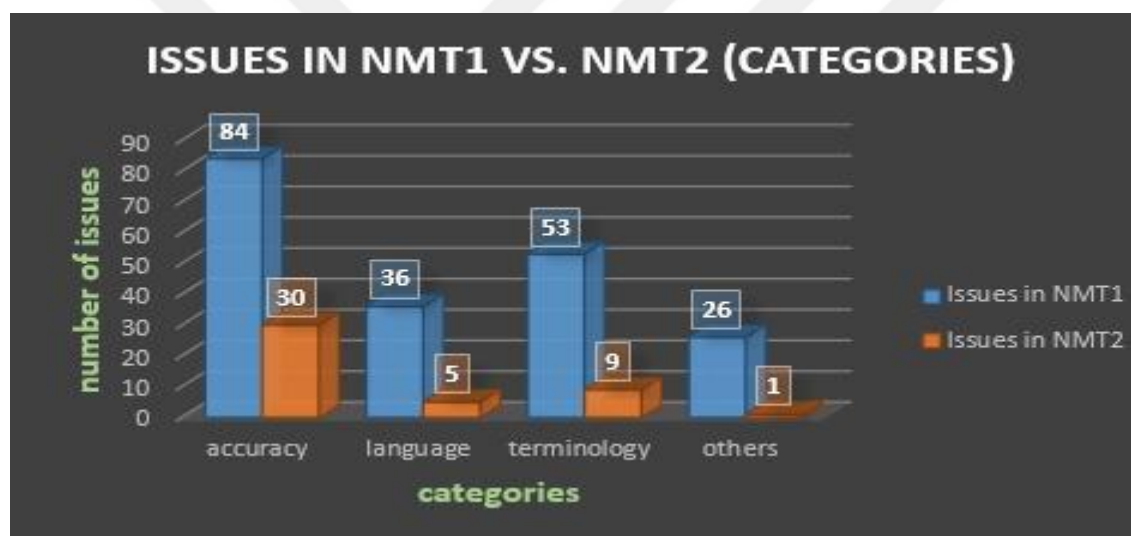
| Source Sentence                                                                                                                                                                 | NMT1                                                                                                                                               | NMT2                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Merkez Bankası</b> olarak, daha önceki konuşmalarımda da değindiğim gibi, her yıl, düzenli aralıklarla, farklı sektör ve ölçeklerden firmaları ziyaret ediyoruz. (Source 10) | As the <b>CBRT</b> , as I mentioned in my previous speeches, we are visiting firms at regular intervals, different sectors and scales, every year. | As the <b>central bank</b> , as I mentioned in my previous speeches, we visit firms at regular intervals, different sectors and scales every year. |

### Comment:

In this example, NMT1 uses abbreviation “CBRT” as the translation of “Merkez Bankası” while NMT2 follows source and does not use abbreviation.

### 5.3. Discussion

In the above comparison chapters, common cases of differences between the outputs of NMT1 and NMT2 in data set of 500 sentences were categorized and provided with detailed examples. Furthermore, statistics and the ratio of the differences in each category to the general data set were also included. The main objective of this chapter is trying to investigate reasons of the differences between NMT1 and NMT2 translations of the same sentences. With this aim in mind, the relation between the comparison results and Controlled Language rules will be sought for in this chapter.



**Figure 7.** Comparison of issue numbers between NMT1 and NMT2

Statistics illustrated in above table and 5 points difference between the BLEU scores of NMT1 and NMT2 indicate that NMT systems behave differently. As totally same corpus was used for training, the difference between the results of NMT1 and NMT2 can be attributed to the Controlled Language rules which were applied in the corpus before training NMT2. It can be observed that CL rules improve the performance of NMT2 in terms of accuracy, language, terminology, and some additional aspects such as following the source format for abbreviations and tendency to use fewer words in translation compared to NMT1.

The positive impacts of CL rules which were defined in Chapter 4.1. are obvious. In this chapter, I will take a step further and attempt to analyze and comment on which applied rule is effective in which category.

When we examine CL rules and categories of issues in which the number of errors increased, the biggest difference between NMT1 and NMT2 is seen in Accuracy category. Total number of accuracy related errors including addition, omission and mistranslation equals to 23%, *i.e.* 114 sentences out of the data set of 500 sentences. Percentage of accuracy related errors spotted in NMT1 was 74% and the rest of these errors was found in NMT2. It is apparent that NMT2 outperforms NMT1 in terms of accuracy by providing translations with less addition, omission, and mistranslation cases. We can attribute better performance of NMT2 to the application of syntactic rules, *i.e.* Rule 3.1 “Avoid long sentences” and Rule 3.2 “Eliminate redundant words and phrases”. By applying Rule 3.1 and 3.2, source sentences became less complex and clearer. Therefore, training of NMT with bilingual corpus including sentences with fewer words may have positively affected the perception of NMT2.

The second biggest share of difference between NMT1 and NMT2 is identified in Terminology category. The number of terminology issues in the data set of 500 sentences is 62 with the ratio of 12% and 53 of the terminology issues were spotted in NMT1. The change between the number of terminology issues of NMT1 and NMT2 may be a sign of positive impact of Rule 4.1.1.1. “Create a glossary including key abbreviations, words, and phrases in the subject field that you will customize NMT.” By applying this rule, the number of issues of terminology decreases, *i.e.* lexical choices of translations tend to become more context-related and domain-specific compared to NMT1 in which no glossary was used during training.

Thirdly, there were total 41 issues in Language category, while 36 of them were found in NMT1, only 5 issues were found in NMT2. It can be possible that the major reason of the difference in language issue numbers of NMT1 and NMT2 is the application of syntactic rules. By applying Rule 3.1 “Avoid long sentences”, Rule 3.2 “Eliminate redundant words and phrases”, and Rule 3.3 “Avoid passive voice if possible”; the number of issues in NMT2 declines with regards to subject-verb disagreement, pluralization errors, and tense usage. Thus, NMT1 falls behind NMT2 in this respect as well.

Another error type, Spelling and Capitalization, is mostly seen in NMT1. The share of this error category is 5%. Although this ratio is pretty low compared to other error categories, the fact that 4 of 5 Spelling and Capitalization errors were spotted in NMT1 and only one Spelling and Capitalization error was found in NMT2 is meaningful. The number of differences in this error category between NMT1 and NMT2 can be attributed to Rule 4.1.1.2. “Fix any misspelling error according to Turkish orthography” and Rule 2.2. “Start sentences with capital letters”.

When it comes to two additional sub-categories of common differences between NMT1 and NMT2 that were provided under Chapter 5.2.4 Others, *i.e.* Word Economy and Use of Abbreviations, the positive effect of CL rules may be seen in NMT2 again. NMT2 system’s tendency of translating with fewer words which is the topic of Word Economy chapter can be attributed to Rule 3.2 “Eliminate redundant words and phrases”. On the other hand, as mentioned in Chapter 5.2.4.2 Use of Abbreviations, NMT2 has a tendency to follow source to use or not to use abbreviation in source sentence while NMT1 does not always follow source in terms of using abbreviations. This may also be a result of applying Rule 4.1.1.1. “Create a glossary including key abbreviations, words, and phrases in the subject field that you will customize NMT”. As the most common abbreviations like CBRT (Central Bank of the Republic of Turkey), TRY (Turkish Lira) and GNM (Gross National Product) were included in the glossary added to NMT2; NMT2 is most likely to translate exact equivalences of abbreviations in source sentences.

To sum up, the positive effects of CL rules applied in NMT can be traced in translations. However, there is a limitation which hinders us from ensuring which applied CL rule has a positive effect on which error category. The limitation of the present study is that it is not possible to see internal processing of NMT system to know the actual impact of each CL rule on algorithm. Therefore, it may be wrong to reach certain attributions between error categories and exact CL rules. Nevertheless, this can be further investigated in collaboration with computer science experts.

## 6 CONCLUSION

The aim of this study was twofold. The first was to customize an NMT System in banking and finance domain for Turkish – English language pair. Before working through NMT customization process, in the first chapter, fundamentals of translation technologies, *i.e.* CAT tools were briefly touched upon in this thesis. The reason is that each milestone in technological innovations of translation industry needs to be well known to have a solid grasp of cutting-edge technologies.

In line with its aim, the place and significance of MT were provided by concentrating on different approaches of MT including Rule Based Machine Translation, Statistical Machine Translation and Neural Machine Translation in chapter 2. However, the main focus was on NMT, which has a certain importance for the current study. Upon providing fundamental information on MT systems, the process of customization including choosing appropriate tools, preparing data for corpus, training, and deployment of the models, and using deployed models in production were presented with details. In this way, it was proved that translators could build or customize NMT systems if user-friendly systems were used. As a result of the first aim of the study, it became apparent that the whole process towards creating an NMT system could be implemented by a translator although this task is generally associated with the experts of computer science.

The second aim of this thesis was to examine if the application of certain CL rules improved the output performance of customized NMT system or not. With this purpose, two different NMT systems were developed with the same training data including 10.000 segments in the same portal, *i.e.* Microsoft Custom Translator. One of the two NMT systems, which is called NMT2 throughout the thesis, was developed by applying seven CL rules to the training data. (see chapter 4.1. Controlled Language Design) Besides, a glossary including 350 common banking and finance phrases and words was created and uploaded to NMT2. On the other hand, the other NMT system, which is called NMT1 throughout the thesis, was trained without applying any CL rules and without glossary. Upon completing customization of NMT systems, a data set including 500 sentences related to banking and finance was formed and this data set was translated in both systems to analyze the outcomes. Comparison results demonstrated

that the application of specific CL rules, which were “Create a glossary including key abbreviations, words, and phrases in the subject field that you will customize NMT”, “Fix any misspelling error according to Turkish orthography”, “Use punctuation marks when necessary”, “Start sentences with capital letters”, “Avoid long sentences”, “Eliminate redundant words and phrases” and “Avoid passive voice if possible”, had a positive effect on quality of NMT outputs. The results of comparative analysis of two systems confirmed that the number of issues spotted in translations of data set in different error categories decreased if before mentioned CL rules were applied to source sentences before training. Nonetheless, an apparent limitation of the analysis was that it was not possible to find out the actual impact of each applied CL rule as I lacked the knowledge regarding processing inside NMT system. Hence, we could only reach the conclusion that the performance of NMT system improved if seven afore mentioned CL rules were applied. This promising finding has critical importance because adopting the strategy of application of CL rules may help translation companies and individual translators to drive profit in the long run. The main reason for this is that less time will be required for post-editing of translations as the number of errors to correct will be decreased. This assumption might be further investigated in future studies.

All in all, what this study highlighted is that as translators, our borders are limitless and that there are much to investigate, learn, test, explore and implement especially thanks to today’s opportunities. We can always contribute to translation studies in a most up-to-date manner. In my opinion, what makes us a good translator is not only to render words from one language to another correctly, but to stay on the path of doing our best and to use the advantages of advanced technology in the best way without being stuck in stereotyped roles.

I hope that my study encourages translators and translation students to customize their own NMT systems, which certainly adds to the value of their work.

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**Source 13:**

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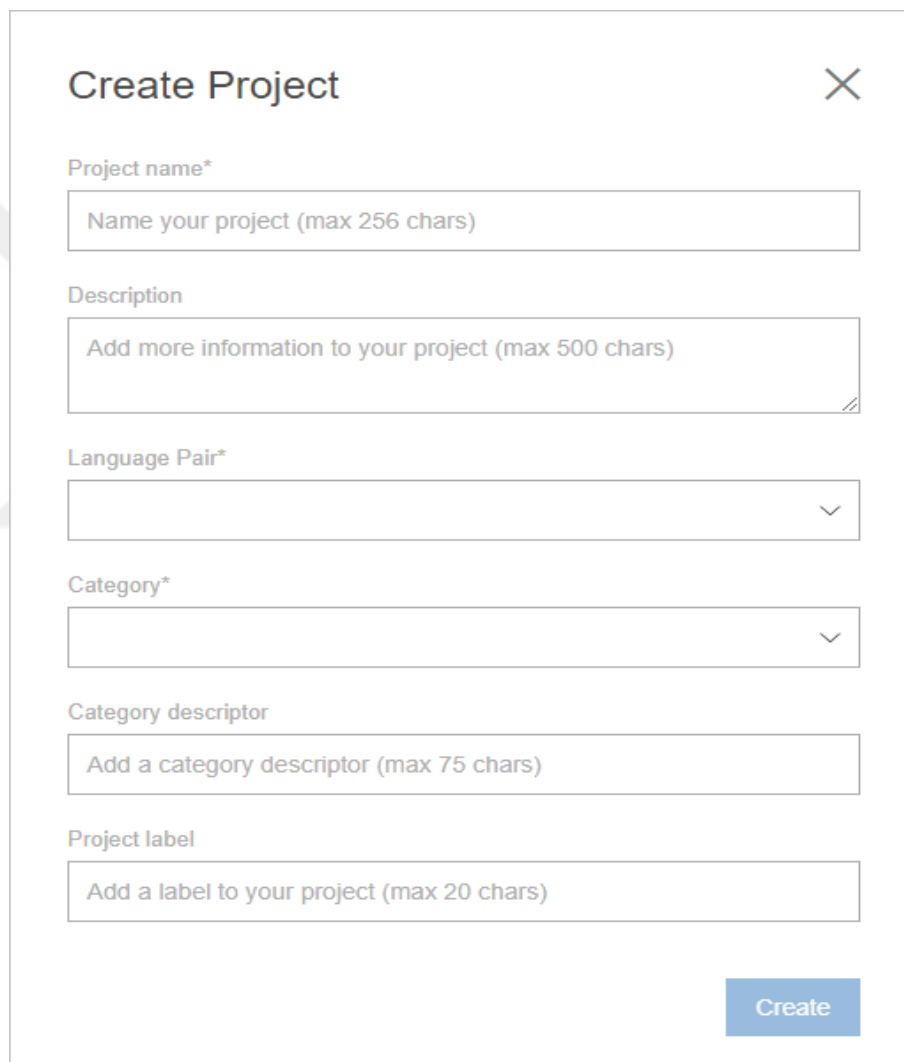
**Source 15:**

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<https://www.worldbank.org/tr/news/press-release/2020/04/08/europe-and-central-asia-health-systems-safety-nets-and-support-to-businesses-all-critical-to-protecting-lives-and-livelihoods>

## APPENDICES

### APPENDIX I: STEPS OF CUSTOMIZATION IN CUSTOM TRANSLATOR

#### I



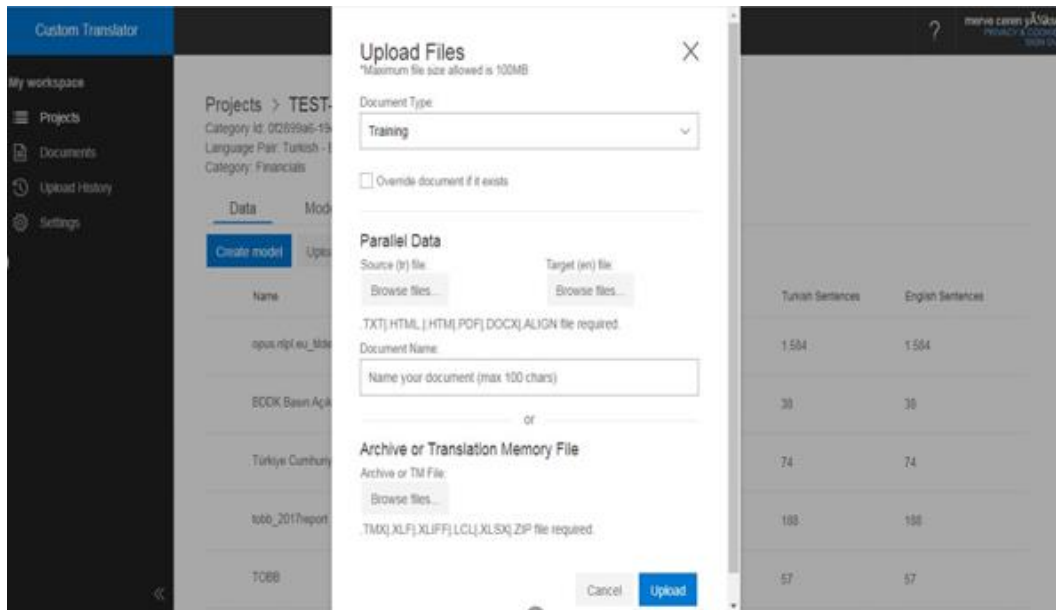
The screenshot shows a 'Create Project' dialog box with a close button (X) in the top right corner. The form contains the following fields:

- Project name\***: A text input field with the placeholder text 'Name your project (max 256 chars)'.
- Description**: A text input field with the placeholder text 'Add more information to your project (max 500 chars)' and a small diagonal icon in the bottom right corner.
- Language Pair\***: A dropdown menu with a downward arrow icon.
- Category\***: A dropdown menu with a downward arrow icon.
- Category descriptor**: A text input field with the placeholder text 'Add a category descriptor (max 75 chars)'.
- Project label**: A text input field with the placeholder text 'Add a label to your project (max 20 chars)'.

A blue 'Create' button is located at the bottom right of the dialog box.

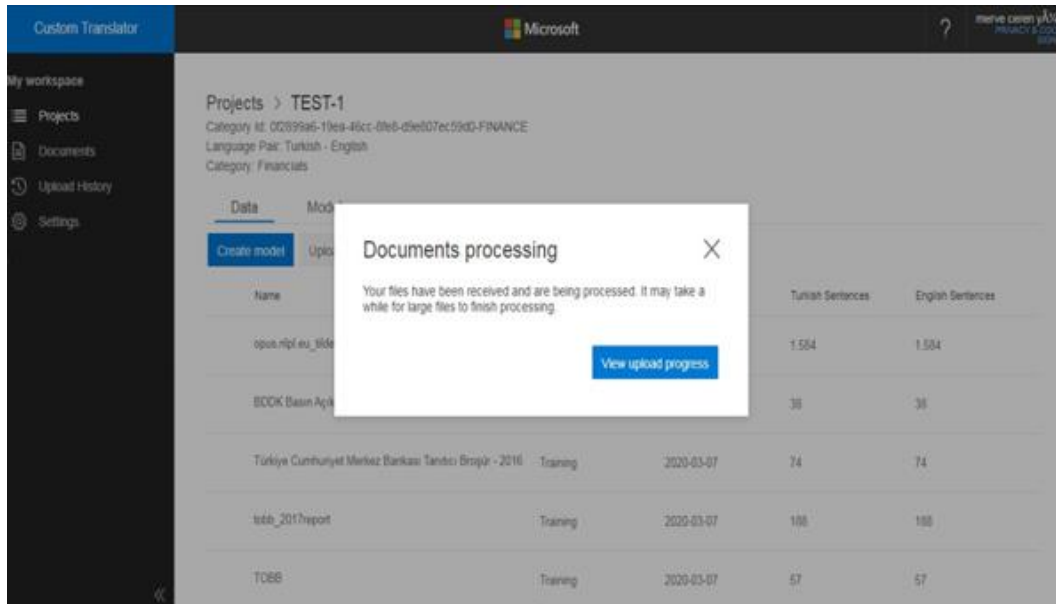
Creating Project in Microsoft Custom Translator

## II



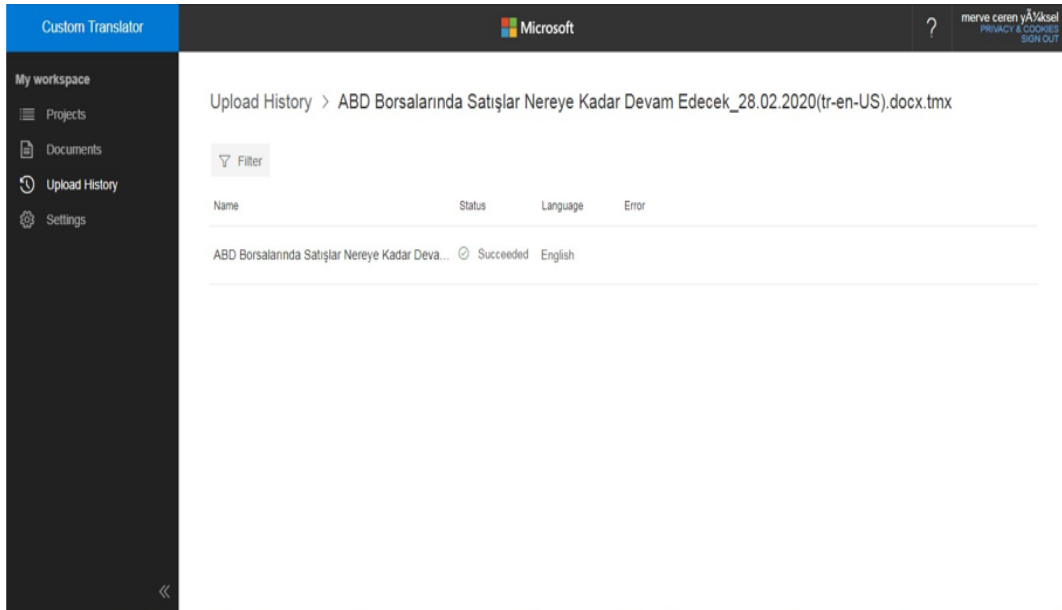
Uploading Files to Microsoft Custom Translator

## III



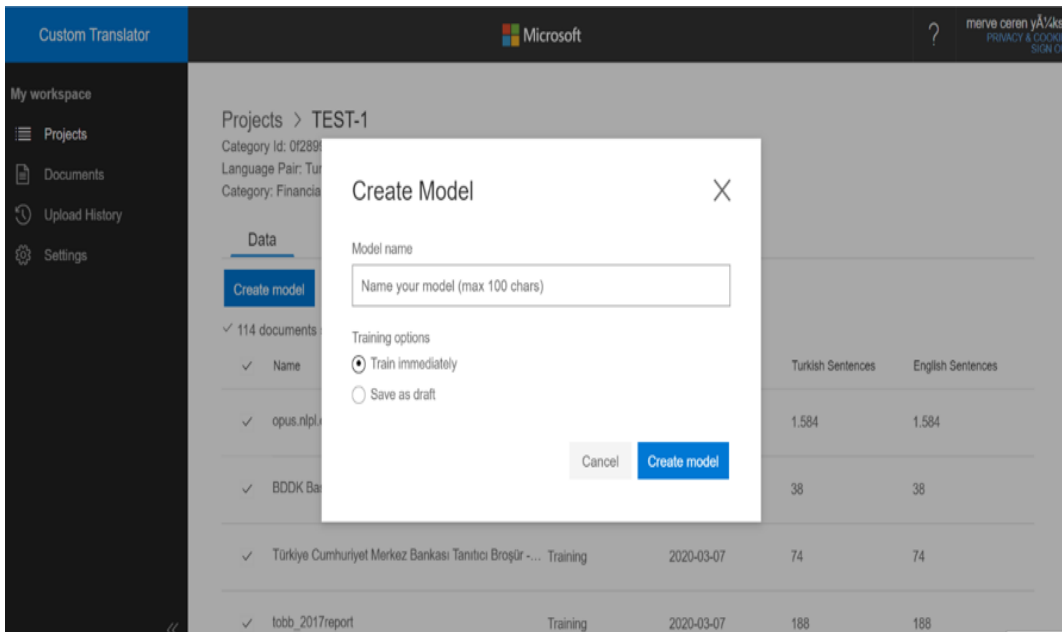
Document Processing in Microsoft Custom Translator

## IV



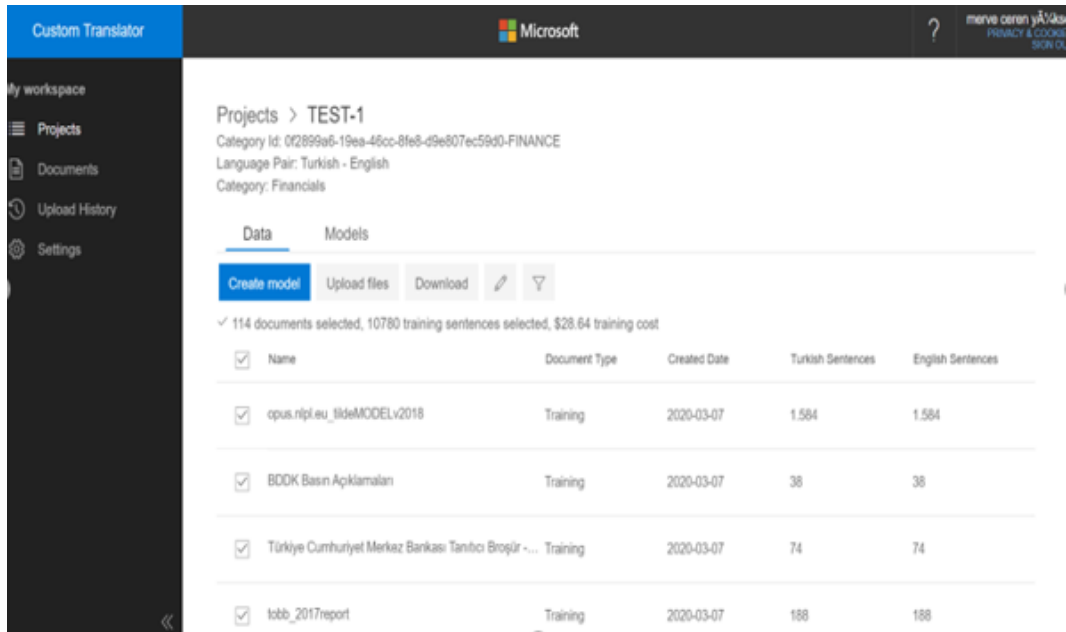
Upload History, Status “Succeeded” in Microsoft Custom Translator

## V



Creating a Model in Microsoft Custom Translator

## VI



Custom Translator Microsoft

Projects > TEST-1  
Category Id: 0f2899a6-19ea-46cc-8fe8-d9e807ec59d0-FINANCE  
Language Pair: Turkish - English  
Category: Financials

Data Models

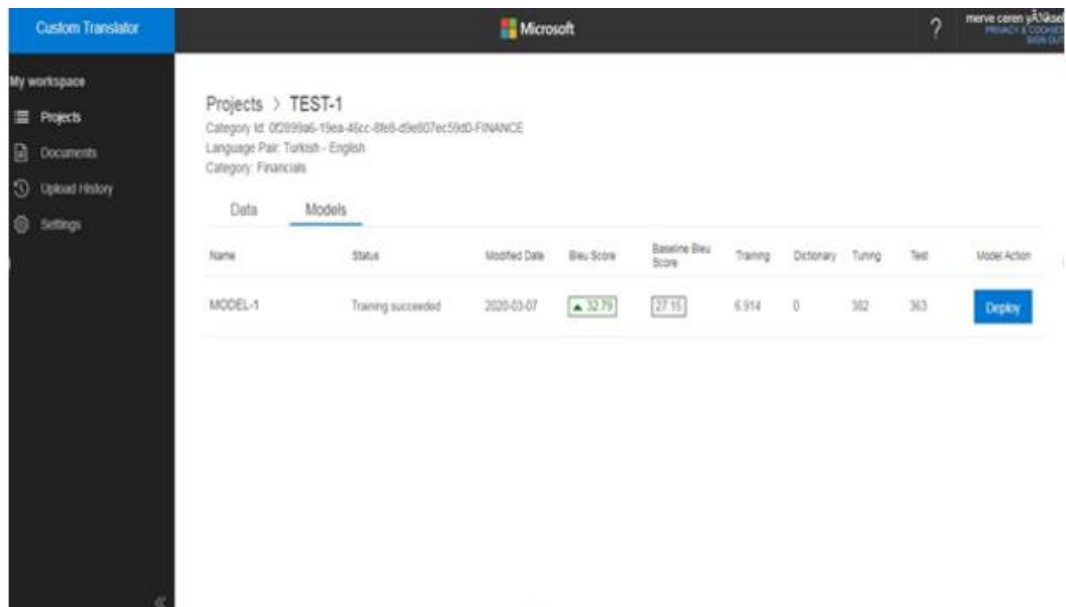
Create model Upload files Download

✓ 114 documents selected, 10780 training sentences selected, \$28.64 training cost

| <input checked="" type="checkbox"/> | Name                                                   | Document Type | Created Date | Turkish Sentences | English Sentences |
|-------------------------------------|--------------------------------------------------------|---------------|--------------|-------------------|-------------------|
| <input checked="" type="checkbox"/> | opus.nlpl.eu_fideMODELv2018                            | Training      | 2020-03-07   | 1,584             | 1,584             |
| <input checked="" type="checkbox"/> | BDDK Basın Açıklamaları                                | Training      | 2020-03-07   | 38                | 38                |
| <input checked="" type="checkbox"/> | Türkiye Cumhuriyet Merkez Bankası Tanıtıcı Broşür -... | Training      | 2020-03-07   | 74                | 74                |
| <input checked="" type="checkbox"/> | lobb_2017report                                        | Training      | 2020-03-07   | 188               | 188               |

Training a Model in Microsoft Custom Translator

## VII



Custom Translator Microsoft

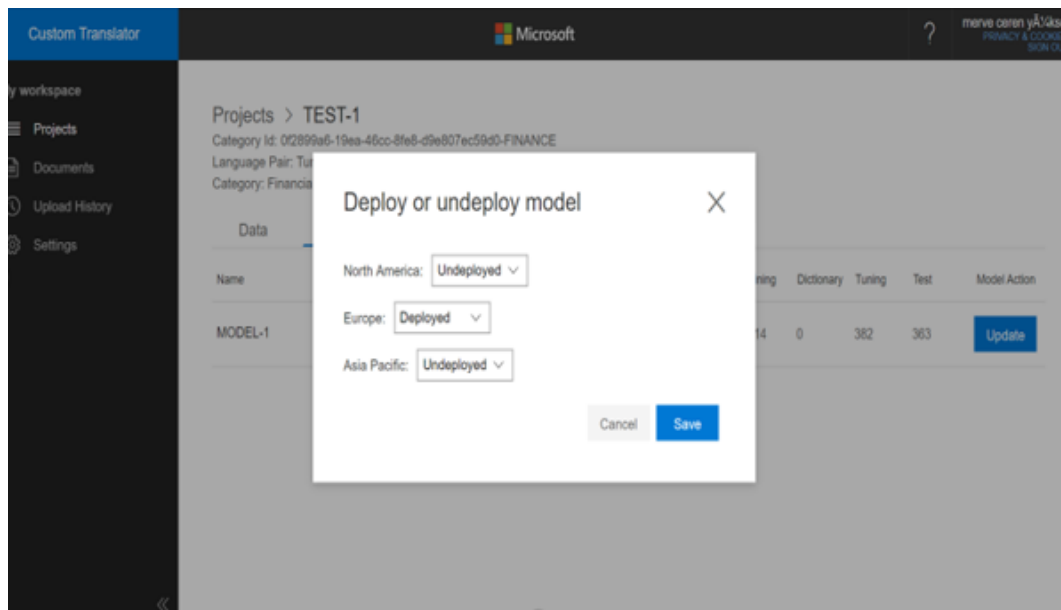
Projects > TEST-1  
Category Id: 0f2899a6-19ea-46cc-8fe8-d9e807ec59d0-FINANCE  
Language Pair: Turkish - English  
Category: Financials

Data Models

| Name    | Status             | Modified Date | Bleu Score | Baseline Bleu Score | Training | Dictionary | Tuning | Test | Model Action |
|---------|--------------------|---------------|------------|---------------------|----------|------------|--------|------|--------------|
| MODEL-1 | Training succeeded | 2020-03-07    | ▲ 32.79    | 27.15               | 6,914    | 0          | 362    | 363  | Deploy       |

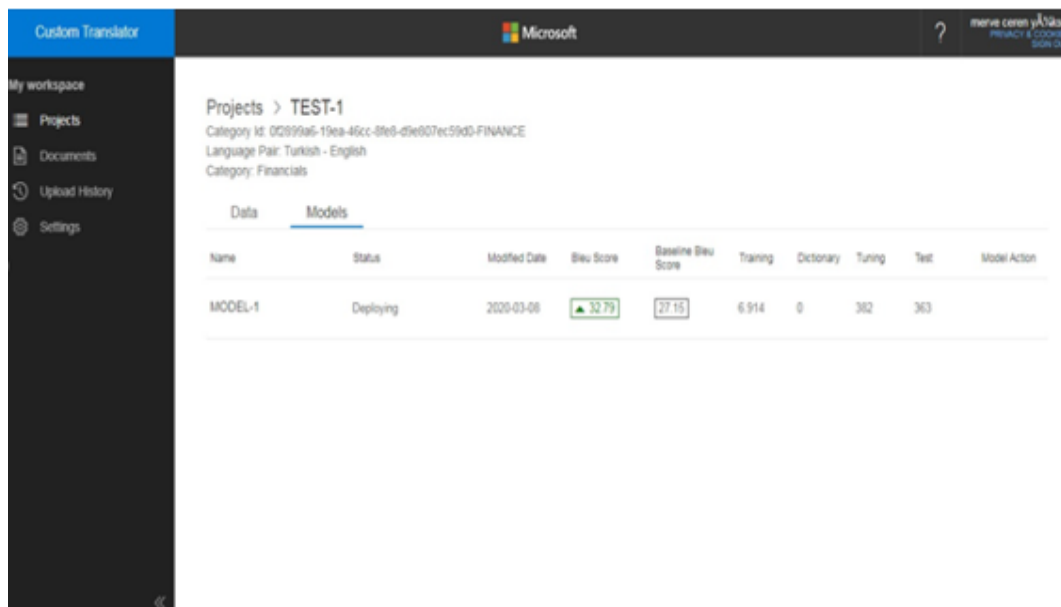
Training Succeeded and Completed in Microsoft Custom Translator

## VIII



Starting Deployment in Microsoft Custom Translator

## IX



Deployment a Model in Microsoft Custom Translator

## APPENDIX II: GLOSSARY

| <b>Turkish</b>                  | <b>English</b>                                            |
|---------------------------------|-----------------------------------------------------------|
| 5 yıllık enflasyon beklentileri | 5-year inflation expectations                             |
| AB                              | EU                                                        |
| ABD                             | USA                                                       |
| ABD Başkan Yardımcısı           | U.S. Vice President                                       |
| ABD Merkez Bankası              | Federal Reserve                                           |
| ABD Sayıştayı                   | Government Accountability Office                          |
| ABD Tarım Bakanı                | US Secretary of Agriculture                               |
| ABD Temsilciler Meclisi Başkanı | the Speaker of the United States House of Representatives |
| ABD Ticaret Bakanlığı           | U.S. Department of Commerce                               |
| açığa satış                     | short selling                                             |
| açığa satış işlemi              | short selling                                             |
| Açık Piyasa İşlemleri           | Open Market Operations                                    |
| alçalan üçgen formasyonu        | descending triangle pattern                               |
| Almanya Başbakanı               | Chancellor                                                |
| Almanya İstatistik Kurumu       | Destatis                                                  |
| altın sikke standardı           | gold species standard                                     |
| AMB                             | ECB                                                       |
| AMB Başkanı                     | ECB President                                             |
| Amerikan Petrol Enstitüsü       | American Petroleum Institute                              |
| API                             | OMO                                                       |
| ara ürünler                     | intermediate goods                                        |
| Arakazanç Ticareti              | Carry Trade                                               |
| arakazanç ticareti              | carry trade                                               |
| arz                             | supply                                                    |
| arz fazlası                     | excess supply                                             |
| Avam Kamarası                   | House of Commons                                          |
| Avam Kamarası Başkanı           | House of Commons Speaker                                  |

|                                     |                                         |
|-------------------------------------|-----------------------------------------|
| avro                                | euro                                    |
| Avro bölgesi                        | Eurozone                                |
| Avrupa Birliği İç Piyasa Komisyonu  | European Commission for Internal Market |
| Avrupa Birliği Komisyonu            | European Commission                     |
| Avrupa İstatistik Kurumu            | Eurostat                                |
| Avrupa Merkez Bankası               | European Central Bank                   |
| Avustralya Merkez Bankası           | Reserve Bank of Australia               |
| ayı trendi                          | bearish                                 |
| azil                                | impeachment                             |
| Bank of Japan                       | Japonya Merkez Bankası                  |
| Bankalararası Kart Merkezi          | Interbank Card Center                   |
| Bankalararası Takas Odaları Merkezi | Interbank Clearing House                |
| basın sözcüsü                       | spokesperson                            |
| Baş Ekonomist                       | Chief Economist                         |
| Baş ekonomist                       | Chief economist                         |
| başdanışman                         | senior advisor                          |
| Batı Teksas Tipi                    | West Texas Intermediate                 |
| beşeri sermaye                      | human capital                           |
| Beyaz Saray                         | White House                             |
| beylik hakkı                        | seigniorage                             |
| BIST                                | BIST                                    |
| BIST-30                             | BIST-30                                 |
| Bileşik Endeks                      | Composite Index                         |
| bileşik endeks                      | composite index                         |
| bileşik faiz                        | compound interest                       |
| bileşik faiz oranı                  | compound interest rate                  |
| bir hafta vadeli repo faiz oranı    | one-week repo rate                      |
| bir hafta vadeli repo oranı         | one-week repo rate                      |
| birikmiş faiz                       | accrued interest                        |
| Bitcoin                             | Bitcoin                                 |

|                                            |                                                 |
|--------------------------------------------|-------------------------------------------------|
| BK                                         | UK                                              |
| BOE                                        | BOE                                             |
| boğa trendi                                | bullish                                         |
| Brent petrol                               | Brent oil                                       |
| Brexit                                     | Brexit                                          |
| Brexit Belirsizlik Endeksi                 | Brexit Uncertainty Index                        |
| BTC                                        | BTC                                             |
| bütçe açığı                                | budget deficit                                  |
| bütçe dengesi                              | budget balance                                  |
| bütçe fazlası                              | budget surplus                                  |
| Caixin İmalat Satın Alma Müdürleri Endeksi | Caixin Manufacturing Purchasing Managers' Index |
| COVID-19                                   | COVID-19                                        |
| Cumhuriyetçi                               | Republican                                      |
| Cumhuriyetçiler                            | Republicans                                     |
| çapraz kur                                 | cross rate                                      |
| Çekirdek TÜFE                              | Core CPI                                        |
| çıktı açığı                                | output gap                                      |
| çıpa                                       | nominal anchor                                  |
| Çin Merkez Bankası                         | People's Bank of China                          |
| Çin Ulusal İstatistik Ofisi                | the National Bureau of Statistics of China      |
| dalgalı kur                                | floating exchange rate                          |
| danışman                                   | adviser                                         |
| daralma                                    | contraction                                     |
| daraltıcı                                  | contractionary                                  |
| darboğaz                                   | bottleneck                                      |
| DAX                                        | DAX                                             |
| DAX30                                      | DAX30                                           |
| deflasyon                                  | deflation                                       |
| deflatör                                   | deflator                                        |
| değişken faizli ihraçlar                   | floating rate notes                             |

|                                       |                                                       |
|---------------------------------------|-------------------------------------------------------|
| Demokrat                              | Democrat                                              |
| Demokratlar                           | Democrats                                             |
| destek seviyesi                       | support level                                         |
| devalüasyon                           | devaluation                                           |
| devlet iç borçlanma senedi            | government domestic borrowing security                |
| devlet iç borçlanma senetleri         | government domestic borrowing securities              |
| devlet tahvili                        | government bond                                       |
| dezenflasyon                          | disinflation                                          |
| dış ticaret açığı                     | foreign trade deficit                                 |
| dış ticaret hadleri                   | terms of trade                                        |
| direnç seviyesi                       | resistance level                                      |
| dolar                                 | dollar                                                |
| dolarizasyon                          | dolarization                                          |
| durgunluk                             | recession                                             |
| ekonomik hissiyat                     | economic sentiment                                    |
| Ekonomik Hissiyat                     | Economic Sentiment                                    |
| Ekonomik Kalkınma ve İşbirliği Örgütü | Organisation for Economic Cooperation and Development |
| ekonomik teşvik paketi                | economic stimulus package                             |
| emision                               | issue                                                 |
| Enerji Bilgi İdaresi                  | Energy Information Administration                     |
| enflasyon                             | inflation                                             |
| enflasyona endeksli                   | inflation indexed                                     |
| erken itfa                            | early redemption                                      |
| ETF                                   | ETF                                                   |
| euro                                  | euro                                                  |
| Euro bölgesi                          | Eurozone                                              |
| fabrika siparişleri                   | factory orders                                        |
| Faz 1 Anlaşması                       | Phase 1 Deal                                          |
| Faz 1 Ticaret Anlaşması               | Phase 1 Trade Deal                                    |
| Faz 2 Ticaret Anlaşması               | Phase 2 Trade Deal                                    |

|                              |                                |
|------------------------------|--------------------------------|
| FED                          | FED                            |
| FED Başkanı                  | FED Chair                      |
| Federal Açık Piyasa Komitesi | Federal Open Market Committee  |
| federal fon oranı            | federal funds rate             |
| finansal kiralama            | leasing                        |
| fiyat boşluğu                | price gap                      |
| FOMC                         | FOMC                           |
| friksiyonel işsizlik         | frictional unemployment        |
| FTSE100                      | FTSE100                        |
| G20                          | G20                            |
| G-20                         | G-20                           |
| G7                           | G7                             |
| G-7                          | G-7                            |
| gecikmeli net mutabakat      | deferred net settlement        |
| geç likidite penceresi       | late liquidity window facility |
| gelişen piyasa               | emerging market                |
| gelişen piyasalar            | emerging markets               |
| gelişmekte olan piyasa       | emerging market                |
| gelişmekte olan piyasalar    | emerging markets               |
| genişlemeci                  | expansionary                   |
| geri ödenmeme riski          | default risk                   |
| Goldman Sachs Group Inc      | Goldman Sachs Group Inc        |
| GSMH                         | GNP                            |
| GSYH                         | GDP                            |
| GSYİH                        | GDP                            |
| gün içi likidite imkanı      | intraday liquidity facility    |
| güvenli liman varlığı        | safe-haven asset               |
| güvenli liman varlıkları     | safe-haven assets              |
| güvercin                     | dovish                         |
| haftalık ham petrol stokları | weekly crude oil inventories   |

|                                             |                                              |
|---------------------------------------------|----------------------------------------------|
| Halifax konut fiyat endeksi                 | Halifax house price index                    |
| halka arz değeri                            | IPO value                                    |
| ham petrol                                  | crude oil                                    |
| ham petrol stokları                         | crude oil inventories                        |
| hanehalkı                                   | household                                    |
| hanehalkı geliri                            | household income                             |
| hareketli ortalama                          | moving average                               |
| hesaben saklama                             | book entry                                   |
| Hizmet satın alma müdürleri endeksi         | Service purchasing managers' index           |
| HK50                                        | HK50                                         |
| Hong Kong İnsan Hakları ve Demokrasi Yasası | Hong Kong Human Rights and Democracy Act     |
| Hürmüz Boğazı                               | Strait of Hormuz                             |
| IHS Markit                                  | IHS Markit                                   |
| IMF Başkanı                                 | IMF Managing Director                        |
| ikame etkisi                                | substitution effect                          |
| İmalat dışı satın alma müdürleri            | Non-manufacturing purchasing managers' index |
| İngiltere Maliye Bakanı                     | Chancellor of the Exchequer                  |
| İngiltere Merkez Bankası                    | Bank of England                              |
| inşaat verileri                             | construction data                            |
| İran Devrim Muhafızları                     | Islamic Revolutionary Guard Corps of Iran    |
| İspanya Merkez Bankası                      | Banco de Espana                              |
| istihdam                                    | employment                                   |
| istihdam değişimi                           | employment change                            |
| İsveç Merkez Bankası                        | Sveriges Riksbank                            |
| İsviçre Merkez Bankası                      | Swiss National Bank                          |
| iş gücü piyası                              | labor market                                 |
| İş İmkanları ve Personel Değişimi Anketi    | Job Openings and Labor Turnover Survey       |
| İşçi Partisi                                | Labor Party                                  |
| işsizlik                                    | unemployment                                 |
| işsizlik haklarından yararlanma             | jobless claims                               |

|                                  |                                     |
|----------------------------------|-------------------------------------|
| başvuruları                      |                                     |
| itfa                             | redemption                          |
| JAPONYA                          | JAPAN                               |
| kaldıraç                         | leverage                            |
| kamu kaynaklı finansman          | bail-out                            |
| kamu kesimi                      | public sector                       |
| Kanada Merkez Bankası            | Bank of Canada                      |
| kar satışı                       | take profit sale                    |
| Karar Verici Panel               | Decision Maker Panel                |
| Kişisel Tüketim Harcamaları      | Personal Consumption Expenditures   |
| KOBİ                             | SME                                 |
| konut fiyat endeksi              | house price index                   |
| koronavirüs                      | coronavirus                         |
| KOVID-19                         | COVID-19                            |
| KOVID-19                         | COVID-19                            |
| kredi arzı daralması             | credit crunch                       |
| kredi arzında daralma            | credit crunch                       |
| Kredi Derecelendirme Kuruluşu    | Credit Rating Agency                |
| kredi derecelendirme kuruluşu    | credit rating agency                |
| kripto para                      | cryptocurrency                      |
| kripto paralar                   | cryptocurrencies                    |
| kriptopara                       | cryptocurrency                      |
| kriptoparalar                    | cryptocurrencies                    |
| kuponlu ihraç                    | coupon bond                         |
| Küçük ve Orta Ölçekli İşletmeler | Small and Medium-sized Enterprises  |
| külçe                            | bullion                             |
| Küresel Resesyon Sonrası On Yıl  | A Decade After the Global Recession |
| Londra borsası                   | London stock exchange               |
| Lordlar Kamarası                 | House of Lords                      |
| makro ihtiyati                   | macroprudential                     |

|                                            |                                               |
|--------------------------------------------|-----------------------------------------------|
| makroihtiyati                              | macroprudential                               |
| mali politika                              | fiscal policy                                 |
| maliye politikası                          | fiscal policy                                 |
| marj                                       | margin                                        |
| menkul kıymetler                           | securities                                    |
| merkez bankası müdahalesi                  | central bank intervention                     |
| merkezi karşı taraf                        | central counterparty                          |
| merkezi kayıt kuruluşu                     | central registry agency                       |
| mevsim etkilerinden arındırılmış           | adjusted for seasonal effects                 |
| mevsim ve takvim etkilerinden arındırılmış | adjusted for seasonal and calendar effects    |
| mevsim ve takvim etkisinden arındırma      | adjustment for seasonal and calendar effects  |
| mevsimsel                                  | seasonal                                      |
| mevsimsellik                               | seasonality                                   |
| MKK                                        | CRA                                           |
| MKT                                        | CCP                                           |
| Muhafazakar Parti                          | Conservative Party                            |
| müzakereler                                | negotiations                                  |
| NASDAQ                                     | NASDAQ                                        |
| net hata ve noksan                         | net errors and omission                       |
| New York Empire State İmalat Endeksi       | the New York Empire State Manufacturing Index |
| NIKKEI225                                  | NIKKEI225                                     |
| nicel genişleme                            | quantitative easing                           |
| nihai kredi mercii                         | lender of last resort                         |
| Noel Ertesi Tatili                         | Boxing Day                                    |
| nominal değer                              | par value                                     |
| OECD                                       | OECD                                          |
| OPEC                                       | OPEC                                          |
| OPEC+                                      | OPEC+                                         |
| oto-finansman                              | bail-in                                       |

|                             |                                 |
|-----------------------------|---------------------------------|
| otomatik finansman          | bail-in                         |
| oynaklık                    | volatility                      |
| ödeme karşılığı ödeme       | payment versus payment          |
| ödeme karşılığı teslimat    | delivery versus payment         |
| ödemeler dengesi            | balance of payments             |
| ÖKÖ                         | PvP                             |
| ÖKT                         | DvP                             |
| ölçüt kıymet                | benchmark security              |
| öncü veri                   | preliminary data                |
| özel çekme hakkı            | special drawing right           |
| özel çekme hakları          | special drawing rights          |
| para politikası             | monetary policy                 |
| Para Politikası Kurulu      | The Monetary Policy Board       |
| para politikası kurulu      | the monetary policy board       |
| Para Politikası Kurulu      | the Monetary Policy Committee   |
| paranın dolaşım hızı        | velocity of money               |
| parasal aktarım mekanizması | monetary transmission mechanism |
| parasal büyüklükler         | monetary aggregates             |
| parasal genişleme           | quantitative easing             |
| parite                      | pair                            |
| PBOC                        | PBOC                            |
| perakende satışlar          | retail sales                    |
| petrol ihracatçısı ülkeler  | oil exporting countries         |
| piyasa yapıcılığı sistemi   | primary dealership              |
| PMI                         | PMI                             |
| POTUS                       | ABD Başkanı                     |
| reeskont                    | rediscount                      |
| resesyon                    | recession                       |
| rezerv para                 | hard currency                   |
| Riksbank                    | Sveriges Riksbank               |

|                                 |                                      |
|---------------------------------|--------------------------------------|
| risk primi                      | risk premium                         |
| riske maruz değer               | value at risk                        |
| Riske Maruz Değer               | Value at Risk                        |
| riskten kaçınan                 | risk averse                          |
| riskten korunma                 | hedging                              |
| sahte banknot                   | counterfeit banknote                 |
| saklama hizmeti                 | custodian service                    |
| sanayi üretimi                  | industrial production                |
| sarı yelekliler                 | yellow vest movement                 |
| satın alma müdürleri endeksi    | purchasing managers' index           |
| Satın Alma Müdürleri Endeksi    | Purchasing Managers' Index           |
| Senato                          | Senate                               |
| Sentix yatırımcı güveni endeksi | Sentix investment confidence index   |
| senyoraj                        | seigniorage                          |
| serbest dalgalı                 | free-floating                        |
| serbest dalgalı kur             | free-floating exchange rate          |
| serbest yatırım fonu            | hedge fund                           |
| sermaye kullanım oranı          | capacity utilization rate            |
| sıkı                            | tight                                |
| Sivil Havacılık Kurumu          | Civil Aviation Organization          |
| SP500                           | SP500                                |
| spot valör                      | spot date                            |
| stagflasyon                     | stagflation                          |
| sterlin                         | sterling                             |
| şahin                           | hawkish                              |
| Şangay borsası                  | Shanghai stock exchange              |
| tahvil                          | bond                                 |
| Takasbank                       | Istanbul Settlement and Custody Bank |
| talep                           | demand                               |
| talep çekişli enflasyon         | demand pull inflation                |

|                                |                                   |
|--------------------------------|-----------------------------------|
| talep fazlası                  | excess demand                     |
| tarım dışı istihdam            | non-farm payrolls                 |
| tarife                         | tariff                            |
| TCMB                           | CBRT                              |
| Tedarik Yönetim Enstitüsü      | Institute for Supply Management   |
| Temsilciler Meclisi            | House of Representatives          |
| tepki alımları                 | purchases in response             |
| teşvik paketi                  | stimulus package                  |
| tezgahüstü piyasalar           | over the counter                  |
| ticaret dengesi                | trade balance                     |
| ticaret savaşı                 | trade war                         |
| Ticaret Savaşı                 | Trade War                         |
| TL                             | TRY                               |
| toptan satışlar                | wholesale sales                   |
| TSK                            | Turkish Army                      |
| tutanaklar                     | minutes                           |
| TÜFE                           | CPI                               |
| türev piyasalar                | derivative markets                |
| Türk lirası                    | Turkish lira                      |
| TürkAkım                       | TurkStream                        |
| Türkakım                       | TurkStream                        |
| Türkiye İstatistik Kurumu      | Turkstat                          |
| Uluslararası Mutabakat Bankası | Bank for International Settlement |
| Uluslararası Para Fonu         | International Monetary Fund       |
| USDHKD                         | USDHKD                            |
| USMCA                          | USMCA                             |
| üçüncül piyasa                 | tertiary market                   |
| ÜFE                            | PPI                               |
| üretici fiyat endeksi          | producer price index              |
| üssel                          | exponential                       |

|                                 |                                   |
|---------------------------------|-----------------------------------|
| vade primi                      | term premium                      |
| vadeli işlemler                 | futures                           |
| vadeli işlemler sözleşmesi      | futures contract                  |
| varlığa dayalı menkul kıymet    | asset backed security             |
| varlık alım programı            | asset purchase program            |
| VIOP                            | VIOP                              |
| volatilite                      | volatility                        |
| WTI                             | WTI                               |
| YA                              | IS                                |
| yatırım anketi                  | investment survey                 |
| Yatırım Anketi                  | Investment Survey                 |
| YD-ÜFE                          | NDPPI                             |
| Yeni Dönemsel Fonlama programı  | New Term Funding scheme           |
| yeni koronavirüs                | novel coronavirus                 |
| yeni tip koronavirüs            | novel coronavirus                 |
| yıl sonu enflasyon beklentisi   | year-end inflation expectations   |
| Yİ-ÜFE                          | D-PPI                             |
| Yönetim Konseyi                 | Governing Council                 |
| Yurt Dışı Üretici Fiyat Endeksi | Non-Domestic Producer Price Index |
| Yurt İçi Üretici Fiyat Endeksi  | Domestic Producer Price Index     |
| yükselen üçgen formasyonu       | ascending triangle pattern        |
| zamanaşımı süresi               | redemption period                 |
| zorunlu karşılık                | reserve requirement               |
| zorunlu karşılık oranı          | reserve requirement ratio         |
| zorunlu karşılıklar             | reserve requirements              |

**ÖZGEÇMİŞ**

|                                                  |                               |                              |                                                                                                                                       |
|--------------------------------------------------|-------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Adı, Soyadı</b>                               | Merve Ceren                   |                              | Yüksel                                                                                                                                |
| <b>Doğum Yeri ve Yılı</b>                        | İzmir                         |                              | 1995                                                                                                                                  |
| <b>Bildiği Yabancı Diller</b>                    | İngilizce                     |                              | İspanyolca                                                                                                                            |
| <b>ve Düzeyi</b>                                 | İleri                         |                              | Orta                                                                                                                                  |
| <b>Eğitim Durumu</b>                             | <b>Başlama – Bitirme Yılı</b> | <b>Kurum Adı</b>             |                                                                                                                                       |
| <b>Lise</b>                                      | 2009                          | 2013                         | 85. Yıl Anadolu Lisesi                                                                                                                |
| <b>Lisans</b>                                    | 2013                          | 2017                         | Boğaziçi Üniversitesi                                                                                                                 |
| <b>Yüksek Lisans</b>                             | 2017                          | 2020                         | İstanbul 29 Mayıs Üniversitesi                                                                                                        |
| <b>Doktora</b>                                   |                               |                              |                                                                                                                                       |
| <b>Çalıştığı Kurum (lar)</b>                     | <b>Başlama - Ayrılma Yılı</b> | <b>Çalışılan Kurumun Adı</b> |                                                                                                                                       |
| 1.                                               | 2017                          | 2017                         | Şekerbank Genel Müdürlük                                                                                                              |
| 2.                                               | 2017                          | 2018                         | NR Translation                                                                                                                        |
| 3.                                               | 2019                          | Devam ediyor                 | Commit Global                                                                                                                         |
| <b>Üye Olduğu Bilimsel ve Mesleki Kuruluşlar</b> |                               |                              | 1. GALA<br>2. Nimdzi<br>3. Slator                                                                                                     |
| <b>Katıldığı Proje ve Toplantılar</b>            |                               |                              | 1. Account Management for Project Managers<br>2. Slator Design Thinking Workshop (2020)                                               |
| <b>Yayınlar:</b>                                 |                               |                              | 1) Yüksel, M. “Finance and Banking Translation: A General Overview”<br>Enriching Translation Studies through Re-Readings [28.03.2018] |
| <b>Diğer:</b>                                    |                               |                              |                                                                                                                                       |
| <b>İletişim (e-posta):</b>                       |                               |                              | mervecerenyüksel@gmail.com                                                                                                            |
| <b>Tarih</b>                                     |                               |                              | 27.07.2020                                                                                                                            |
| <b>İmza</b>                                      |                               |                              |                                                                                                                                       |
| <b>Adı Soyadı</b>                                |                               |                              | Merve Ceren Yüksel                                                                                                                    |