

The Effect of the Reduction of the Cash Payment Limit on Compliance (VAT gap) in France

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ABSTRACT: The cash payment limits in Europe are getting increasingly stringent due to the lack of traceability. Cash payments often concern governments because of their use for money laundering, terrorism financing, and other illegal activities that increase countries' shadow economies. For instance, one of the noticeable policies, reducing the cash payment limit to €1,000, was established in 2015 in France. In this paper, we explore the extent to which this policy affected tax compliance in France by using the difference-in-difference method together with empirical data from relevant papers for comparing the VAT gap before and after 2015 in France and Germany. We expect to see a decrease in the VAT gap, reflecting that the cash payment limit was consistent with the reduction of informality in France. Our difference-in-difference estimate shows that the VAT gap as % of VTTL after 2015 declined in Germany by 2.8 pp more than in France. Although the VAT gap decreased in France after 2015, the decrease was smaller than in Germany. Therefore, the difference-in-difference estimate suggests that the policy had a limited relative effect on tax compliance. Consequently, these observations could be taken into consideration for future policy studies and decision-making for the EU economies.

KEYWORDS: Economics, Public Finance, VAT Gap, Tax Compliance, Cash Payment Limits.

■ Introduction

The European economy shifts a lot from what is often called "traditional" cash payments to more traceable, online transactions, combating informality. One of the primary reasons for this is the increasing VAT gap that many governments face. Low compliance suggests multiple issues, not only for the government but also for society as a whole. It decreases VAT revenues, reflecting the increasing informal sector of economies. Even though the shadow economy is difficult to measure or estimate, the VAT gap is widely considered to be one of its main determinants.¹ Evidently, following the VAT gap estimations,^{2,3} some countries need government intervention due to the low levels of compliance. France, for instance, has one of the largest VAT gaps in the 2009-2013 time period in the EU. Moreover, the country experiences challenges in VAT tax collection. VAT receipts in France appeared to be only 14.5% of total tax revenue in 2014, while the EU average was 17.5%.⁴ That is why this country serves as a prominent case study of the EU member state that has implemented one of the strict cash-payment limit reductions (see Appendix A: Table A1).⁵ As the OECD notes, "In France, since September 2015, there has been a limit of €1000 for cash payments between businesses and individuals as well as business to business transactions."¹ This means that residents of France wishing to purchase by cash can pay a maximum amount of €1,000 in cash. Many consumers are highly dissatisfied with such requirements, as the system doesn't allow for even a slight exception, making purchasing a luxury good a more complex action today.

However, the cash-payment limitations are essential in the EU, because they often control terrorism finance and money laundering.⁶ Cash payments are generally untraceable, which makes them a driver of illegal and informal activity.¹ Another

piece of evidence from the paper on the determinants of compliance, indicating greater improvement, states that "the fiscal evasion risk, which includes that of VAT evasion, is larger in less digitalized countries."⁷ This implies that traceability is crucial for keeping low levels of informality. Additionally, the same paper validates the strong relationship between VAT gap and shadow economy. That is why we link cash payment limitations with informality, assuming that these restrictions influence shadow economies directly, helping to reduce them in particular. Consequently, many European countries, including France, aim to control cash flow. Nevertheless, despite the decrease in demand, cash remains essential as well as highly accessible in the French economy.⁸ The consumers' behavior is often well explained by the cash-holding model, which suggests that "the agent pays cash whenever he has enough cash and with another payment instrument otherwise."⁹

We investigate how the 2015 reduction of the cash payment limit to €1,000 affects tax compliance in France. In our research, the majority of the literature on the cash payment restrictions doesn't explore or focus on any economies in particular, but on the EU in general.¹⁰ While previous studies have analyzed VAT gaps across the EU, fewer studies focus on specific country-level policy changes. One of the relevant examples would be an empirical paper that raises a similar question of whether the cash restriction affects the tax evasion levels, investigating the economy of Italy.¹¹ The Italian case findings show that cash restriction policies rather change the tax compliers' behavior than reduce tax evasion itself.¹¹ Our paper contributes to economic literature in three ways. First, we extend the literature by studying the impact of a specific cash payment limit reform in France, focusing on one country rather than the EU as a whole. Second, we use a difference-in-difference approach with Ger-

many as a control group, which has not been applied in this context in the existing literature. Third, we focus directly on the VAT gap as the outcome variable to measure tax compliance.

Being one of the largest economies in the EU, France appears not only a strong representative, but also an important one to explore in order to understand the link between the earlier-mentioned policy and the French economy. The strictness of cash payment limitation in France makes it illustrate such policies better. Furthermore, identifying the effect is crucial for policymakers' and governments' decisions against the shadow economy. We study the behavior of the VAT gap, which can potentially reflect a country's informal sector, since it has a direct and exceptionally strong correlation with the VAT gap.

We compare compliance in France before and after the 2015 cash-payments limit reduction. We expect compliance to increase (or, in other words, the VAT gap to decrease) as payments should become more traceable. This might leave less freedom for informality and more overall control. This trend is already observed in related economic literature, as the EU's VAT gap has declined in 2018–2020.³ It also might suggest the significant contribution of France, as the time period acquired is after the restriction implementation, which satisfies our requirement for testing the hypothesis. However, it is important to highlight that we consider the cash-payments limitation to be one, but not the only factor that influences tax evasion. For example, changes in labor informality might also affect tax revenues and thus the VAT gap itself both positively and negatively.¹²

Our hypothesis is going to be tested with the use of recalculated empirical data from reports on the VAT gap in the EU-28 Member States and a strong review of already existing literature in the field.^{2,3} The difference-in-difference method shall be performed on the two separate economies (France and Germany), respectively representing one treated and one control.

Our paper is then structured as follows. In the next Section (2), we present our data and methodology with resources. Next, in Section 3, the results are only shown and described, but are discussed later, as well as evaluated in Section 4. Finally, Section 5 will conclude the paper. Some of the sections are divided into subsections for smoother guidance and a breakdown of the paper.

■ Methods

Data:

In our paper, we used a variety of economic literature and empirical data from economic reports to test the hypothesis. In this subsection, we briefly list and explain the main sources that were used for collecting and evaluating data. We chose the VAT gap as our key variable because of its direct relationship with the shadow economy.¹³

We compared the data on the VAT gaps in the EU by taking the examples of the French and German economies in the “reports of VAT gaps in the EU-28 member states” of 2016 and 2020, respectively, which were our main data sources.^{2,3} The first paper reflects a 2010–2014 time period, which is before

the 2015 cash-payment limit implementation in France, while the second is a follow-up update with the data when the policy was already in place. Germany was chosen to be a control group for several reasons. First, no similar cash restriction policy took place over the observed time period in Germany. This satisfies our difference-in-difference approach. Second, both French and German economies are considered to be among the largest EU economies, making them “together account for almost half of the euro area's GDP.”¹⁴ With their technological advancements and world influence, the two economies appear to be comparable.¹⁴ Third, Germany's compliance gap is close to the EU's average, which makes it a strong representative not only of a specific economy, but also of a more collective model of the EU economies.¹⁵ So, we observe the same time period for the two developed economies in the EU to construct the correlation between changes in VAT compliance in France and its cash payment limit reduction.

In order to explain the correlation between VAT gap and cash payments, we used data on both the German and French economies. To show the relationship between the size of the shadow economy and VAT gap, we recorded shadow economy estimates as percentages of official GDP for France and Germany from the “Taxation of the Informal Economy in the EU” report.¹⁶

Methodology:

This study explores the effect of the cash payment limit reduction of 2015 in France on its compliance, through the difference-in-difference method. We use data from reports on VAT gaps in EU member states and focus on France and Germany over the period of 2010–2018.^{2,3} The pre-policy period is 2010–2014, while the post-policy period is 2015–2018. This data allows us to compare VAT gap behavior before and after the policy. Over the same time period (2010–2018), we observed the behavior of the four key variables: VAT gap, VTTL, VAT revenues, and VAT Gap as a percentage of VTTL, which helped us to evaluate the effectiveness of the cash payment limit.

The main variable used in the analysis is the VAT gap as a percentage of VTTL. This measure allows for comparison across countries by removing the effect of differences in economic size. It is commonly used as an indicator of tax compliance. In order to eliminate the problem of data inconsistency that arose when using the data from two separate reports due to the revised methodology of the 2020 report, the data before 2014 were spliced using the ratio method (see Appendix A for raw series).² Our calculations harmonized the data, removing these inconsistencies and allowing for accurate comparison. We ran a regression to evaluate the statistical significance of our results (Table 4). We also computed the difference-and-difference estimate with a robustness check (Tables 3, 5). To evaluate the effect of the 2015 policy, we apply a difference-in-differences approach. France is treated as the policy country, while Germany is used as the control group. We compare the change in the VAT gap before and after 2015 in both countries to estimate the policy effect.

This paper explicitly highlights the link between the VAT gap and informality by calculating the correlation between the two variables. This allowed for a deeper analysis, representing not only the consistency of the policy with an improvement of the VAT gap, but also the significance of the 2015 cash payment limit. In the concluding section, we suggested potential improvements as well as stated the limitations of our method.

Difference-in-Difference Approach:

To apply the difference-in-difference method, we investigate the behavior of the VAT gaps in France as a treated group and Germany as a control group over two different time periods: the pre-policy period (2010-2014) and post-policy period (2015-2018).

The difference-in-difference estimate is computed as follows:

$$\delta_{DID}^{2010-2018} = (\bar{Y}_{FR, 2015-2018} - \bar{Y}_{FR, 2010-2014}) - (\bar{Y}_{GR, 2015-2018} - \bar{Y}_{GR, 2010-2014}) \quad (\text{Equation 1})$$

Where;

$\delta_{DID}^{2010-2018}$ - the DiD estimate value for VAT gap as a percentage of VTTL

$\bar{Y}_{FR, 2010-2014}$ - the mean of VAT gap as a percentage of VTTL for the pre-policy period (2010-2014) in France

$\bar{Y}_{FR, 2015-2018}$ - the mean of VAT gap as a percentage of VTTL for the post-policy period (2015-2018) in France

$\bar{Y}_{GR, 2010-2014}$ - the mean of VAT gap as a percentage of VTTL for the pre-policy period (2010-2014) in Germany

$\bar{Y}_{GR, 2015-2018}$ - the mean of VAT gap as a percentage of VTTL for the post-policy period (2015-2018) in Germany

A positive difference-in-difference estimate indicates that the reduction in the VAT gap in France was smaller than in Germany, while a negative value would indicate a stronger improvement in France.

We then run a regression in order to estimate the treatment effect, evaluating the statistical significance of our difference-in-difference estimate.

Our regression model is constructed as follows:

$$Y_{it} = \beta_0 + \beta_1 \text{France}_i + \beta_2 \text{Post}_t + \beta_3 (\text{France}_i \times \text{Post}_t) + \varepsilon_{it} \quad (\text{Equation 2})$$

Where:

Y_{it} - the VAT gap as a percentage of VTTL

France_i - Dummy variable that identifies the treated country (Germany is 0, France is 1)

Post_t - Dummy variable that identifies the policy period (2010-2014 is 0, 2015-2018 is 1)

β_0 - Baseline VAT gap for Germany before 2015

β_1 - Difference between France and Germany for the pre-policy period (2010-2014)

β_2 - Average post-policy period change affecting both France and Germany

β_3 - the DiD estimate value for VAT gap as a percentage of VTTL

$(\text{France}_i \times \text{Post}_t)$ - An interaction term that is used to estimate the difference-in-difference treatment effect

ε_{it} - Error term capturing unobserved factors affecting the VAT gap

β_3 represents the difference-in-difference estimate. A positive value of β_3 would indicate a smaller reduction in VAT gap in France relative to Germany, while a negative β_3 value would indicate the opposite.

The regression model also provides standard errors, which will allow us to make a judgment on the statistical significance of the result. The model is estimated using the Ordinary Least Squares (OLS) regression framework.

In our paper, the difference-in-difference approach has an assumption that the economic behavior of the two countries would have been similar if no policy had taken place. In other words, it relies on the parallel trends assumption. Our visual presentation of the VAT gap as a percentage of VTTL in both countries shows that the pre-policy trends in the two countries are not perfectly parallel. (Figure 4) This weakens the validity of our difference-in-difference estimate. Because the initial pre-policy trends of the two economies differ, Germany does not fully satisfy the assumed model of the French economy without government intervention. Nevertheless, there is a noticeable trend of the VAT gap as a percentage of VTTL increasing in France and Germany before the policy implementation in 2015. Therefore, they should be interpreted cautiously, with the mentioned limitation taken into consideration.

In our robustness check, we applied the same treated and controlled groups, but with slightly different time periods: pre-policy period (2010-2014) and post-policy period (2016-2018), which excludes the year of the policy implementation. We use an alternative post-policy period for our robustness check in order to eliminate the possible effects, as well as the sensitivity of the transition year (2015). A significant change in the difference-in-difference estimate after the robustness check might suggest the dependency of the results on the timing.

The robustness check was therefore computed as follows:

$$\delta_{DID}^{2010-2018} = (\bar{Y}_{FR, 2016-2018} - \bar{Y}_{FR, 2010-2014}) - (\bar{Y}_{GR, 2016-2018} - \bar{Y}_{GR, 2010-2014}) \quad (\text{Equation 3})$$

Where:

$\delta_{DID}^{2010-2018}$ - The DiD estimate value for VAT gap as a percentage of VTTL.

$\bar{Y}_{FR, 2010-2014}$ - the mean of VAT gap as a percentage of VTTL for the pre-policy period (2010-2014) in France

$\bar{Y}_{FR, 2016-2018}$ - the mean of VAT gap as a percentage of VTTL for the post-policy period (2015-2018) in France

$\bar{Y}_{GR, 2010-2014}$ - the mean of VAT gap as a percentage of VTTL for the pre-policy period (2010-2014) in Germany

$\bar{Y}_{GR, 2016-2018}$ - the mean of VAT gap as a percentage of VTTL for the post-policy period (2015-2018) in Germany

■ Results

In this section, we introduce our results without interpretation. These figures are explained with the highlight of the key findings, which are then going to be used in the discussion as well as the conclusion for analysis, interpretation, and evaluation.

Table 1: France. VTTL, VAT revenue, VAT gap, VAT gap as a percentage of VTTL and its changes (expressed in percentage points), 2010-2018, (EUR Million). While the VAT gap worsened by 3.1 pp in the pre-policy period (2010-2014), it declined by 2.4 pp following the introduction of the cash payment limit in 2015, with the overall net change of only 0.1 pp across the full period.

	Before cash payment limit					After cash payment limit			
	2010	2011	2012	2013	2014	2015	2016	2017	2018
VTTL	144,369	147,654	156,992	158,026	165,520	167,521	168,611	173,840	180,406
VAT Revenue	135,875	140,880	142,840	144,618	148,454	151,680	154,490	162,011	167,618
VAT Gap	10,439	9,359	14,771	14,286	17,066	15,841	14,121	11,829	12,788
VAT Gap as a percent of VTTL	7.2	6.3	9.4	9.0	10.3	9.5	8.4	6.8	7.1
VAT Gap change since 2010									0.1
VAT Gap change since 2015									-2.4
VAT Gap change since 2010-2014					3.1				

Table 2: Germany. VTTL, VAT revenue, VAT gap, VAT gap as a percentage of VTTL and its changes (expressed in percentage points), 2010-2018, (EUR Million). The VAT gap declined by 1.8 pp over the full period, with the post-policy reduction of 2.4 since 2015.

year	Before cash payment limit					After cash payment limit			
	2010	2011	2012	2013	2014	2015	2016	2017	2018
VTTL	202,304	216,280	221,946	224,338	229,881	232,507	239,911	248,382	257,207
VAT Revenue	180,213	189,910	194,034	197,005	203,081	211,616	218,779	226,582	235,130
VAT Gap	21,880	26,510	28,199	27,499	26,800	20,891	21,132	21,800	22,077
VAT Gap as a percent of VTTL	10.8	12.3	12.7	12.3	11.7	9.0	8.8	8.8	8.6
VAT Gap change since 2010									-1.8pp
VAT Gap change since 2015									-0.4pp
VAT Gap change since 2010-2014					0.9pp				

In Tables 1 and 2, we reported VAT gaps (all expressed in millions of euros) in France and Germany over the same time periods (before and after the policy implementation). The tables show that both countries experienced a rise in VAT gap in the pre-policy period. The VAT gap in France had a limited net change over the full time period, so the VAT gap as a percentage of VTTL decreased only by 0.1 pp. Germany, however, experienced a noticeable decline in VAT gap after 2014. Its VAT gap as a percentage of VTTL also decreased more significantly compared to France (by 1.8 pp), suggesting a larger decline compared to France.

Table 3: Mean of the VAT gaps as a percent of VTTL (2010-2018) for France and Germany across pre- and post-policy periods in percentage points (pp) showing the Difference-in-Differences estimate of 2.8 pp.

	Pre-policy period	Post-policy period	Difference
	2010-2014	2015-2018	
France	8.4	7.9	-0.5
Germany	12.0	8.8	-3.2
Difference-in-differences			2.8

Table 3 shows the means of VAT gaps as a percent of VTTL over two different time periods: pre-policy (2010-2014) and post-policy (2015-2018). The table shows that the mean VAT gap as a percent of the VTTL in France was 8.4 pp in 2010-2014, but it then declined by 0.5 pp (to 7.9 pp) for the post-policy period (2015-2018). Similarly, in Germany, the mean VAT gap as a percent of the VTTL has declined, but by 3.2 pp (from 12.0 pp in 2010-2014 to 8.8 pp in 2015-2018). The computed difference-in-difference estimate is therefore 2.8 pp, which indicates that the reduction of the VAT gap as a percent of VTTL in France was smaller by 2.8 pp relative to Germany.

To provide statistical inference, we estimate the difference-in-differences model using an OLS regression framework. The coefficient on the interaction term (France $\times$ Post) is 2.715 and statistically significant at the 5% level ($p = 0.022$). This indicates that the reduction in the VAT gap in France was significantly smaller than in Germany.

Table 4: Regression-based Difference-in-Differences estimates with standard errors, showing the interaction term as the Difference-in-Differences estimate of 2.715, significant at the 5% level.

Variable	Coefficient
Constant	11.96*** (0.498)
France	-3.540*** (0.705)
Post	-3.185*** (0.747)
France $\times$ Post	2.715** (1.057)
Observations = 18	
$R^2 = 0.7323$	
Notes: Standard errors are reported in parentheses.	
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.	

Table 5: Mean of the VAT gaps as a percent of VTTL (2010-2018) in percentage points (pp)- Robustness check of the Difference-in-Differences estimate excluding 2015 as the reform year, which gives a Difference-in-Differences value of 2.3 pp.

	Pre-policy period	Post-policy period	Difference
	2010-2014	2016-2018	
France	8.4	7.4	-1.0
Germany	12.0	8.7	-3.3
Difference-in-differences			2.3

Table 5, similarly to Table 3, shows the means of VAT gaps as a percentage of VTTL over two different time periods: pre-policy (2010-2014) and post-policy (2016-2018), but excluding 2015 as the year of the reform implementation. This allows us to mitigate the effect of the policy implementation year and revise the earlier obtained results. The values for the pre-policy period of both countries, therefore, remain unchanged. However, the mean value for the post-policy period in France is slightly smaller: 7.4 pp instead of 7.9 pp, which implies a greater decrease (by 1.0 pp instead of 0.5 pp). In Germany, the mean value of the post-policy period did not change significantly either: 8.7 pp instead of 8.8 pp, which leads to a similar difference of 3.3 pp instead of 3.2 pp. The computed difference-in-difference estimate after the robustness check is 2.3 pp, which is close to the earlier computed value of 2.8 pp. This result implies that our results were consistent and not sensitive to the 2015 shock due to the policy implementation.

Table 6: Size of Shadow economy in France and Germany as a percent of official GDP, 2010 - 2018, from "Taxation of the Informal Economy in the EU."¹⁶ The shadow economy of France has increased over the time period, while in Germany it has decreased.

	Size of Shadow Economy as a percent of official GDP								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
France	11.3	11.0	10.8	9.9	10.8	12.3	12.6	12.8	12.5
Germany	13.5	12.7	12.5	12.1	11.6	11.2	10.8	10.4	9.7

We also examine the relationship between the VAT gap and the shadow economy. Table 6 represents the size of shadow economies in each country as a percentage of its GDP over the same time period. The results for France show an inverse relationship, suggesting that the VAT gap may not fully capture all aspects of informality. For Germany, however, the results show a proportional trend.

The averages, however, do not determine the overall trend accurately, which is why we plotted our data on the following graphs:

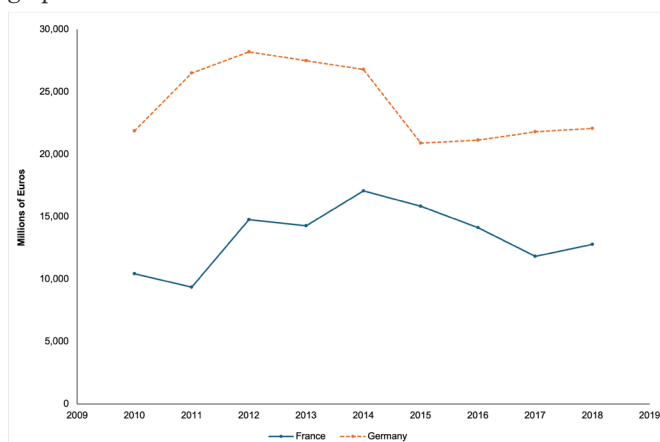


Figure 1: The VAT gap in France and Germany (2010-2018) shows a not perfectly parallel trend. Both countries show a rising VAT gap before 2015, followed by a decline in the post-policy period, with Germany exhibiting a steeper absolute reduction. The author's calculations are based on Poniatowski (2016, 2020).^{2,3}

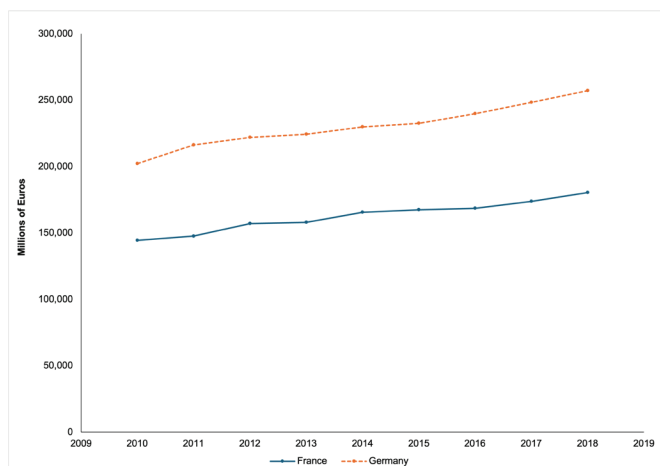


Figure 2: The VAT gap in France and Germany (2010-2018) shows a not perfectly parallel trend. Both countries show a rising VAT gap before 2015, followed by a decline in the post-policy period, with Germany exhibiting a steeper absolute reduction. The author's calculations are based on Poniatowski (2016, 2020).^{2,3}

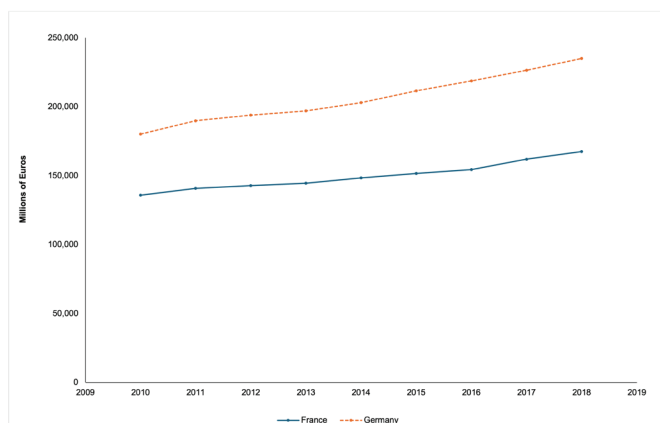


Figure 3: VAT revenue in France and Germany (2010-2018) shows a parallel trend in the two countries. Germany's VAT revenue levels are higher throughout the period, consistent with its larger VTTL base. The author's calculations are based on Poniatowski (2016, 2020).^{2,3}

Figures 2 and 3 show increases in VTTL and VAT revenue in both countries, reflecting higher economic activity over time. Germany exhibits higher levels in both variables, consistent with its larger economic size.

Figure 1, nevertheless, shows different patterns in VAT gap behavior of each economy. The dynamics of the curve of France suggest an increasing trend before 2015, which then declines after the cash payment limit implementation. The VAT gap appears to be more stable in France after 2015. In Germany, we found the net VAT gap to be larger due to the greater size of its economy as a whole. Figure 1 shows a significant VAT gap decrease from 2014 to 2015 in Germany, yet this shock is followed by an increasing trend right after. In 2012, the gap between the VAT gap curves of the two countries was at its maximum, and in 2015, it reached its minimum due to the VAT gap decline in Germany, but an overall increasing trend in France. We observed an increase in VAT gap in France and Germany during the pre-policy period and a decrease during the post-policy period.

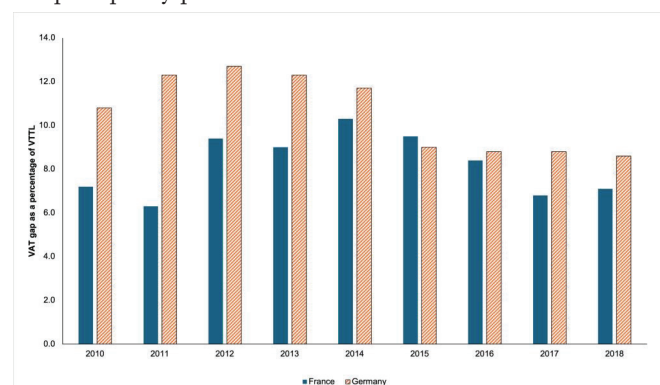


Figure 4: VAT gap as a percentage of VTTL in France and Germany (2010-2018). Germany shows a larger post-policy decline in the VAT gap as a percentage of VTTL, while France displays a more modest reduction following 2015. The author's calculations are based on Poniatowski (2016, 2020).^{2,3}

Figure 4 illustrates the VAT gap as a percentage of VTTL in France and Germany. These results were essential for understanding the difference and changes in the VAT gap behavior in each economy with respect to their scales.

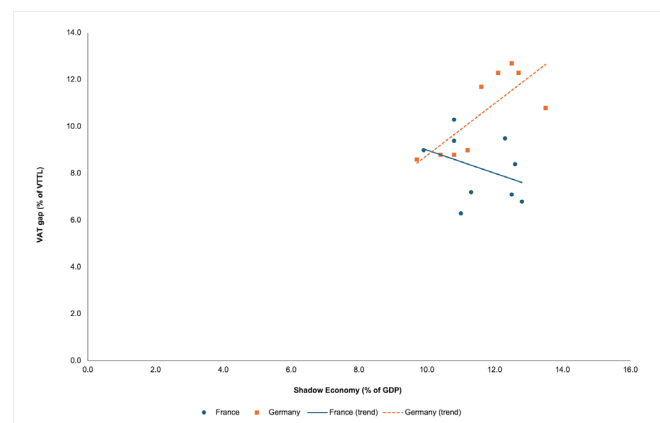


Figure 5: Relationship between VAT gap and Shadow Economy in France and Germany (2010-2018), showing a contrasting correlation pattern between the two countries. France has an inverse relationship between the two variables, while Germany displays a proportional trend. Author's calculations based on Schneider (2022).¹⁶

Finally, Figure 5 illustrates the correlation between the shadow economies of France and Germany as percentages of their official GDPs and VAT gap as percentages of their VTTLs. The relationship between the two variables is different in the two countries. In Germany, the shadow economy is positively correlated with the VAT gap, which implies that as the shadow economy increases, the VAT gap increases too. In France, on the other hand, the opposite trend was observed; as the shadow economy increases, the VAT gap decreases. Figure 5 helps us to examine the relationship between the VAT gap and the shadow economy in France and Germany.

■ Discussion

This section evaluates and discusses whether the 2015 cash payment limit in France has affected its VAT compliance with respect to the results obtained. We find that our hypothesis was not fully supported by the results.

First, while the VAT gap declined in France, the reduction was smaller than in Germany, indicating a weaker improvement. Figure 1 shows that both countries experienced a decline in the VAT gap after 2015. In France, the decline is gradual and includes a small increase in 2018. In contrast, Germany shows a more pronounced drop around 2015, followed by relatively stable levels. This is consistent with the average changes reported in Tables 3, 4, and 5, where the VAT gap decreases by about 0.5 percentage points in France and by about 3.2 percentage points in Germany. Overall, the reduction in the VAT gap is greater in Germany than in France.

Second, Figure 4 allows us to execute the difference-in-difference analysis of the cash payment limit efficiency in France, comparing its VAT gap as a percent of VTTL to the German one, excluding the influence of the two economies' scales (or in other words, sizes). In Figure 4, before 2015, we observed an increase in VAT gap (as a percentage of VTTL), yet a decline right after, which is again consistent with an improvement. In Germany, after 2015, the trend appears to be rather stable.

Third, Tables 3 and 4 show the difference-in-difference estimates that serve as counter-arguments for our hypothesis. The results imply a decline in the VAT gap as a percent of VTTL in both countries; however, with Germany experiencing a major improvement relative to France. The difference-in-difference estimate shows that the VAT gap decrease in France was 2.8 pp (or 2.3 pp) less relative to Germany. Our regression model showed that this evidence is statistically significant at the 5% level. Our results are consistent with the estimate being close to the computed value after the robustness check (2.8 and 2.3 pp, respectively). While the results obtained present a decline of the VAT gap in France after the policy implementation, this decline is not as strong as in Germany, where no such policy was introduced in the same year. So, it is likely that there are other factors that might have influenced the results. For instance, the greater improvement in VAT compliance in Germany might be caused by a more effective tax administration, which eliminates opportunities for tax evasion more than in France. Another possible reason is the difference in the economic structure of the two countries. Even though our method

mitigated the influence of the difference in sizes of each economy, it is still impossible to fully eliminate the influence of other differences in institutional, business, and administrative frameworks. Finally, the weaker improvement in the VAT gap reduction of France might suggest that the policy needs a longer period to fully materialize. Additionally, our estimate relies on the assumption that both European economies would've had a similar behavior if no policy took place, which means that it highly depends on how parallel the VAT gap as a percentage of VTTL trends in both countries before 2015 policy implementation are. This is the parallel trends assumption, which was earlier mentioned in the methodology section. Because France and Germany show different trends of the VAT gap as a percentage of VTTL, they are not perfectly parallel, so the results should be interpreted cautiously.

Finally, linking the VAT gap trends to the shadow economy, we found an interesting relationship in Figure 5. In Germany, we observed an evident result of the shadow economy being proportional to the VAT gap. The relationship in France, however, shows the opposite; as the shadow economy increases, its VAT gap decreases. This inverse relationship may have appeared due to multiple factors. Primarily, the dataset used for this paper was relatively small, which suggests its sensitivity to changes. Secondly, the VAT gap can capture only a particular part of the informal sector of an individual economy, as it reflects a tax evasion problem. It does not, however, correlate with all illegal economic activities. That is why even when decreasing the VAT gap, the overall shadow economy levels may increase due to external and other influencing factors that appeared to be greater in magnitude than the VAT gap improvement. Finally, we assume that the specifics of the time period may have also played a role. Therefore, the VAT gap cannot be taken as a perfect proxy for reflecting the shadow economy. From this, we consider the VAT gap to be one of the indicators of the shadow economy, but not its major determinant. Thus, in the short run, this inconsistency does not necessarily imply a negative trend but shows how informality is affected by various aspects.

■ Conclusion

In this final section of the paper, we conclude our findings as well as indicate the limitations and improvements that could be made.

This paper studied the effect of the 2015 cash payment limit reduction to €1000 in France on its VAT gap. For our analysis, we decided to use the difference-in-difference method, exploring the behavior of such variables as VAT gap, VTTL, VAT revenues, and informality in two strong European economies, France and Germany, over the same period of time (2010–2018).

Our key findings show that our hypothesis was not fully supported by the evidence. Primarily, the VAT gap trends observed in both France and Germany imply a tendency toward improvement. When excluding the scale of each economy, we still observed a decrease in the VAT gap in both countries, with a larger decline in Germany, followed by relatively stable levels

in the post-policy period. However, the difference-in-difference estimate showed a smaller reduction of the VAT gap in France relative to Germany. This result appeared to be statistically significant at a 5% level after running a regression model, and it is consistent, as shown by the robustness check. Finally, we analyzed how the VAT gap changes links to the shadow economies of these two countries, determining an unexpected inverse relationship between these two variables in France. The difference-in-difference result does not support a strong positive policy effect. The findings suggest that the reform had a limited influence on the VAT gap reduction in France, and it is not enough to combat the growth of the shadow economy. In order to fight the informal sector more effectively, this policy should be followed by other government interventions or replaced with other measures. It therefore implies that further research is needed.

Our paper is important not only for economic literature but also for future policy decision-making. By expanding the VAT gap studies with a specific case study of the French economy, we provide an evaluation of the association between the cash payment limit policy and VAT gap improvements, which are currently highly debated. Our results suggest that the policy had a limited effect on reducing the VAT gap. Therefore, the cash payment restrictions alone may not be enough to reduce the VAT gap. Policymakers may need to combine this policy with other measures to improve tax enforcement.

Our method, however, has limitations, as the economies compared are similar to some extent, yet are not identical. The accuracy of the difference-in-difference method could be argued due to the absence of full control of the German economy (which is taken as our control group). Furthermore, there are external factors affecting both the French and German shadow economy, which could influence our results. Consequently, further research is needed to determine the potential impact of cash payment limits outside of France. These factors leave our paper open to future improvement in accuracy and studies.

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■ Appendix

Table A1: Raw data - 26-EU member states: VAT receipts, VTTL, VAT Gap as a share of VTTL, VAT Gap as a share of GDP.⁵

Member State	VAT receipts	VTTL	VAT Gap	VAT Gap as share of VTTL (%)		VAT Gap as share of GDP (%)	
	2011	2011	2011	2011	2000–2011	2011	2000–2011
Austria	23,447	26,915	3,468	13	11	1.2	1.0
Belgium	26,021	30,991	4,970	16	13	1.3	1.1
Bulgaria	3,352	3,956	604	15	16	1.6	1.8
Czech Republic	10,994	15,235	4,241	28	23	2.7	2.1
Denmark	23,869	26,436	2,566	10	10	1.1	1.1
Estonia	1,363	1,664	301	18	15	1.9	1.6
Finland	16,915	19,746	2,831	14	13	1.5	1.3
France	140,506	172,739	32,233	19	16	1.6	1.3
Germany	189,920	216,830	26,910	12	13	1.0	1.0
Greece	15,027	24,790	9,763	39	30	4.7	3.0
Hungary	8,516	12,216	3,700	30	26	3.7	3.0
Ireland	9,782	10,890	1,108	10	8	0.7	0.6
Italy	98,557	134,691	36,134	27	26	2.3	2.1
Latvia	1,368	2,322	954	41	24	4.7	2.3
Lithuania	2,444	3,795	1,352	36	35	4.4	3.9
Luxembourg	2,690	3,242	551	17	12	1.3	0.8
Malta	520	541	21	4	13	0.3	1.0
Netherlands	41,610	45,622	4,012	9	5	0.7	0.4
Poland	29,843	35,253	5,410	15	13	1.5	1.1
Portugal	14,235	16,999	2,764	16	9	1.6	0.8
Romania	11,412	21,760	10,348	48	42	7.9	5.4
Slovakia	4,711	7,484	2,773	37	29	4.0	2.9
Slovenia	3,049	3,375	326	10	7	0.9	0.6
Spain	56,547	71,744	15,197	21	12	1.4	0.8
Sweden	36,610	37,542	932	2	4	0.2	0.4
United Kingdom	130,577	150,064	19,487	13	12	1.1	1.0
EU-26, total	903,884	1,096,841	192,957	18	15	1.5	1.2
EU-26, average				20	17	2.1	1.6

Table A2: Raw data: France. VTTL, VAT revenue, VAT gap, VAT gap as a percent of VTTL and its changes (expressed in percentage points), 2010–2018, (EUR Million).^{2,3}

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
VTTL	150,550	153,975	163,713	164,791	172,806	165,520	167,521	168,611	173,840
VAT Revenue	135,578	140,552	142,527	144,301	148,129	148,454	151,680	154,490	162,011
VAT Gap	14,972	13,423	21,186	20,490	24,477	17,066	15,841	14,121	11,829
VAT Gap as a percent of VTTL	10.0	9.0	13.0	12.0	14.0	10.3	9.5	8.4	6.8
VAT Gap change since 2010					4 pp				-3.2 pp

Table A3: Raw data: Germany. VTTL, VAT revenue, VAT gap, VAT gap as a percent of VTTL and its changes (expressed in percentage points), 2010–2018, (EUR Million).^{2,3}

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
VTTL	199,390	213,145	218,749	221,107	226,570	229,881	232,507	239,911	248,382
VAT Revenue	180,213	189,910	194,034	197,005	203,081	203,081	211,616	218,779	226,582
VAT Gap	19,177	23,235	24,715	24,102	23,489	26,800	20,891	21,132	21,800
VAT Gap as a percent of VTTL	10.0	11.0	11.0	11.0	10.0	11.7	9.0	8.8	8.8
VAT Gap change since 2010					1 pp				-3.1 pp