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GOVERNMENT EXPENDITURES WITHOUT GROWTH: THE CASE OF TURKEY

BÜYÜMEYE DÖNÜŞMEYEN KAMU HARCAMALARI: TÜRKİYE ÖRNEĞİ

Arif Orçun SÖYLEMEZ[1], Özkan ZÜLFÜOĞLU[2]

1. Doç. Dr., Marmara Üniversitesi, İktisat Fakültesi, İktisat Bölümü, orcun.soylemez@marmara.edu.tr, https://orcid.org/0000-0001-5920-8592
2. Dr. Öğr. Üyesi, Marmara Üniversitesi, İktisat Fakültesi, Maliye Bölümü, ozkan.zulfuoglu@marmara.edu.tr, https://orcid.org/0000-0002-0305-1685

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Abstract

Share of government expenditures in the GDPs are increasing virtually everywhere. Available data for developed countries indicate that the beginnings of this upward trend date back to the mid-19th century. Interestingly, economic growth rates did not increase significantly over time despite the increases in government expenditures. Low income countries today spend more than the double of what today's developed economies were spending on average in 1900. However, this is not helping them to converge to richer economies. Why are government expenditures increasing then? This question might have global pertinence but due to the variety of country-specific factors, it can be best studied on a single country level. In this article, the country of focal interest is Turkey. Five important variables that might affect government expenditures from different angles are evaluated regarding their contributions to the out-of-sample predictions of government expenditures using random forest methodology. Military expenditures are estimated as primarily important for determining the government expenditures in Turkey in the last fifty years, while tax collections happened to be the second most important factor affecting the ups and downs of government expenditures around a time-varying average line. Per capita income, urbanization and inflation also affect government expenditures in various ways.

Keywords: Government Expenditures, Machine Learning, Random Forests.

Öz

Kamu harcamalarının GSYH içerisindeki payı hemen hemen dünyanın her yanında artış göstermektedir. Gelişmiş ülkeler için elde var olan veriler, sözkonusu artış trendinin 19.yy'ın ortalarından beri devam ettiğini ortaya koymaktadır. Daha ilginç olan ise, devlet harcamalarındaki artış trendine rağmen ekonomik büyüme oranlarının zaman içerisinde anlamlı bir artış kaydetmemiş olmasıdır. Örneğin, günümüzdeki en fakir ülkeler gelişmiş ülkelerin 1900'ların başında GSYH'ya oranla harcadığının iki katından fazla kamu harcaması yapmaktaysa da bu onların düşük gelirli seviyeden daha yüksek seviyelere geçiş yapmalarına yetmemektedir. Bu durumda kamu harcamalarının neden artış gösterdiği ilginç bir soru olarak ortaya çıkmaktadır. Ancak küresel ölçekte değer taşıyan bu soru ne yazık ki her ülkenin kendine özgü şartları düşünüldüğünde ülkeler bazında çalışılması gereken bir konudur. Çalışmada bu soruya Türkiye örneği üzerinde yoğunlaşılmıştır. Rassal orman yöntemiyle kamu harcamalarına farklı açılardan etki edebilecek beş önemli değişken örneklemdışı tahmin performansları dikkate alınarak değerlendirilmiştir. Neticede Türkiye'de son elli yılda askeri harcamaların kamu harcamalarını artıran en önemli unsurlardan olduğu, ikinci olarak toplanan vergilerin de kamu harcamalarında ortalamaya göre artış ya da azalışları belirleyen nitelikte olduğu ortaya çıkartılmıştır. Bunlardan başka, kişi başına gelir, şehirleşme ve enflasyon da çeşitli şekillerde kamu harcamalarını etkilemektedir.

Anahtar Kelimeler: Kamu Harcamaları, Makine Öğrenmesi, Rassal Ormanlar.

GENİŞLETİLMİŞ ÖZET

Çalışmanın Amacı

Kamu harcamalarının artışı gelişmiş ülkelerdeki mevcut verilere göre, 19. yüzyılın ortalarından itibaren devam eden bir olgudur. Bununla beraber, neoliberal fikirlerin 1980'lerin başından beri dünyanın farklı köşelerinde yükselişi, kamu harcamalarındaki bu sürekli artış eğiliminde değişikliğe yol açmamıştır. Daha da ilginci, dünyanın hemen her yerinde kamu harcamalarının getirilerinin zaman içinde azalması gibi bir durum yaşanmaktadır. Başka bir deyişle, dünyanın farklı bölgelerinde oldukça farklı özelliklere sahip hükümetlerin her biri daha fazla kamu harcaması yapmakta, buna karşın artan kamu harcaması düzeyi yüksek büyüme performansı anlamına gelmemektedir. Tüm bu gözlemler doğal olarak şu soruyu akla getirmektedir: Artan kamu harcamalarının itici güçleri nelerdir? Çalışmada temel olarak bu soruya Türkiye üzerinden cevap aranması amaçlanmaktadır.

Araştırma Soruları

Çalışmanın temel araştırma sorusu artan kamu harcamalarının belirleyicilerinin neler olduğudur. Bu soruya küresel boyutta geçerli tek bir cevap bulmak olası değildir. Çünkü kamu harcamalarını ortaya çıkaran dinamikler her ülke için farklılık göstermektedir. Bu nedenle, makalenin kapsamı tek bir ülke analizi ile sınırlandırılmıştır. Çalışmada, kamu harcamalarını belirleyen faktörlerin çeşitlilik gösterdiği bir ülke olarak Türkiye seçilmiştir. Önceleri ithal ikameci sanayileşme (ISI) politikalarına sahip bir ülke olan Türkiye'de, 1980'den sonra geniş kapsamlı pazar temelli dönüşümler başlatılmıştır. Bu dönüşüm, büyük ideolojik aksama olmadan, günümüze kadar devam etmiştir. Sürecin sonunda Türkiye sanayileşmiş, güçlü özel sektör varlığına sahip, gelişmekte olan bir ekonomiye dönüşmüştür. Bu dönemde, yükselen serbestleşme söylemlerine karşın kamu harcamaları gerilememiş, aksine yükselmiştir. Bunun yanında Türkiye'de kamu harcamaları ile ekonomik büyüme arasındaki ilişkinin çok güçlü olmadığı görülmektedir. Tüm bu bulgular bir bütün olarak değerlendirildiğinde, son yarım yüzyılda Türkiye'de kamu harcamalarının belirleyicilerinin neler olduğunun farklı bir metodolojiyle analizinin faydalı olacağı düşünülmektedir. Bu sayede kamu harcamalarının büyümeye dönüşmemesinin nedenleri de irdelenebilecektir.

Literatür Araştırması

Kamu harcamalarının belirleyicilerinin neler olduğunun tespitini amaçlayan bu çalışmada kamu harcamasına yönelik temel teorik çalışmaları üç kategoride değerlendirmemin mümkün olacağı düşünülmüştür. Bunlardan ilki olarak, refah teorileri olarak adlandırabileceğimiz bir grup teori, kamu harcamalarının neden ve amacını sosyal faydayı artırma faaliyetleriyle ilişkilendirmiştir. Bu teoriler, kamu harcamalarına sosyal fayda maksimizasyonu üzerinden bir bakış açısı ortayı koymayı hedeflemişlerdir. Buna göre, kamu harcamalarının en uygun oranı, toplum için yapılan son birim harcamanın marjinal sosyal faydasının, marjinal sosyal maliyetine eşit olduğu noktada oluşmaktadır. Yani bu çalışmalar, kamu harcamalarının en uygun düzeyi ne olmalıdır sorusuna saf bir mikroekonomik perspektiften cevap verme yoluna gitmişlerdir. Literatürdeki öncü mikroekonomik temelli yaklaşımlara

örnek olarak Pigou (1947), Musgrave ve Peacock (1958) ve Buchanan ve Tullock (1961) gibi çalışmalar örnek gösterilebilir. Bunun yanında konuya makroekonomik perspektiften cevap bulmayı hedefleyen yaklaşımlar da literatürde fazlasıyla yer almaktadır. Bu çalışmalar genellikle Keynesyen bir ruha sahiptirler ve kamu harcamaları ile ekonomik büyüme arasındaki ilişkiyi temel almaktadırlar. Keynesyen bakış açısındaki makroekonomik çalışmalara örnek olarak ise, Harrod (1948) ve Domar (1957) çalışmaları verilebilir. Bunların yanında üçüncü bir görüş olarak ise kamu harcamaları ile kişi başına düşen çıktıyı ilişkilendiren çalışmalar yer almaktadır. Bu konudaki öncü çalışmada Wagner (1890) kamu harcamalarının, kişi başına çıktının büyüme oranından daha hızlı arttığını iddia etmiştir. Adams (1898) ise kamu harcamalarının kişi başına çıktının büyüme oranıyla orantılı olarak arttığını ifade eden bir görüş öne sürmüştür. Wagner ve Adams, hem Avrupa hem de Amerika'daki ekonomilerdeki değişimlere tanık olmuş ve gözlemlerine dayanarak iddialarını ortaya koymuşlardır. Kamu harcamalarına ilişkin literatür yıllar içinde ciddi biçimde ilerlemiş, temel görüşleri pek çok farklı ülke için test eden çalışmalar yapılmıştır. Literatürdeki son çalışmalar daha çok çeşitli harcama türlerinin işlevsel ayrıştırmalarına odaklanmaktadır. Bu çalışmada Türkiye'de kamu harcamalarını etkileyen çeşitli faktörlerin makine öğrenmesi ile tahmin edilmesi amaçlanmaktadır. Bu doğrultuda, literatürdeki bu öncü ve sağlam temelli teoriler modelin bağımsız değişkenlerinin oluşturulmasında temel olarak dikkate alınmıştır..

Yöntem

Makine öğrenimi yöntemlerinin, son on yılda sosyal bilimlere güçlü bir giriş yaptığını görmekteyiz. Bu çalışma, kamu harcamalarını açıklayan beş bağımsız değişkeni örnek dışı tahmin güçlerine göre sınıflandırma ve sıralama girişimi olarak ifade edilebilir. Dolayısıyla makine öğreniminin sunduğu denetimli bir sınıflandırma analizi bu makalenin amaçları için oldukça uygun görünmektedir. Makalede, rassal orman algoritması olarak bilinen bir topluluk sınıflandırıcı analiz yöntemi kullanılmıştır. Bu yöntem, tek karar ağacı kullanılırken karşılaşılabilecek problemleri düzeltme yeteneğine sahip güçlü bir sınıflandırıcıdır. Metodoloji, çalışmanın ilgili bölümünde detaylı olarak açıklanmıştır..

Sonuç ve Değerlendirme

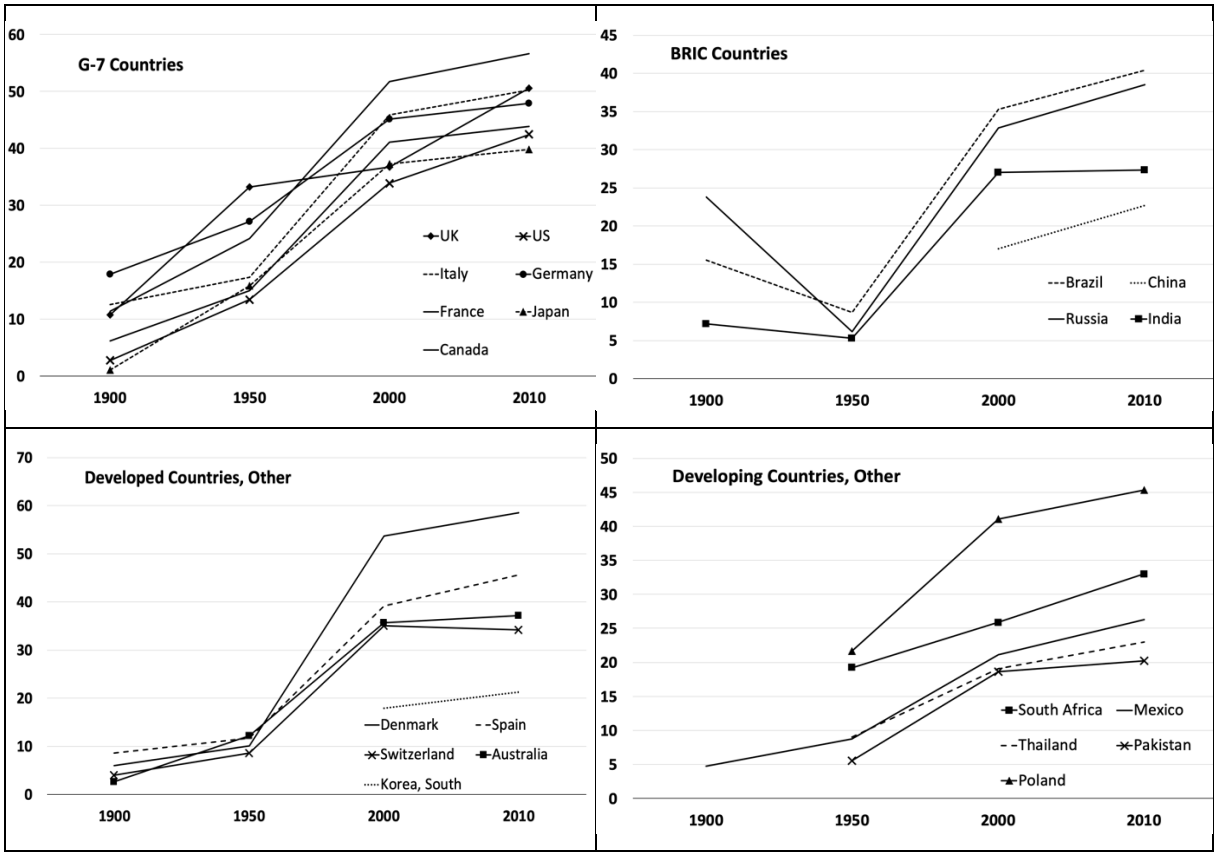
Çalışmada uygulanan rassal orman algoritması, Türkiye'de 1970'lerin başından itibaren askeri harcamalar ile kamu harcamaları arasında güçlü bir ilişkinin varlığına işaret etmektedir. Daha açık ifade etmek gerekirse, belirli bir yıldaki askeri harcamalar, son üç yılda yapılan ortalama askeri harcamayı aştığında, kamu harcamaları da yüksek olma eğilimindedir. Vergi tahsilatları ile kamu harcamaları arasında da benzer bir ilişki vardır. Bu durum vergi tahsilatlarının kamu harcaması düzeyinin önemli bir belirleyicisi olduğu şeklinde yorumlanabilse de hükümetlerin kamu harcamalarını vergi dışı kanallar aracılığıyla da finanse edebilecekleri unutulmamalıdır. Kişi başına düşen gelir artışları ve kentsel nüfus artış oranları, Türkiye'de kamu harcamalarını etkileyen diğer önemli faktörlerdir. Kısmi bağımlılık analizi sonucunda kişi başına gelir ile kamu harcamaları arasında pozitif bir ilişki olduğu bulgusuna

ulaşılmıştır. Yani, insanların zenginleştikçe daha fazla kamusal mal ve hizmet talep edecekleri tezini destekleyen sonuçlar elde edilmiştir. Son olarak, kısmi bağımlılık analizleri, askeri harcamaların ve vergi tahsilatlarının son üç yıldaki ortalamalarının üzerinde olduğu durumlarda, kamu harcamalarının son üç yılın ortalamalarından daha yüksek seviyede gerçekleşme eğiliminde olduğunu göstermektedir. Son üç yıldaki askeri harcamalar ve vergi tahsilatları kendi ortalamalarının altında kaldığında ise kamu harcamaları da son yılların ortalama kamu harcama düzeyinden daha düşük gerçekleşme eğilimindedir. Bununla beraber, kişi başına düşen gelir ve kentsel büyüme oranları ne olursa olsun kamu harcamaları artmaya devam etmektedir. Bu iki değişken, kendi ortalamalarının üzerine çıktığında kamu harcamaları hızlanmakta; bu iki değişken kendi ortalamalarının altına düştüğünde kamu harcamaları yine artmakta ancak azalan bir hızla artmaktadır. Analiz sonucunda enflasyonun kamu harcamalarını tahmin etmede en az önemli olan değişken olduğu bulgusuna ulaşılmıştır. Türkiye son elli yılda olağanüstü yüksek enflasyon dönemleri yaşadığı için enflasyon oranları da modele dahil edilmiştir. Sürekli olarak yaşanan yüksek enflasyon toplum için yoksullaştırıcı olabilmekte ve bu durum hükümetlerin düşük gelirlilere yönelik sunulan erdemli mal ve hizmetleri artırmalarına yol açabilmektedir. Ancak analiz sonucunda, enflasyon oranının sonuçları tahmin etmede yalnızca marjinal olarak önemli olduğu bulgusuna ulaşılmıştır.

1. INTRODUCTION

Share of government expenditures as a percentage of GDP has been rising for many decades in a significant number of countries with highly different characteristics. The following graphs might provide us with a rough idea about the vast geographical and economic diversity of those countries that have enjoyed increasing government expenditures in their GDPs over the years.

Figure 1. Government Expenditures in Selected Countries and Country Groups (% of GDP)

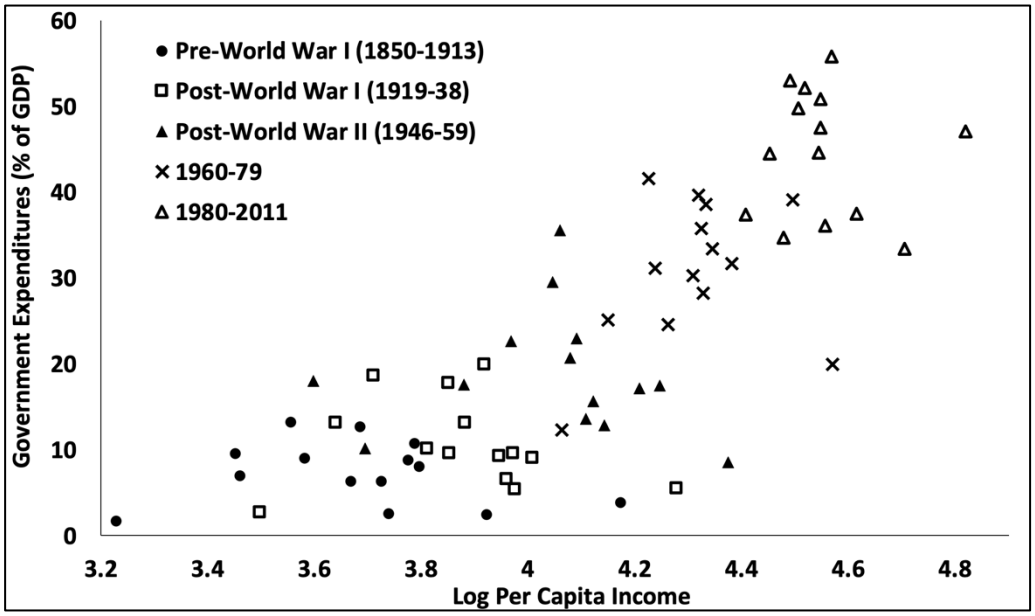


Source: IMF Fiscal Prudence and Profligacy database, and Ortiz-Ospina and Roser (2016)
Note: 1950 figure is not available for Australia. 1960 figure is used instead of it.

In return of that global trend, states all around the world have typically become bigger in time. When we focus only on the developed countries, for which we have observations available for longer periods of time, we can clearly observe that the economic expansion of the states through the expenditures has been an uninterrupted process since the mid-19th century (see Figure2).

This uninterrupted continuation of the upward trend in government expenditures, especially for the developed Western economies, is essentially a very intriguing fact since it so clearly shows us that the rise of the neoliberal ideas over the last four decades has hardly changed anything in terms of the global expansion of government expenditures even in the countries where neoliberal political and economic rhetoric and the subsequent emphasis on the "minimal state" have been so popular at least since the late 1970s.

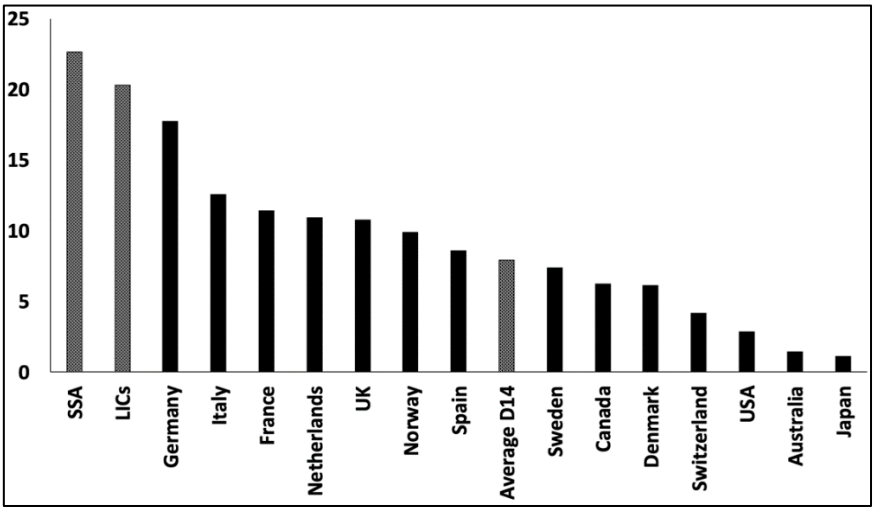
Figure 2. Government Expenditures in 14 Developed Countries over Different Time Periods



Source: Brookings Institute (2019).
Note: 14 developed countries included are Germany, Italy, France, Netherlands, the UK, Norway, Spain, Sweden, Canada, Denmark, Switzerland, the USA, Australia, Japan.

Although the governments' expenditures have been on a steady rise in a significant part of the world for more than a century, returns on those expenditures usually receded in time. As Izvorski and Karakülah (2019) report, low income countries today spend more than the double of what today's developed economies were spending on average more than a century ago. Sub-Saharan countries spend even more than that (see figure 3). However, whether they should spend that much in order to grow faster remains a debatable question.

Figure 3. Government Expenditures (as % of GDP) of Low-income Countries in 2018 vs. Government Expenditures of Today's Developed Economies in 1900



Source: Brooking Papers (2019).
Note: SSA stands for Sub-Saharan Africa, LIC stands for Low-income Country. D-14 stands for developed 14 countries, which are highlighted in black boxes.

These two interesting stylized facts regarding the government expenditures are suggestive of the following questions: What are the determinants of the rising government expenditures? And, from a developmentalist perspective, why do the government expenditures return less to countries now than they used to return a century ago? Although these two are interesting questions, they do not have universal answers suitable for all countries. After all, the theories on government expenditures, which we will briefly review in section two, speculate that the government expenditures would differ cross-sectionally and in time due to various country- and time-specific factors such as whether the country is poor or rich, is in a war or not, etc. For this reason, we will limit our scope in this paper and concentrate on a single country. The country we have selected is Turkey since this Country presents us an interesting case.

Turkish economy has been going through significant transformations since the early 1980s. As a result of massive changes over the decades, it is now a highly liberal economy. The Country has one of the largest and the most industrialized economies in the MENA region and it is strongly linked to the rest of the world through voluminous transactions of international trade and finance.

In the next and the following paragraphs, we will provide a brief summary of the Turkish economy for the post-WWII era, setting 1980 as a year of structural break in the Turkish economy. The era from 1950 to 1980 and the era from 1980 to the present time will thus be treated as two different episodes. Our aim is to draw attention to an interesting conundrum: Turkey has become a more liberal and market-oriented economy since the 1980s but the government expenditures in the Turkish GDP have not fallen as it should have been the case as the economy was becoming more market-oriented. In fact, government expenditures have been slightly lower before the 1980s although the government was playing a more central role within the economy in that era.

In the post-WWII era, until 1980, Turkish economic policies were pretty much parallel to the policies of most other developing countries. Import substitution policies were followed at least since the 1950s until 1980 (Krueger, 1995). In 1950, the multi-party electoral regime brought Democrat Party to power, whose leaders were placing great emphasis on the agricultural sector. Agricultural production was already rising when Democrat Party came into power. For example, Pamuk (2010) reports that the agricultural output in Turkey was doubled from 1947 to 1953, although in 1947 pre-War output levels were already attained. That is to say, there was a net and strong increase in agricultural production at the time thanks to the expansion of the cultivated areas under the Marshall Plan and the government policies. From 1950 to 1953, because of the global stress caused by the Korean War, primary commodity prices remained high all around the world, which was a situation benefiting Turkey as an exporter of agricultural goods. However, following the end of the Korean War, primary commodity prices dropped radically causing significant declines in Turkey's export earnings. Knowing that the rural population had a two-thirds share of the total vote, the government decided to start an energetic price support

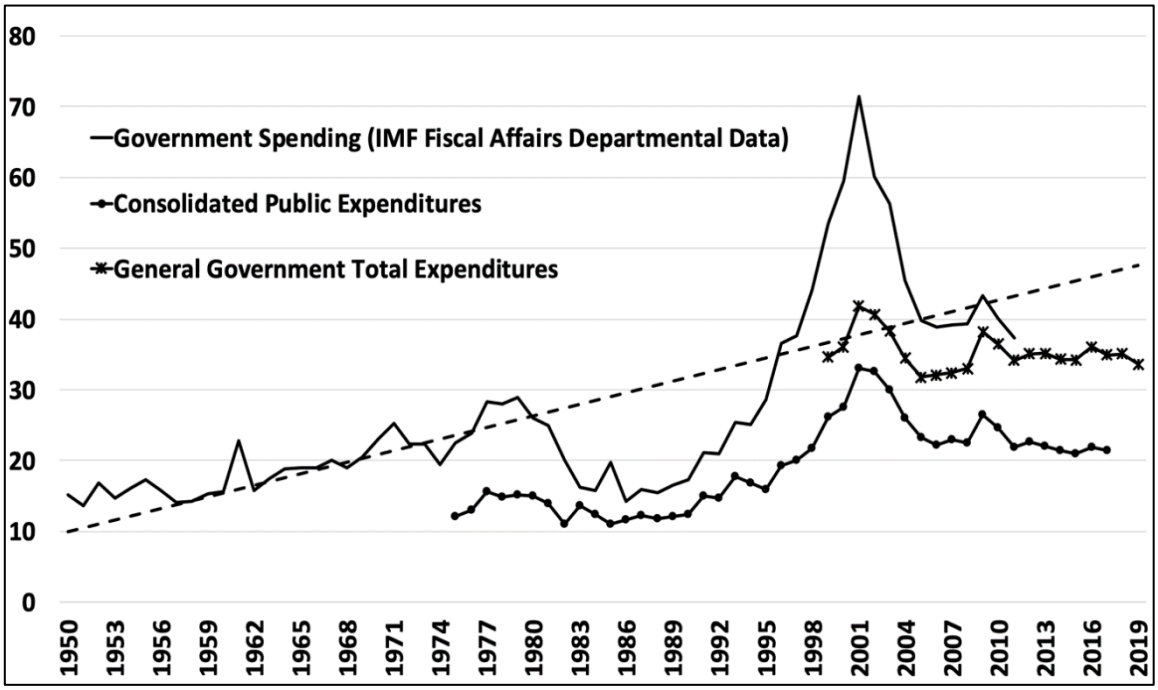
program for wheat, financed by increases in the money supply (Pamuk, 2010). Imports of certain commodities were also prohibited. These were the commodities for which government considered domestic production sufficient (Krueger, 1995). In the end, the Turkish economy confronted with a wave of rising inflation accompanied by a foreign exchange crisis. These problems were exacerbated by shortages of consumer goods and generated major economic and political problems for Democrat Party, especially among the urban population (Pamuk, 2010; Sunar, 1984). In 1960, a military coup occurred and a new political and economic era began. In 1958, Turkey had so reluctantly agreed upon a stabilization problem with the IMF under the pressure of economic problems. In 1960, after the coup, Turkey declared her recommitment to the IMF program and managed to become one of the fastest-growing developing countries in the world during the 1960s. Both private and public investment expenditures increased rapidly. In the first part of the decade, these expenditures were largely financed with foreign aid. However, in the latter part of the decade foreign aid did not suffice. Yet the investment expenditures continued at the same pace. One of the major conundrums of the import substituting industrialization policies of the time was Turkey's growing dependence on imported spare parts and intermediate goods. Turkish industry was becoming more dependent on foreign spare parts and intermediate goods, so the high rate of investments was even further boosting the import bill of Turkey. However, the lack of incentives for producing better products in the most cost-effective way under import substituting industrialization policies were crippling the exports capacity of the Country. Turkey thus confronted with problems in the foreign exchange market once again at the end of the decade. The 1970s, on the other hand, was an especially difficult period for the Turkish economy. The Turkish economy was pressed under the US embargo from 1975 to 1978 due to the Cyprus issue. The OPEC oil shock in 1973 deteriorated the international trade and current account balances severely. The Energy Crisis in 1979 following the Iranian Revolution made everything else only worse regarding the external balances of the Country. The Turkish economy was on the brink of a collapse at the end of the 1970s due to the mounting balance of payment problems once again.

In short, from the 1950s to 1980, there existed a clear pattern: Turkey was confronting with economic problems and scarcity of foreign currencies in every 10 years. As the import substitution policies were repeatedly proven unsustainable, Süleyman Demirel appointed Turgut Özal, the former director of the State Planning Organization, as his deputy prime minister in charge of economic affairs when he became the prime minister in 1979 and gave Turgut Özal the mandate to design a new economic program. In January 1980, the two men announced the famous 24 January decisions, a far-reaching program aiming to tear Turkey away from the realm of import substituting industrialization policies and reposition her as a country targeting export-led growth. 24 January package is a milestone in the Turkish economic history, marking the beginning of a new liberal era. The true spirit of that new era has since been a strong faith in the free market. For example, one of the first moves in that new era was the removal of price controls, including interest rates and exchange rates, which were set to float freely in

the market. Privatization became another important goal of the Turkish governments in that new era since state-owned enterprises were deemed inefficient. The idea was simple: inefficient enterprises would not be able to compete in the international markets. The credit lines of state-owned enterprises were cut, etc. In brief, a new era, very much in the spirit of the famous Washington Consensus, began for Turkey in 1980. Turkey was supported by the IMF and the World Bank throughout the 1980s.

Upon this concise summary of the Turkish economy in the post-WWII era, one would expect to see a radical decline in the government expenditures starting from early 1980s. However, the following figure (Figure4) tells us a different story. Government expenditures declined after 1980 but this was a temporary decrease that lasted until 1986 only. Since 1986, government expenditures as a percentage of GDP – measured both according to the IMF methodology and by the Turkish authorities – started to climb up again. The second important year after which another episode of declines began was 2001. In 2001, Turkey experienced the most severe financial crisis in her history since she was officially founded in 1923. Fiscal austerity measures taken after the crisis are the root cause of the decline in government expenditures right after the 2001 crisis until 2006. Other than these two episodes of temporary declines, government expenditures followed an upward trend as the trend line (dashed line in Figure4) shows below. Last but not least, we also see a few years when the government expenditures increased radically, forming spikes on the chart. For example, such spikes exist in the early 1960s, in the early 1970s and in the second half of the 1970s. The most dramatic increase, however, is the one recorded in 2001. 2009 is another year of significant increase in government expenditures. The shared characteristic of all those years is that they are the problematic years for the Turkey economy. 2001, for instance, was a year of severe economic crisis, while 2009 was the year during which the negative impact of the Global Economic Recession was severely felt in Turkey. Hence, the heightened government expenditures in those years hint us that fiscal measures were used as 'lean against the wind' policies during economic downturns.

Figure 4. Government Expenditures in Turkey (% of GDP)



Source: Government spending data are retrieved from the webpage of the IMF's Fiscal Prudence and Profligacy database.
Consolidated public expenditures and general government total expenditures data are retrieved from webpage of the Turkish Presidency Directorate of Strategy and Budget.
Note: IMF Data is the one used by the IMF's Fiscal Affairs Department and it is estimated in accordance with the methodology put forward by Mauro et al. (2015).

As in many parts of the world, liberal economic ideas obviously failed to decrease the share of government expenditures in Turkey, too. What about the efficiency? That is to say, did the economic return on the government expenditures become higher since the 1980s? To answer that question, we would like to estimate the incremental capital output ratios for Turkey over the years but because of data unavailability (Turkey does not release the public sector share in her gross fixed capital formation numbers), we decided to develop a similar metric named the average incremental government expenditures - output ratio (IGOR). IGOR figures for Turkey in each decade since 1970 are presented in table 1 below. IGOR numbers, as we estimated them, indicate the extra government expenditures that need to be made to make an economy grow one percentage point more. A lower figure signals superior efficiency of expenditures by definition. As the following table indicates, IGOR figure for Turkey was smaller during the 1970-79 period than the IGOR figures recorded during 1980-89, 1990-99, and 2000-09 periods. Only the average IGOR figure in the last ten years has been able to surpass that of 1970-79.

Table 1. The Rate at Which Government Expenditures Were Translated into Growth in Turkey in the Last Five Decades

	Average GDP Growth (%)	**Average Government Expenditures (% of GDP)**	**IGOR**
	a	**b**	**b / a**
1970-1979	4.70	32.46	6.91
1980-1989	4.10	34.03	8.30
1990-1999	3.98	34.19	8.59
2000-2009	3.97	35.90	9.04
2010-2019	5.85	34.92	5.97

Source: Turkish Statistics Office and Turkish Presidency Directorate of Strategy and Budget

After all these discussions, we want to question in this paper the determinants of government expenditures in Turkey to understand two points: First, the drivers of expenditures, and, second, the reasons for the lack of desired efficiency gains of these expenditures.

This paper will try to provide an answer to these questions for Turkey using a classifier method implemented on a dataset of five variables. But before we move on with the methodological discussions, we believe that a review of the theories on government expenditures would be highly beneficial to illuminate the reason of why we selected these five variables to estimate the model in section four. Therefore, the rest of this paper is organized as follows. The theories of government expenditures are reviewed in the next section. The variables that are chosen to be used in the classifier model are introduced in section three. The model and the dataset are presented in section four. Section five is spared for the estimation results. The last section concludes.

2. THEORIES ON GOVERNMENT EXPENDITURES

Historically, a group of theories – we can call them the welfare theories of public expenditure following Peacock and Wiseman (1961) – related the reason and purpose of public expenditures to welfare seeking activities. Although public expenditures are a broader term than government expenditures, we will assume that these discussions made on public expenditures are projectable to the government expenditures as well without loss of generality since only government expenditures data is available for Turkey. That point being explained, let us return to explaining the welfare theories. Studies emphasizing the importance of welfare issues in understanding the optimal share of public expenditures used to have a prescriptive perspective and their general tendency – from a methodological point of view - was to conduct utility maximization analysis, where a representative agent (i.e. an aggregation of all the individual utilities) was employed to understand the optimal (i.e. utility-maximizing) amount of public expenditure in a society. According to the usual finding in this line of studies, the optimal share of public expenditures was the share where the marginal utility from the last one penny spent for the public was equal to the marginal cost of spending. That is to say, these studies provided an answer to the question of the optimal share of public expenditure from a pure microeconomic perspective. Another line of studies approached the question from a macroeconomic perspective though. These studies were

usually Keynesian in spirit and they often investigated the relationship between public expenditures and economic growth. For the scope and analyses of the first microeconomic line of studies, one could revisit the classics such as Musgrave and Peacock (1958), Pigou (1947), and Buchanan and Tullock (1962). For the macroeconomic perspective a la Keynes, Harrod (1948), and Domar (1957) are still the illuminating reads.

The third school of thought on public expenditures, at least as old as the previous two, was a school that was relating the public expenditures to the output per person. Writing as early as in 1898, Adams proposed a law according to which public expenditures had to increase in proportion to the growth rate of output per person. Wagner's claim in 1890 was even stronger: Wagner claimed that public expenditure had to increase faster than the growth rate of output per person. This school was empirical in nature and not prescriptive like the previous two schools. Wagner and Adams both witnessed the changes in the economies in Europe and America and made their claims based on their observations.

The literature on public expenditure surely progressed over the years. Recent studies focus more on functional decompositions of the various types of expenditures. However, a study like ours, i.e. a study attempting to understand the various factors affecting the government expenditures in Turkey from a bird's-eye angle using a state-of-the-art statistical classifier model, has to consider these aged but well-founded cornerstone theories in order to decide on which variables to try as the independent variables of the model.

3. VARIABLES AFFECTING THE GOVERNMENT EXPENDITURE

A vast literature obsessed with the discovery of the determinants of government expenditures came into being over the decades. This line of research is assumed to have begun with the 1952 study of Fabricant about the US. Fabricant, in his study, had identified i) population density, ii) per capita income, and iii) urbanization as the three factors responsible for growth in government expenditures in the US. According to Wagner, per capita output growth was a determinant of the growth in government expenditures, while succeeding researchers identified demographic structure, technological progress, tax revenue, etc. as important factors. Wiseman and Peacock claimed the significance of social upheavals and stressful times as important determinant of fiscal policies including government spending decisions. Choosing a different path, Solano (1983) investigated the existence of a relationship between the institutional and political factors and public expenditure decisions.

Combining the welfare theories of government spending with the Wagner's law and Weisman-Peacock hypothesis, we decided to include the following five variables in our model: i) Per capita income, ii) consumer inflation rate, iii) tax revenue over GDP, iv) annual change in urban population ratio, and v) military expenditures as a percentage of GDP.

Per capita income is an important factor for understanding the ups and downs in the share of government expenditures in the GDP because, as per capita income changes, the income elasticity of per capita government expenditure likely changes. Ernst Engel, a German statistician, famous for his empirical studies around the mid-19th century on the income and expenditure patterns of individuals, thought that the expenditure patterns of individuals and governments should not be significantly different from each other. Based on this assumption of public-private spending similarity and his empirical findings for individuals, he later claimed that the consumption patterns of society would change along with changes in per capita income. At the initial stages of development, when the society was still not that affluent, necessities such as educational facilities and hospitals, etc. would be high in demand. As society got richer, demand would change from basic necessities to luxuries such as parks, highways, recreational facilities, etc. According to Engel, the income elasticity of per capita expenditures had to be greater than one, which meant that people would demand more of the social goods in relation to private goods as their income increased, leading to a rising share of social goods in the consumption mix of society. This hypothesis enforced us to include per capita income as an independent variable in our model.

We included inflation rates in our model as well since high and persistent inflation rates could impoverish consumers considerably over the years. It is this impoverishment effect that might cause a government to step in and take action to deal with the problems of its constituents, causing it to increase the provision of social goods over the years.

Thirdly, we decided to include in our model tax revenues over GDP, too. Tax collections are important because tax is a determinant of the extents a government could finance its expenditures. Annual changes in urban population ratio is yet another variable we chose to include in our dataset for the understandable reason that as urbanization rates go up, government spending on infrastructure, residential housing units for the poor, education, etc, go up as well. Finally, military expenditures are also included in the dataset with the inspiration from the Weisman-Peacock hypothesis.

Considering that these variables should have lagged influences on the government spending rather than contemporary impact, we used the last three years' average values. We constructed a classification model instead of a regression model in the next section. That is why we categorized all the observations in our dataset as 'high' or 'low'. High value was recorded in those years when the realized observation exceeded the average of the last three years, low value was recorded otherwise. We used observations for Turkey from 1973 to 2019.

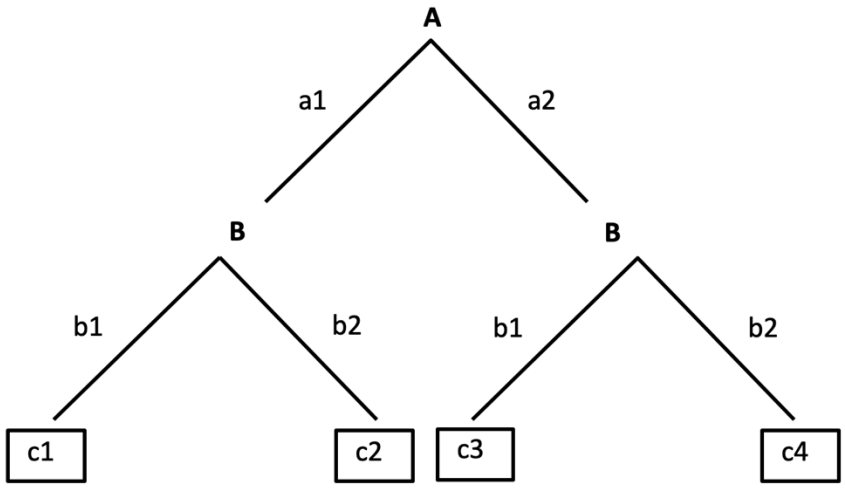
4. THE MODEL AND THE DATASET

In the last decade, machine learning algorithms made a strong penetration into social sciences (Radford and Joseph, 2020). Machine learning algorithms can be classified into two as supervised and

unsupervised algorithms. The difference between the two is that supervised models have a dependent variable which needs to be explained by a set of independent variables, while unsupervised models do not pinpoint one of the variables as the dependent one. Unsupervised models try to capture the hidden associations and relationships between the variables, while supervised models try to relate a set of independent variables to a dependent variable. Since we want to explain the relationship between the five factors we have chosen above and the government expenditures, we had to select a supervised model. As we explained in the final paragraph of the previous section, all our observations in the dataset are categorical. That is why, we decided on an unsupervised classifier that can deal with categorical variables. Random forest methodology, a learning classifier, has thus been the model of selection in this paper. But before we explain it, we have to explain the decision trees first since decision trees are the building blocks of the random forest methodology.

The two main targets of any machine learning algorithm are i) to extract the relationships between the variables in the dataset, and ii) use these learnt relationships in order to make out-of-sample predictions. To achieve these two targets, the researcher usually splits the dataset at hand into two parts as the training and testing datasets. Training dataset (a subset of the entire dataset at hand) is used to extract the hidden relationships. Testing dataset is used to test whether those relationships are useful for making accurate predictions into the future. The targets of a decision tree are no different. Decision trees are used to learn and to predict as any other machine learning algorithm. The self-similar nature of a decision tree is its being a simple collection of binary paths leading the researcher into some conclusions. Those conclusions are nothing but the most likely conditional expectations under some certain situations. The following sketch provides us with a useful visual aid for better understanding what that means.

Figure 5. Plot of an Exemplary Decision Tree



The exemplary figure above tells that c1 is the most probable outcome if A=a1 and B=b1. Likewise, c4 is the most probable outcome if A=a2 and B=b2. We can think of C as t-shirt styles preferred by people, A as gender, and B as age. Let a1 be male and a2 be female. Let b1 be young and b2 be old. Let c1 be polo t-shirt and c4 be basic t-shirt. Then, the decision tree above is simply telling that a customer is likely to prefer polo t-shirts if he is a young male. As aforesaid, these binary paths are leading us to the most likely conditional expectations in each case. Take for example c1, it is nothing but the value of $E(C \mid A = a1 \cap B = b1)$. These said, decision tree methodology has a unique jargon, which is somewhat different than statistics and econometrics. In figure 2, class A sits at the top of the tree, that is why A is called the root of the tree. Root forks into two branches and reaches class B at the end of these branches to form the nodes of the tree. Although Figure5 represents a symmetric sketch, decision trees can grow branches asymmetrically. Finally, the outcomes from two different paths can be the same, i.e. c1 can be equal to c3 for example.

Decision trees are attractive tools for their practicality and ease of implementation. However, they cannot be grown to arbitrary complexity due to the risk of overfitting (Ho, 1995). That means, as they are grown to become more detailed, they would be fitting more to the training data and thus losing generalization accuracy over the testing data. The reason behind this issue is nothing but the well-known "everything but the kitchen sink problem" in statistics. In return, i) we should be careful for the outlier observations since they would cause large out-of-sample estimation variances, and ii) we should prune our trees so that we should not try large numbers of variables since that might arbitrarily increase the complexity of the model and lead us to find spurious associations between the independent variables and the dependent variable. But how can we overcome the problem of outliers if some of them just miss our attention? Plus, how can we make sure that we are going to extract the information from all the variables that we consider important without artificially enforcing our model to become a simpler one with limited number of variables? These questions can be addressed with an ensemble learning classifier model called the random forest model.

The name of the random forest model is indeed highly self-revealing since a random forest is a collection of a large number of individual decision trees. Each decision tree in the forest uses only a subset of the independent variables to produce the tree-level predictions. At the end, all these estimations are either averaged out to make the final prediction (if the analysis is regression based) or the predictions receiving the majority votes are selected as the final prediction of the model (if the analysis is classification based). Out of sample prediction accuracy of the random forest model is expected to be superior to the prediction of a single tree under normal circumstances since the large number of trees would smoothen out the overfitting problems that a single tree could suffer from. Therefore, we can claim that the random forest methodology depends on the wisdom of crowds. In the next section, an optimized random forest is estimated and its results are presented.

5. ESTIMATION RESULTS

To find the optimal number of trees and the number of variables available at each split (mtry value in machine learning jargon), we estimated a large number of random forests iteratively changing the number of trees and mtry values. Figure6 indicates that the estimation results are best if roughly around 80 to 180 trees were grown. As for the mtry, Figure7 clearly shows that 2 is the best value. The rule of thumb choice for mtry in classification forests is the square root of the number of independent variables (while one third of the number of variables is assumed to be best for regression forests). Since we have five variables and ours is a classification forest, 2 seems to be in accordance with the rule of thumb choice as well.

Figure 6. Optimal Number of Trees

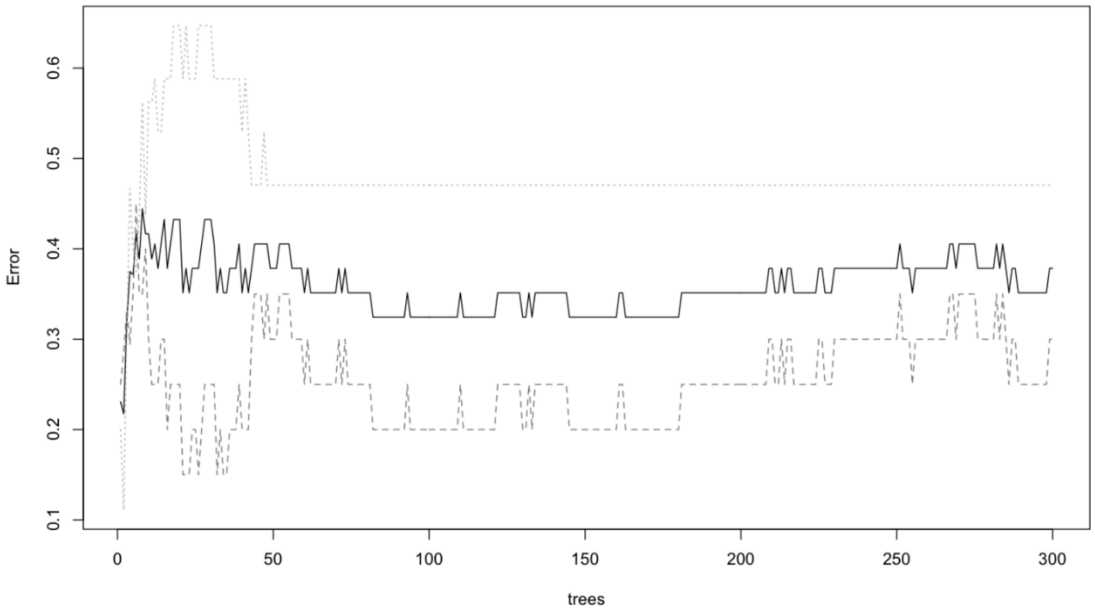
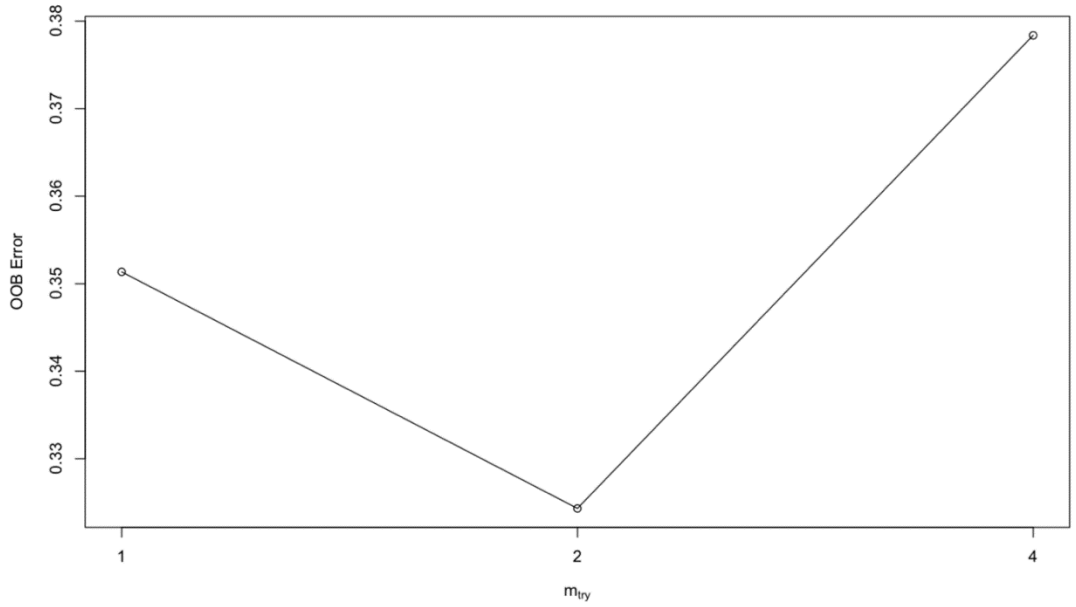


Figure7. OBB-Minimizing Value of 'mtry'



We randomly partitioned our dataset into two as the training set (80% of the observations) and test set (20% of the observations). The estimation results from the training set are presented in the following tables. 'Real high' tag in the following confusion matrix indicates the number of actual observations for high government spending share in the GDP, while 'predicted low' tag indicates the predicted number of low government spending share in the GDP, etc.

Table 2. Confusion Matrix (for the Training Data)

Confusion Matrix		
	Real High	Real Low
Predicted High	11	3
Predicted Low	2	12

Table 3. Estimation Results (for the Training Data)

Statistics			
Accuracy	0.8214	Prevalence	0.4643
Balanced Accuracy	0.8231	Sensitivity	0.8462
Positive Pred. Value	0.7857	Specificity	0.8000
Negative Pred.Value	0.8571	McNemar's Exact P-val.	1.0000
No Information Rate	0.5357	Kappa	0.6429
Detection Rate	0.3929	Detection Prevalence	0.5000

Note: Formulas for each statistic are in the appendix at the end.

According to Table 3, the sensitivity of our training model is 84.6%, which means that our model is capable of predicting high shares of government expenditures 84.6% of the time correctly. The specificity of our model, on the other hand, is 80% and what this value indicates is that our model has a slightly weaker performance in correctly predicting the low shares of government expenditures. The average of specificity and sensitivity is the balanced accuracy score of our model, which is 82.3%. That is the average ratio of making a correct prediction, while the actual ratio of making a correct prediction is 82.1% as measured by the accuracy score. In a good model, prevalence and detection rate statistics should be as close to each other as possible. In our model, they are respectively 46.4% and 39.2%. Positive predictive value of our model is 78.6% and this means that out of all the high predictions of our model, 78.6% are correct. Similarly, 85.7% of the low predictions are correct predictions. This 85.7% figure should not be confused with the specificity figure of 80%. Specificity tells us that our model predicted 14 low cases, although there are 15 cases of low government expenditures, and furthermore 2 of these 14 predictions were wrong. Negative predictive value, however, tells that our model made 14 low predictions and 12 of them were correct. Kappa value indicates the relative progress towards perfect prediction performance from a random baseline. If random accuracy is 40% and the classifier accuracy is 70%, Kappa would be 0.5, meaning that the model's predictions are 50% of the way to perfect prediction since 70% is 30% above the 40% random accuracy and that is half of the way from 40% to 1. Estimated kappa value for our forest in Table 3 shows that our forest is 64.3% closer to perfect prediction case than the random baseline. McNemar's exact p-value, on the other hand, shows that there is no significant difference between the predictions of high and low government expenditures.

According to these results, our trained forest seems capable of making decent in-sample predictions. However, predicting the out-of-sample data is of course the main concern. The following table presents the prediction performance of the forest on the testing (i.e. out-of-sample) data.

Table 4. Confusion Matrix (for the Testing Data)

Confusion Matrix		
	Real High	Real Low
Predicted High	6	1
Predicted Low	4	8

Table 5. Estimation Results (for the Testing Data)

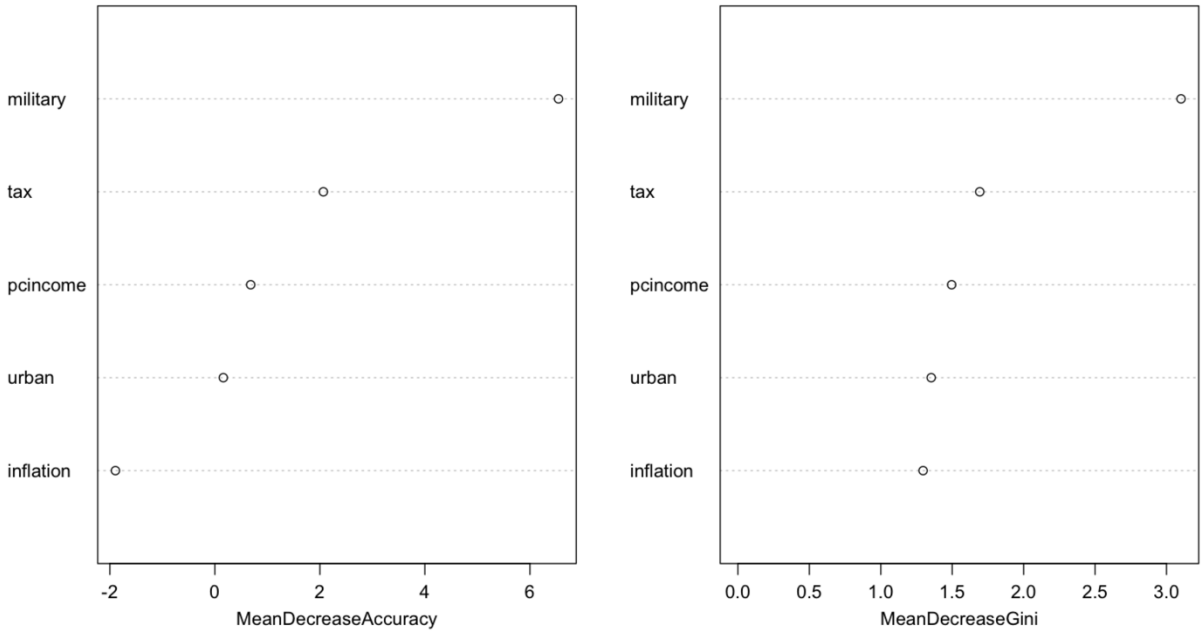
Statistics			
Accuracy	0.7368	Prevalence	0.5263
Balanced Accuracy	0.7444	Sensitivity	0.6000
Positive Pred. Value	0.8571	Specificity	0.8889
Negative Pred.Value	0.6667	McNemar's Exact P-val.	0.3711
No Information Rate	0.5263	Kappa	0.4809
Detection Rate	0.3158	Detection Prevalence	0.3684

Note: Formulas for each statistic are in the appendix at the end.

Although the out-of-sample prediction performance is slightly worse than the in-sample performance, estimation output in Table 5 still point at a decent prediction performance. Take for example the difference between the 73.7% accuracy and the 52.6% no information rate. No information rate indicates the probability of making a correct prediction just by selecting the largest class. The 21.1% difference between the accuracy and the no information rates is, therefore, an indicator of the power of the estimated forest to make informed predictions that are superior to predictions based on pure chance. The only weak part of the model seems to be its relatively poor prediction performance for high observations. The forest estimates 8 of the 9 low observations correctly (that is the reason for the very high specificity). However, it only predicts 6 of the 10 high observations correctly (although 60% sensitivity score is not an much by any sense, we still need to note down that it exceeds the no information rate, i.e. the model provides useful information over random choice). In brief, the forest we trained seems to have acceptable out-of-sample performance for high observations and very good performance for low observations. That is why we proceed with it to rank the five independent variables in our dataset according to their importance on predicting the right class of the government expenditures, i.e. government expenditures are high or low at a given year. The importance rankings of the variables are based on two different metrics: These are the i) mean decrease in accuracy (MDA), and ii) mean decrease in gini index (MDG) metrics. MDA in the field of machine learning refers to average accuracy losses from the trees in a forest when a variable is intentionally removed from the trees that used to have this variable in some of their nodes. Gini index on the other hand is a splitting parameter, which shows us how each variable contributes to the homogeneity of the end results in a decision tree. Let us assume

that we want to classify the cases we drink coffee and we have two independent variables: i) weather, and ii) mood. Our past observations tell us that we drank coffee 2 times when it was raining outside and 2 times when it was sunny. In the overall, we have observations for 4 rainy and for 4 sunny days, which automatically means we did not drink coffee in 2 rainy days just as we did not drink coffee in 2 sunny days, either. Hence, if we make a tree and use weather to split the tree into branches, half of the times we are going to make misclassifications, i.e. our Gini index would be 0.5. As for the mood, i.e. the second variable, assume that we have 8 observations where 4 times we felt sad and 4 times we felt happy. Furthermore, we know that we drank coffee whenever we felt sad and we did not drink coffee whenever we felt happy. Then, if we use mood to make splits, we end up with pure nodes, meaning that we can make 100% correct classifications. Gini coefficient in such a case would be zero. That is why, a variable is an important variable if it decreases the Gini index number when added onto a tree. In the following graphs, MDG refers to the average decreases in the Gini indexes of single trees in a forest.

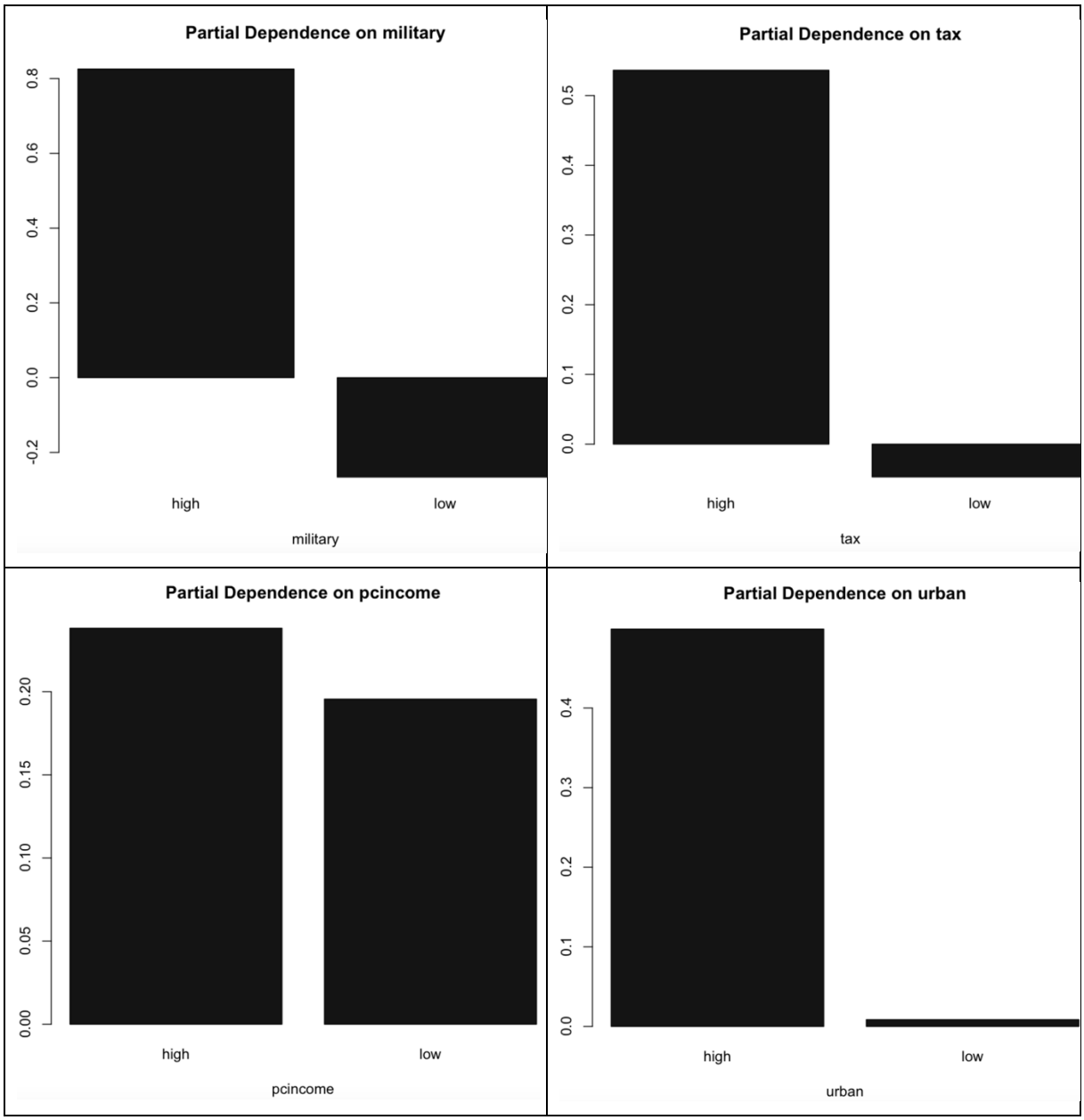
Figure 8. The Importance Rankings of Variables

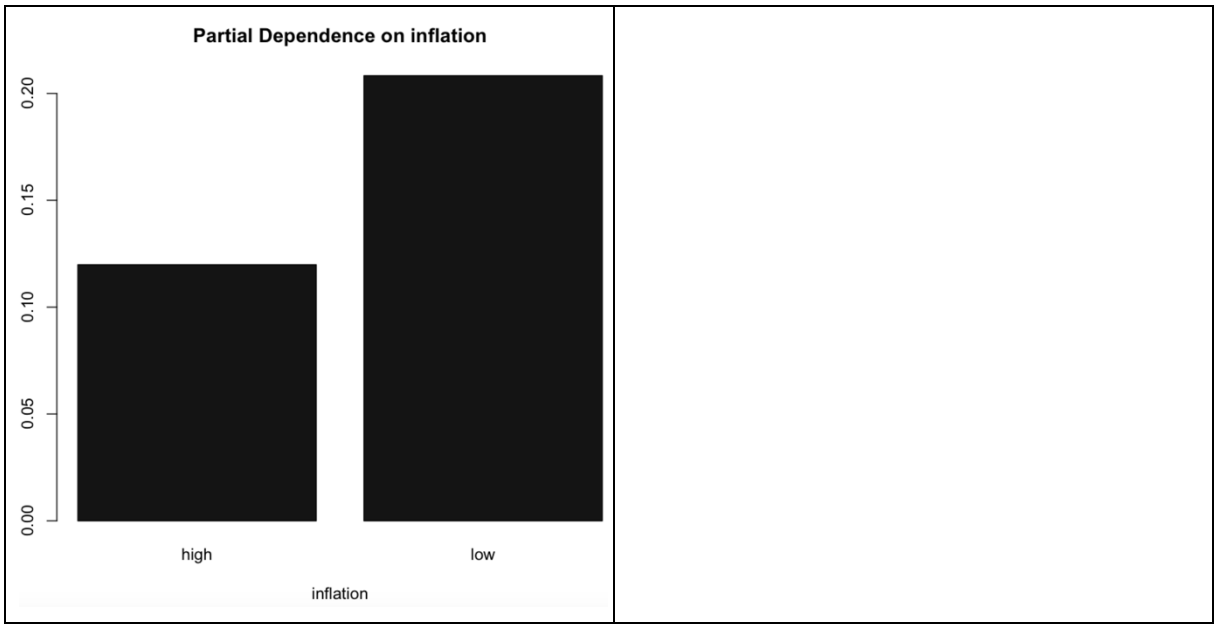


Both indicators of variable importance rank the variables in the same order as seen in Figure8. Military spending is the number one factor affecting the government expenditures. Given the way we produced our categorical data in this study, this means that whenever the military spending at a given year exceeds the average military expenditures of the last three years, government expenditures also tend to exceed the average government expenditures of the last three years. Tax is the second most important determinant of the government expenditures, which indicates that tax collections are important for determining the future course of budgets although in theory expenses should be agreed upon prior to the accrual of revenues as a key principle of budgeting. Whenever the tax collection becomes higher than the average of the last three years' collections, government expenditure also tends to become higher than the average of the last three years' expenditures. Per capita income and urban

population growth rate are ranked as the 3rd and 4th most important determinants, respectively, both by the MDA and MDG indicators. Inflation is the least important variable. Nonetheless, it should be included in the list of variables according to both the MDA and MDG scores. Urban population growth rate, however, is an interesting case since it can be omitted from the list of predictors according to MDA. However, this should not be done (i.e. it should not be omitted from list of predictors) because as the following partial dependence plots show, the almost zero MDA score of urban population growth rate is attributable only to the weak importance of low urban population growth rate for making better out-of-sample predictions of government expenditures. However, government expenditures depend heavily on the high urban population growth rates. That said, partial dependence plot of each variable is sketched below.

Figure 9. The Importance Rankings of Variables





These partial dependence plots visually prove an interesting fact. When military expenditures or tax collections slow down, less government expenditure than the previous years' average expenditure can be made. However, for the other three variables, even when they slow down, government expenditures continue to rise, albeit at a slower pace.

6. CONCLUSION

Government expenditures kept rising in several countries around the world for long. It is quite interesting that although the share of government expenditures almost continuously increased, growth rates did not change much. If governments are not spending in order to achieve faster growth, then why are they spending? Although this questions bears much pertinence for the whole globe, it is nonetheless highly unlikely to find a universal answer fitting each and every country since government expenditures are likely to be affected by numerous country- and time-specific factors. Hence, in this study, we focused on a single interesting case: Turkey. Turkey is an interesting case for the transformations the Turkish economy experienced since the early 1980s. The Country switched to a more market-oriented economy starting in 1980 but the government expenditures kept increasing even in the post-1980 era. Therefore, in this article, we questioned the drivers of government expenditures in the last fifty years in Turkey. Using five variables, such as the tax collections, military expenditures, per capita income changes, urban population growth rates, and inflation rates, we tried to identify the factors bearing the highest information content for the future course of government expenditures. One of the most appropriate methodologies to adopt for this sort of a research question was the random forest methodology, an ensemble classifier method used to predict an optimal number of decision trees to identify the most important factors for making out-of-sample predictions of a dependent variable.

According to our estimated random forest model, the most important factor determining the government expenditures in Turkey in the last five decades was the military expenditures. Whenever military expenditure in a specific year exceeded the last three years' average military expenditures, government expenditure in that same year also tended to exceed the last three years' government expenditures. Tax collections were the second most important determinant of government expenditures in Turkey as to our estimated model. Obviously, this is a signal that governments cannot continue spending more than they collect in taxes for long. Non-tax forms of government finances such as the fees, profits transferred from state owned enterprises or debt are not able to change the extent to which a government can spend by themselves. Per capita income is the third important factor. This is interesting because it shows that people might be demanding more social good as they become richer, just like Ernst Engel had observed empirically around the mid-19th century. Urban population growth rate and inflation rate are the fourth and the fifth important variables but interestingly mean decrease in accuracy (MDA) scores show that urban population growth rate could be omitted and that would not lead to significant decreases in out-of-sample prediction accuracy of the estimated random forest in this study.

In fact these results are higly illuminating for explaining the reason why the government expenditures fall short of stimulating economic growth in contrast to one would expect. Military expenditures are named to be the major driver of government expenditures followed by tax collections. Azam (2020) reports empirical evidence from non-OECD countries providing support that military expenditures are detrimental to economic growth. This is similar finding to that of Castillo et al. (2001), where authors had convincingly found for the five most advanced nations that increases in military expenditures had perverse effects on economic growth. According to Castillo et al., if the military expenditures are rising not because the economy is growing but because the foreign threat is growing, then the impact turns out to be negative. As for the case of Turkey, Fatah and Salihoğlu (2016) find a negative relationship between military expenditures and GDP growth in Turkey from 1988 to 2014. As such, military expenditures might well fall short of stimulating economic growth. The fine line here seems to be the distinction that whether the military expenditures are rising because the economy is growing or because of a clear threat to national security. In a country like Turkey, the military expenditures might have low elasticity in responding to the level of economic activity as one would expect. Focusing on the second important factor, i.e. tax collections, there exists a revival in the literature questioning the impact of taxes on economic growth due to the various new taxes proposed by the Biden Administration in the United States (Durante, 2021). Gunter et al. (2018), using a dataset of 51 countries fort he period of 1970-2014, report a highly nonlinear impacts of tax collections on growth. At low rates with small changes, effects remain virtually null, while economic damage grows with higher tax rates and larger rate changes. Ljunvist and Smolyansky (2018) focus on 250 state corporate tax rate changes from 1970 to 2010. They find tax rate increases to be universally harmful on economic growth, while the impact of tax cuts remain regime dependent since tax cuts happen to most effective during

recessions. A very detailed recent study that is written by Alinaghi and Reed (2021) estimates the impact of taxes on growth for OECD countries. Unlike many papers in this literature, they classify changes in tax collections into three categories as tax negative fiscal policies, tax positive fiscal policies and tax ambigous fiscal policies, where tax negative policies include increases in tax collections to fund unproductive investments. If the overall economic impact is unclear, an increase in tax collection is called an ambigous policy and if the economic impact is positive because the taxes are used to fund productive investment, this kind of policies are called tax positive policies. They find only the increases in tax collections for funding tax positive fiscal policies tend to have positive impact eventually on the economic growth. That is why, it should not be a surprising to find for Turkey that the government expenditures led by military expenditures and tax collections do not significantly translate into economic growth.

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APPENDIX

Formulae for the Random Forest Estimation Statistics

In order to comprehend the estimation outputs in the article that are presented in tables 3 and 5, one needs to know the true meanings of the estimated statistics in those tables since machine learning has its own jargon. Let us assume for a moment that we have the following confusion matrix.

Confusion Matrix		
	Real High	Real Low
Predicted High	A	B
Predicted Low	C	D

Then,

$$\boldsymbol{Sensitivity} = \frac{A}{A+C}$$

$$\boldsymbol{Specificity} = \frac{D}{B+D}$$

$$\boldsymbol{Prevalence} = \frac{A+C}{A+B+C+D}$$

$$\boldsymbol{Detection\ Rate} = \frac{A}{A+B+C+D}$$

$$\boldsymbol{Accuracy} = \frac{A+D}{A+B+C+D}$$

$$\boldsymbol{Positive\ Predictive\ Value}\ (\boldsymbol{PPV}) = \frac{A}{A+B}$$

$$\boldsymbol{PPV} = \frac{(sensitivity \times prevalence)}{(sensitivity \times prevalence) + ((1-specificity) \times (1-prevalence))}$$

$$\boldsymbol{Negative\ Predictive\ Value}\ (\boldsymbol{NPV}) = \frac{D}{C+D}$$

$$\boldsymbol{NPV} = \frac{D}{C+D} = \frac{(specificity \times (1-prevalence))}{((1-sensitivity) \times prevalence) + (specificity \times (1-prevalence))}$$

$$\boldsymbol{Balanced\ Accuracy} = \frac{(sensitivity + specificity)}{2}$$

$$\boldsymbol{Kappa} = \frac{accuracy - random\ accuracy}{1 - random\ accuracy}$$

$$\boldsymbol{Random\ Accuracy} = p_1 \times p_2 + (1-p_1) \times 1 - p_2)$$

$$where\ \boldsymbol{p_1} = \frac{A+C}{A+B+C+D}\ and\ \boldsymbol{p_2} = \frac{A+B}{A+B+C+D}$$