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An Analytical Report on How the Schengen Agreement has Impacted Economic Productivity in the Region

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ABSTRACT

The Schengen Agreement was created to allow for free movement of people, goods, services, and capital in the Schengen area. Due to the COVID 19 pandemic, some member nations have enacted temporary border controls to stop the spread of the coronavirus. As a result, many members are questioning the relevance of this Agreement. This study examines the impact of the Schengen agreement on member nations' economic productivity. To determine whether the difference in Gross Domestic Product (GDP) growth before and after becoming a member of Schengen is due to chance alone or the result of the Schengen agreement; three groups of data on annual GDP growth were acquired: annual GDP growth of Schengen member nations and Non-Schengen European nations, as well as annual global GDP growth. The timing of member enrollment was also considered. While it was hypothesized that the annual GDP growth of a nation would differ by a statistically significant amount after joining Schengen, multiple two sample, two-sided T-Tests and one sample, two-sided Z-Tests found that, overall, the differences in GDP growth were not significant enough to demonstrate joining Schengen positively impacted GDP growth. It must also be noted that there were other overarching trends found in the data, including the impact of the 2007-2008 global fiscal crisis on GDP growth for the three groups. Further research into other unique aspects of Schengen is needed to explain these other effects.

Introduction

The Schengen Agreement led to the creation of Europe's Schengen Area. The Schengen Agreement, which allows for the gradual reduction of border control between its members, was signed by five countries on June 14th, 1985, near the town of Schengen, Luxembourg[1]. The main purpose of the Schengen Agreement was to fulfill one of the European Union's (EU) principles of free movement of people, goods, services, and capital[2]. In 1990, at the Schengen convention, abolition of each country's internal borders was conducted, creating a single authority for immigration and asylum. Over the years, twenty-four different nations have joined the Schengen Agreement. Bulgaria and Romania are the newest members, having joined in late March of 2024[3]. While four non-EU countries did join the agreement, the majority of the nations involved are part of the EU. As a result, the Schengen agreement was incorporated within the EU framework and extended to all EU members except for Ireland and the United Kingdom who opted out[4].

The Schengen Area is unique in that it is the only place in the world with completely open borders between multiple nations. While many scholars speculate the increased economic development and higher quality of life in the region could be due to the agreement, there has not yet been any causal evidence to confirm it. One study by Tahir Mahmood and Mikael Lindon explored the distinct parts of industrialized economies and how economic growth is related to those varying sector shares[5]. However, that study does not examine the reverse: how different sector shares explain varying values of GDP growth. So, while scholars might be able to hypothesize which sectors of Schengen might be more productive, the direct relationship between the Schengen Agreement and economic growth has yet to

be analyzed. There are also multiple confounding variables that make it difficult to ascertain whether the increased economic development is in fact caused by the agreement such as (1) the creation of the European Union, (2) the varying stages of development before joining Schengen, (3) other economic policies enacted by member nations, etc. With the COVID-19 pandemic causing economic decline and job loss, determining whether the Schengen Agreement has been the primary contributor to the economic productivity in the region, or if it has made only a minimal impact has become increasingly important.

There also has been discussion regarding the possible termination of the Schengen Agreement. Following the COVID-19 pandemic, many nations erected temporary border controls to stop the movement and spread of the virus[6]. There has also been heightened immigration to Europe in the last few years. Many Europeans are concerned that an increase in immigration will contribute to larger unemployment rates. Another concern is that as more people migrate to Europe, housing will be much more in demand, potentially causing increased inflation as housing prices rise. There are also numerous social effects of the Schengen Agreement. As immigration continues, cultural diffusion occurs and the spreading of foods, beliefs, and languages commences. While some consider cultural diffusion to be beneficial to a nation , there is still a lot of anti-immigrant rhetoric ingrained on society especially following the terrorist attack on September 11th, 2001[7]. Crime rates have also been higher over the last few years, causing some member countries to enact border controls at only some of their borders to prevent migrant crossings. All of this signals that even if a connection were found between the Schengen Agreement and economic productivity, the social effects of the agreement would also have to be weighed against the possible economic benefits or disadvantages of Schengen. However, many believe that economic growth is a direct effect of the open borders policy. Proponents argue that an open borders policy allows for more participation in the labor market as well as increased trade and thus a stronger economy. As a result, these temporary border controls could be put into permanent use if there is no economic benefit of having open borders.

Therefore, this study aims to gain a better understanding of the economic impact of the Schengen Agreement in hopes of determining better solutions to economic hardship as well as possible ways to enhance economic growth.

Methods

In order to measure economic productivity in a way that encompasses all aspects of a nation's economy, the annual GDP growth of each country was analyzed. While other economic measures exist like the Gross National Income (GNI) and Gross National Product (GNP), GDP is the most accurate measure of the current status of a nation's economy. GDP is the total value of a country's goods and services produced within the country's borders. However, there are two types of GDP: nominal GDP, and real GDP. Because the rate of inflation might change the actual worth of a national currency, real GDP attempts to account for inflation[12]. In most circumstances, real GDP is a more accurate measure of a country's economic productivity largely because previous years' GDP can be compared with the current GDP of a country. As a result, data from the World Bank was gathered on the annual real GDP growth of every country from 1960 to 2024. However, a major problem was encountered when attempting to compare the GDP growth of one nation to another during a specific year: most of the nations that ended up joining the Schengen Agreement did not join initially. Instead, they joined the agreement in various years following its creation. Because of this, the year 1995 could not be used as the "turning point" in the Schengen Area's economy. To account for this, every Schengen nation was sorted into ten groups symbolizing the ten different years at least one European country joined. From there, the annual GDP growth data of each individual country in each group was split into two samples: the ten years before the country joined Schengen, and the ten years after the country joined. However, because multiple nations did not have data gathered for every year in the two samples, comparing the difference in growth was not as simple as finding the average of both samples. Instead, the following formula was created in which y represents the year a country joined, z(y) is the output annual GDP growth for every year a nation joined, x is a random variable with a domain of integers 1 through 10, and d(x) is the difference in annual GDP growth for every x value:

$$d(x) = z(y + x) - z(y - x)$$

By inputting the integers 1 through 10 into each x term, ten output values came out. This process was repeated for every country that joined the agreement except for the five in which there was not enough data to perform the test. To compare these values for the significance tests, d(x) was also measured for the world and non-Schengen European nations for every year a country joined. Once d(x) had been measured for every country, the average difference and standard deviation for each year was found for the Schengen member countries. The same was found for the global difference and the non-Schengen European countries. The data is summarized in Figure 1.

Member Country	Year Joined (y)	Average Annual GDP Growth % of Prior 10 Years	Average Annual GDP Growth % of Later 10 Years	Average Difference in GDP Growth % x years Before and After y (d(x))	Standard Deviation of the Difference (S_x)
Spain	1995	+2.965	+3.69	+0.726	2.354
Portugal	1995	+3.559	+2.479	-1.08	4.458
France	1995	+2.29	+2.311	+0.021	2.163
Germany	1995	+2.733	+1.21	-1.522	1.863
Netherlands	1995	+2.771	+2.846	+0.075	2.211
Luxembourg	1995	+5.878	+4.424	-1.455	3.654
Belgium	1995	+2.274	+2.407	+0.133	2.341
Schengen (S1)	1995	+3.210	+2.77	-0.443	2.857
Non-Schengen Europe (N1)	1995	-2.476	+5.721	+6.548	10.530
World (W1)	1995	+3.058	+3.433	+0.376	1.537
Italy	1997	+2.059	+1.509	-0.550	1.742
Austria	1997	+2.638	+2.654	+0.017	1.534
Schengen (S2)	1997	+2.3485	+2.0815	-0.267	1.624
Non-Schengen Europe (N2)	1997	-0.724	+6.112	+6.174	13.906
World (W2)	1997	+3.013	+3.566	+0.552	0.783
Greece	2000	+2.06	+1.83	-0.23	2.957
Schengen (S3)	2000	+2.06	+1.83	-0.23	2.957
Non-Schengen Europe (N3)	2000	+0.346	+5.202	+5.284	14.881
World (W3)	2000	+2.838	+2.994	+0.156	1.592
Sweden	2001	+2.147	+2.417	+0.269	3.547
Norway	2001	+3.709	+1.483	-2.226	1.755
Finland	2001	+2.395	+1.825	-0.570	4.867
Denmark	2001	+2.680	+0.847	-1.832	2.325
Schengen (S4)	2001	+2.73	+1.64	-1.090	3.368
Non-Schengen Europe (N4)	2001	+0.415	+4.984	+4.234	13.374
World (W4)	2001	+3.010	+3.124	+0.114	1.884
Slovenia	2007	+4.092	+0.748	-3.344	3.364
Slovakia	2007	+4.472	+2.421	-2.052	4.510
Poland	2007	+4.172	+3.372	-0.799	1.050
Malta	2007	+4.628	+4.979	+0.350	5.900
Hungary	2007	+4.073	+1.231	-2.841	3.536
Estonia	2007	+7.352	+0.844	-6.508	7.772
Czech Republic	2007	+3.089	+1.675	-1.414	4.799
Lithuania	2007	+6.390	+1.522	-4.868	6.736
Latvia	2007	+7.642	+0.113	-7.529	7.929
Schengen (S5)	2007	+5.10	+1.88	-3.22	5.806
Non-Schengen Europe (N5)	2007	+5.794	+2.036	-3.783	6.739
World (W5)	2007	+3.520	+2.638	-0.882	1.831
Switzerland	2008	+2.356%	+1.602%	-0.755%	2.350
Schengen (S6)	2008	+2.356%	+1.602%	-0.755%	2.350
Non-Schengen Europe (N6)	2008	+6.112%	+1.899%	-4.138%	6.685
World (W6)	2008	+3.566%	+2.759%	-0.806%	1.973

Figure 1. Summary of collection of data.

Once the standard deviation and average difference was found, determining whether the difference could be due to chance or is statistically significant meant a statistical test was needed. However, if Schengen statistics were only compared to global statistics, then the tests would not account for any confounding variables in which Europe is

unique. For instance, Europe's overall higher development levels. As a result, the Schengen statistics needed to be compared to both global statistics as well as non-Schengen countries that were also in Europe. So, instead of performing one test for each y value, two tests were performed. The first was a two-sided, one sample z test for means in which the Schengen area data was considered the sample, and the global data was considered the population. This test was performed for every y value and the p values are summarized in Figure 2. A graphical representation of each test is summarized in Figure 3.

Once the z tests were completed, the Schengen sample statistics were compared to the Non-Schengen European countries sample statistics using a two-sided, two-sample test for unequal variances. This test was performed for every y value and the p values are summarized in Figure 4.

Results

To determine if the average annual difference in GDP growth could be due to chance or was statistically significant, two different types of tests were performed: six one sample, two-sided z tests, and six two-sample, two-sided t tests. Each z test would compare the average difference in GDP growth of Schengen nations to the difference in global GDP growth. Each t test would determine if the difference in GDP growth between Schengen nations and non-Schengen European nations was significant.

In order to interpret the tests' results, every p value was compared to $\alpha = 0.05$. In every instance where the p value was a larger value than α, the null hypothesis failed to be rejected. Thus, there was not convincing evidence of a difference between either Schengen countries and non-Schengen European countries or Schengen countries and all countries. In every instance where the p value was a smaller value than α, the null hypothesis was rejected. Thus, there is convincing evidence that there is a difference in GDP growth between either Schengen countries and non-Schengen European countries or between Schengen countries and all countries.

In every two-sided, one sample z test, the resulting p value was larger than α, so the null hypothesis failed to be rejected (Figure). There was no convincing evidence of a difference between GDP growth of Schengen countries and all countries. One surprising finding was that the p values were much larger than α, symbolizing a remarkably high likelihood of the difference in GDP growth to be resultant from chance (Figure 3). The only year in which the probability of the difference being significant was even close to α was 2007, which interestingly was the start of the global fiscal crisis of 2007-2008.

Year Joined (y)	Z-Score	P-Value
1995	0.5329	0.5941
1997	1.0460	0.2956
2000	0.2425	0.8084
2001	0.6391	0.5228
2007	1.2769	0.2016
2008	0.0258	0.9593

Figure 2. Summary of z test results.

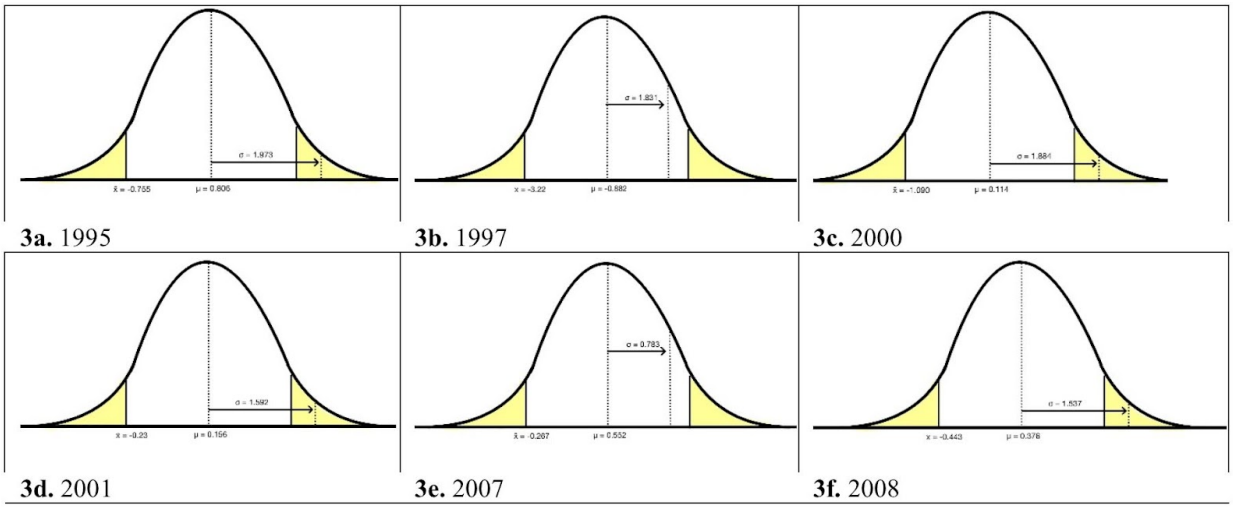

Figure 3. Graphical representation of z test results. Each panel represents a different year's data.

However, the p value was not larger than α in every two-sided, two sample t test for unequal variances. (Figure 4) For all y values except for 2007, the p value was smaller than α and the null hypothesis was rejected. There was convincing evidence of a difference in GDP growth between Schengen member nations and non-Schengen European countries. However, when y was 2007, the p value was larger than α and the null hypothesis failed to be rejected. There was no convincing evidence of a difference in GDP growth between Schengen member nations and non-Schengen countries.

Year Joined (y)	T-Score	P-Value
1995	5.4316	0.00000056237
1997	4.2651	0.000045890
2000	3.3435	0.001375
2001	4.1197	0.000060162
2007	0.6831	0.4953
2008	3.6690	0.001433

Figure 4. Summary of t test results.

Discussion

Data from this study demonstrates the Schengen Agreement did not make a significant contribution to a nation's annual GDP growth when compared to both global GDP and non-Schengen European countries. Moreover, when compared to non-Schengen European nations' GDP growth, Schengen GDP growth was lower by a statistically significant amount in every year except for one. However, there were a few interesting trends in the data centered around three key issues: the 2007-2008 Global Financial Crisis, global GDP growth vs non-Schengen European countries' growth, and the fall of the Soviet Union.

2007-2008 Global Financial Crisis

This study also found that the year 2007 was unique in that it was the only year that Schengen countries did not have a statistically significant difference in annual GDP growth from non-Schengen European countries. It was also unique

in that when the annual GDP growth of Schengen countries was compared to global GDP, 2007 had the lowest probability of the difference in growth being due to chance.

In the early 2000s, increased demand for homes across the United States led to a direct increasing in housing prices[8]. In order to balance the economy, the government raised interest rates several times from 2004 to 2006. While this did decrease demand for new housing, many loan borrowers found that they were unable to afford their payments with the new interest rates. As homeowners started to default on their loans, many mortgage lenders went bankrupt and closed, eventually causing what is known as the Great Recession[9].

As a result, the year 2007 is especially important in this study as it gives insight into how the Schengen Agreement might impact its member countries during times of economic hardship. Since 2007 is the only year that Schengen countries did not have a statistically significant difference from non-Schengen European countries, it is likely that the member nations, despite every other year performing worse than non-Schengen European countries, were able to use the agreement as a type of safeguard. 2007 was also the only year in which Schengen nations had a higher difference in GDP growth than non-Schengen European countries. All of this signals that while the agreement might not make a significant contribution to a nation's annual GDP growth, it could buffer the impact of any possible recession.

Global GDP Growth

While there was a statistically significant difference between the annual GDP growth of Schengen member nations and non-Schengen European nations for almost every year studied, there was never a statistically significant difference between the GDP growth of Schengen when compared with global GDP growth. Even when the GDP growth of the non-Schengen European samples was much larger than that of Schengen countries, global GDP growth was quite close to Schengen GDP growth. This could mean that the Schengen nations were not performing poorly, rather, the non-Schengen European nations were performing excellently. This could be for a variety of reasons, but future research would have to be done in this area.

The Soviet Union's Collapse

When the Soviet Union fell in 1991 due to Mikhail Gorbachev's policies of perestroika and glasnost, much of Eastern Europe was in upheaval as the transition from Communist rule to democratic rule shifted entire economies[10]. While many countries were able to transition their government quickly, others faced major struggles as they attempted to restructure themselves. Regardless, Communist rule was over, and they could now focus on building their economies.

Almost every European nation that is not a part of the Schengen Agreement can be found in Eastern Europe[11]. Furthermore, in every year examined in this study, the standard deviation of the difference in GDP growth for non-Schengen European countries was considerably higher than that of Schengen countries and of the world. This means that even though there was a statistically significant difference in GDP growth between Schengen countries and non-Schengen European countries, that difference might be due to the large economic growth Eastern Europe experienced in the late twentieth and early twenty-first centuries.

A major difference between Schengen countries and non-Schengen European countries during the years examined is the stage of development in many of these countries. While much of Eastern Europe was controlled by the Soviet Union, western and central European countries were free to engage in trade, open markets, and alliances. As a result, much of Western Europe was already at a higher stage of development when they joined the Schengen Agreement. The lower rates of GDP growth could simply be a result of reaching almost peak development.

Pre-Existing Limitations

Although this study aims to examine the economic impact the Schengen Agreement has had, it is important to note that there were a few pre-existing limitations.

First, some of the annual GDP growth needed for the non-Schengen European countries was not available for every year in which a country joined Schengen. This means that the average differences for those countries were not accounted for when calculating overall average differences and standard deviation.

Also, a few members of the agreement joined in the last ten years. As a result, the average differences in GDP growth for those countries could not be observed. However, this should not impact the findings of this study significantly as almost all the data of the other members was acquired. Future research could examine these countries to determine whether they do or do not have a statistically significant difference in their GDP growth after joining the agreement.

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References

C. Karakas, The economic impact of suspending Schengen. *European Parliamentary Research Service.* https://www.europarl.europa.eu/RegData/etudes/ATAG/2016/579074/EPRS_ATA(2016)579074_EN.pdf. (2016).

Understanding the Schengen agreement: history, purpose, and impacts. *European Travel Information Authorisation System.* https://etias.com/articles/schengen-agreement. (2023).

J. Bernsel, A. Hipper, F. Boigner, Bulgaria and Romania join the Schengen area. *European Commission.* https://ec.europa.eu/commission/presscorner/detail/en/ip_24_1722. (2024).

U.S. travelers in Europe's Schengen area. *Travel.State.Gov.* https://travel.state.gov/content/travel/en/international-travel/before-you-go/travelers-with-special-considerations/US_Travelers_in_Europes_Schengen_Area.html#. (2024).

T. Mahmood, M. Lindon, Structural change and economic growth in Schengen region. *International Journal of Economic and Financial Issues.* **7**, 303-309 (2017).

Temporary reintroduction of border control. *European Commission.* https://home-affairs.ec.europa.eu/policies/schengen-borders-and-visa/schengen-area/temporary-reintroduction-border-control_en. (n.d.).

T. Savic, How open borders enhance economic opportunities for countries. *Henley & Partners.* https://www.henleyglobal.com/publications/global-mobility-report/2023-q3/global-insights/how-open-borders-enhance-economic-opportunities-for-countries. (n.d.).

D. Chang, R. Hartill, The subprime mortgage crisis of 2008: a beginner's guide. *The Ascent.* https://www.fool.com/the-ascent/mortgages/subprime-mortgage-

crisis/#:~:text=The%20subprime%20mortgage%20crisis%20was,to%20the%20global%20financial%20system. (2024).

M. Boyle, A. Bellucco-Chatham, Great Recession: what it was and what caused it. *Investopedia.* https://www.investopedia.com/terms/g/great-recession.asp. (2023).

M. Ray, Collapse of the Soviet Union. *Britannica.* https://www.britannica.com/event/the-collapse-of-the-Soviet-Union/The-rise-of-Yeltsin-and-the-foundation-of-post-Soviet-Russia. (2024).

Which European countries are not part of the Schengen area? *AXA Assistance.* https://www.axa-schengen.com/en/non-schengen-countries. (n.d.).

E. Rasure, M. Logan, Real GDP vs. nominal GDP: which is a better indicator? *Investopedia.* https://www.investopedia.com/ask/answers/030515/real-gdp-better-index-economic-performance-gdp.asp#:~:text=Why%20Do%20Economists%20Favor%20Real,(constant%2Ddollar)%20terms. (2024).