Majority Shareholder on the Composition of Public Ownership and Tax Avoidance Practices in Public Companies

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Abstract

This study attempts to analyze the effectiveness of the enforcement of regulations on public share ownership. Specifically, this study analyzes whether there are differences in the composition of public ownership between before and after the regulation was enacted. By using independent t-test, carried out on the Indonesia Stock Exchange during 2008-2011 with a total of 320 observations (company-years), regarding the effectiveness of regulations regarding the provision of tax incentives associated with the proportion of public share ownership, the difference is analyzed with the deadline for the enactment of government regulations on reduction of income tax rates for public entity taxpayers in the form of public company and the Minister of Finance Regulation regarding the procedure for implementing and monitoring the decreasing of granting tariffs for domestic corporate taxpayers in the form of public companies. The results indicate that the regulations were not proven to empirically have significant effect in increasing the proportion of public share ownership in the capital market, and are more likely to lead to trade-offs with government efforts to increase tax revenues and reduce the practice of tax avoidance by companies. Therefore, it is necessary to review the tax incentive scheme that can be given to companies going public in order to be effective in increasing public share ownership in Indonesia and not trade-off with the practice of corporate tax avoidance.

Keywords: shareholder composition, public ownership, tax avoidance, public companies, regulation, Indonesia

1. Introduction

Control of share ownership in several countries, especially developing countries, continues to be a subject of serious regulation (Ramanadham, 2019). This relates to efforts to broaden the base of shareholding of large companies to create inclusion and distribution of capital market-based income (Rasheed et al., 2016). Companies listed on various stock exchanges are mostly owned by a limited circle, and rarely are dominantly owned by the public (see for example, Céspedes et al., 2010; Lefort & Walker, 2000; Almeida & Wolfenzon, 2006; Khanna & Yafeh, 2007; Caselli & Gennaioli, 2013). However, public ownership beyond expanding share ownership inclusions also has an effect on tax
avoidance. Fama and Jensen (1983) and the results of research by Badertscher et al. (2013) provide additional references to the composition of public share ownership and tax avoidance practices found in companies controlled by domestic and foreign parties. The results prove that there is no significant difference in the composition of public share ownership and tax avoidance practices both for companies controlled by domestic and foreign parties. In the context of the relationship of ownership structure with the practice of corporate tax avoidance, the main focus of this study is slightly different from previous research. This study aims to empirically examine the effect the effectiveness of the enforcement of regulations on public share ownership. The relationship of public share ownership in the capital market with the practice of tax avoidance obtained limited attention from scholars. The data, however, suggest that the investor as one of the capital market players contributed to the development of the capital market (Feldstein, 1999). Although the role is very small in controlling the company (the average ownership of each investor is below 5%), cumulative public share ownership at least can be the basis of management decision making.

This study seeks to evaluate and make improvements to government regulations as a basis of regulators related to the provision of incentives for companies to go public, in connection with public share ownership in the capital market, especially in Indonesia. The contributions are to provide a new reference in analyzing the influence of ownership structure on the practice of corporate tax avoidance, namely by showing the influence of public share ownership on corporate tax avoidance practices that are still under-researched. This study uses two specific rules to examine possible differences in the composition of public ownership. The first regulation is Government Regulation No. 81/2007 concerning Reduction of Income Tax Rates for Domestic Corporate Taxpayers in the form of a public company. This regulation is implemented in order to increase the role of the capital market as a source of financing for the business world and to encourage an increase in the number of publicly-listed companies and increase public ownership in publicly-listed companies. The second regulation is Minister of Finance Regulation No. 238/PMK.03/2008, concerning procedures for implementing and supervising tariffs for business entities referred to in regulation No. 81/2007. With the completion of the process and technical specifications for implementing regulations in 2008, this study seeks to test the extent to which these regulations can effectively increase public ownership before and after 2008.

2. Theoretical Review

2.1 Tax Avoidance

The definition of tax avoidance practices cannot be generalized, because of different perspectives in the various definitions (Hanlon and Heitzman, 2010). In this study, in general the practice of tax avoidance is interpreted as an effort to reduce the obligation to pay corporate taxes explicitly. This definition refers to Hanlon and Heitzman (2010) which state that tax avoidance is also a series of tax planning carried out by companies. This research does not differentiate whether efforts to reduce tax payment obligations are carried out in the context of tax planning, tax aggressiveness, tax evasion or forms of non-compliance.

Some previous studies have found determinants of tax avoidance practices in the Company, which are influenced by country characteristics (eg Atwood et al, 2012), company characteristics (eg Gupta & Newberry, 1997), affiliate relationships (eg Taylor & Richardson, 2012), the existence of tax consultants and corporate social responsibility (eg Huseynov & Klamm, 2012; Shafer & Simmons, 2008), legal sanctions (Nurchalis, 2018), implementation of corporate governance (eg Dyreng et al. 2010; Lanis & Richardson, 2011) and ownership factors. Atwood et al. (2012) for example, found that the practice of corporate tax avoidance will decrease in a country if the country has high certainty in law enforcement, high book-tax conformity and uses a home country approach and worldwide in its tax system. Gupta and Newberry (1997) found that company size as well as financing decisions and corporate investment are related to effective tax rates (ETR). Taylor and Richardson (2012) found that
thin capitalization, transfer pricing, income shifting and the use of tax heaven as a practice commonly done with affiliates (subsidiaries) were related to the practice of corporate tax avoidance.

Meanwhile, Huseynov and Klamm (2012) found that using a tax consultant (Public Accountant Office) was related to the practice of corporate tax avoidance. This was not only done in order to reduce tax payments, but also positively affected the company's CSR activities. This finding is in line with Shafer and Simmons, (2008) who found that tax consultant behavior can influence the increase in tax avoidance practices. However, high social responsibility of tax consultants will reduce the practice of tax avoidance. Related to corporate governance, Dyreng et al. (2010), and Lanis and Richardson, (2011) found that the role of top management and composition of commissioners had a significant influence on tax avoidance practices.

In addition, the most important problem of corporate tax avoidance practices is related to measurement problems. Based on previous literature, Annuar et al. (2014) divides the measurement of corporate tax avoidance into three groups. The first group is by using measurements that consider the gap between earnings according to accounting and profit according to tax such as total book-tax gap, residual book-tax gap and tax-effect book-tax gap. The second uses measurements that take into account the proportion of taxes on profits, including effective tax rates with some variants like accounting ETR, current ETR, cash ETR, long-run cash ETR, differential ETR, ratio of income tax expense to operating cash flow, and the ratio of cash taxes paid to operating cash flow (Salihu et al., 2013). Lastly, Annuar et al. (2014) classified the third group with measurements like discretionary permanent differences (PERMIDIFF)/DTAX, unrecognized tax benefits (UTB), and tax shelter estimates. Hanlon and Heitzman (2010) also explained each measurement of tax avoidance and its impact on accounting earnings and its relation to jurisdiction. Although some researchers have used more than one measurement of tax avoidance together (for example Chen et al. 2010), Hanlon and Heitzman (2010) caution that the use should be based on research questions, and if more than one measurement is used together, the interpretation must be carried out carefully.

2.2 Company Ownership Structure and Agency Problems

The ownership structure of the company is very closely related to the practice of corporate tax avoidance, especially its association with agency problems or the separation between ownership and control. Jensen and Meckling (1976) state that agency relations are contracts, in which one or more people (principals) give mandates to other parties (agents) to do some work in their interests which involves delegating some decision-making authorities to the agent. If both parties are oriented towards maximizing their respective utilities, there will be a possibility that agents will not always act in the best interests of the principal and give rise to agency costs. Likewise, if the manager and owner sell part of the company’s equity claims that are identical to their own to outside parties, agency costs will be generated through differences between their interests and other shareholders (Jensen and Meckling, 1976).

This is the basis for the development of research that analyzes the relationship between ownership structure and the practice of corporate tax avoidance. According to Hanlon and Heitzman (2010), the practice of corporate tax avoidance is a reflection of agency problems. When the separation between ownership and control is carried out, the company's tax decisions can reflect the personal interests of management. This is evidenced by Frank et al. (2009) who found that there was a relationship between the aggressiveness of financial reporting and the aggressiveness of tax reporting. When management has objectives in conducting earnings management, the practice of corporate taxation is also carried out by management in order to maximize its utility (Tang and Firth, 2011).

However, the existence of controlling shareholders still contributes so much in relation to the management policy. Lee and Kuo (2014) stated that increased control carried out by controlling shareholders can reduce the effect of income tax rates on trade-off of the relationship between debt and management ownership. The existence of controlling shareholders in the capital market can be
broadly divided into three categories, namely family ownership, government ownership and foreign ownership. Regarding the influence of each of the ownership categories, previous studies showed mixed findings on tax avoidance practices. Some studies emphasized the more aggressive effect of family ownership rather than non-family ones on the tax avoidance practices (Chen et al., 2010, Steijvers & Niskanen, 2014). This can be caused because with majority family ownership. The company is still trying to maintain the family reputation in the public eye by not conducting aggressive tax avoidance, which can be explained by intrinsic motivation of individual taxpayer compliance. This is caused by the nature that family companies are still a representation of individual taxpayer (Hanlon & Heitzman, 2010). Especially in the Malaysian and Indonesian capital markets, the results of these studies are different. Abdullah et al. (2019) show that the higher the public ownership, the higher the tax avoidance, while Chan et al. (2013) show the negative effect between the public ownership and tax avoidance. Furthermore, Sari & Martani (2010) and Anwar et al. (2014) argued that this might be due to differences in corporate orientation and differences in business culture and culture tax audits in Indonesia compared to other countries.

The difference of findings may be due to differences in the level of agency problems faced by each of the government companies. Annuar et al. (2014) argue that the positive influence can be caused due to opportunistic management, as a result of management that is not directly carried out by the government. Further, Egger et al. (2000) explained that indications of tax avoidance by foreign ownership can be seen from the amount of tax paid. Compared to domestic-owned companies, payment of corporate taxes with foreign ownership will be higher in countries with low tax rates. Conversely, in the country with a high tax rate, companies with foreign ownership will pay lower taxes compared to companies owned by domestic parties.

2.3 Incentives for Go Public Companies on Public Share Ownership in Indonesia

In 2007, as a manifestation of Indonesian government’s concern for companies going public and investors in Indonesia, the government enacted Government Regulation No. 81/2007 concerning Reduction of Income Tax Rates for Domestic Corporate Taxpayers in the form of a public company. This regulation is implemented in order to increase the role of the capital market as a source of financing for the business world and to encourage an increase in the number of publicly-listed companies and increase public ownership in publicly-listed companies. In further stage, Minister of Finance issued technical specification for implementing the regulation by enacting Minister of Finance Regulation No. 238/PMK.03/2008, concerning procedures for implementing and supervising tariffs for business entities referred to in regulation No. 81/2007, as a rule of implementation. In both rules, it is suggested that the government will provide a reduction as incentive of 5% income tax rates to go public companies that are able to reduce their concentration of ownership by increasing the proportion of public share ownership by at least 40% of all paid shares of the company. Abdullah et al. (2019) show that the public owned by at least 300 parties, of which each party has shares of less than 5% of the total paid-up shares and the composition of the share ownership of the maximum is valid for 6 months within 1 tax year.

The purpose of the issuance of these two rules is to increase the role of the capital market as a source of financing for the business community, and to encourage an increase in the number of public companies and increase public ownership in corporate companies going public. This is very reasonable. Sautner and Villalonga (2010) revealed that in countries where public companies have concentrated ownership structures, certain tax policies issued by regulators can have an impact on controlling shareholders. Morck (2005) provides similar evidence shows that in the United States, the ownership structure of companies is slowly changing from concentrated to dispersed, as a result of certain taxation policies imposed by the government in the early twentieth century.

To that end, in order to evaluate the effectiveness of the application of this regulation, the government or in this case Bapepam-LK and Ministry of Finance of the Republic of Indonesia, in 2011 conducted a study that generally found that the proportion of public shareholding continued after
the issuance of these two rules. The main driving factor for companies to go public and release shares to the public for companies is business expansion, improved management performance and diversification of financing sources and not intended to obtain tax incentives. Hence, it was found that the regulation has not been effective enough to encourage increase in the number of issuers and public share ownership in the Indonesian capital market. In addition, it was also found that the regulation was not quite responsive in which the decision to release shares to the public depended on the decisions of the controlling shareholders. The conditions also set too high and the share sale transactions were beyond the control of the company. Therefore, the study then suggested a decrease in the minimum proportion of public share ownership, reduction of conditions for issuers to obtain tax incentives and the addition of a tax incentive scheme for issuers.

3. Methodology

This research was carried out on the Indonesia Stock Exchange during 2008-2011 with a total of 320 observations (company-years). The choice of place of research in the Indonesian capital market is motivated by the findings of Claessens et al. (2000). Siregar and Utama (2008) find that companies with high family ownership and not in certain business group networks make efficient and seemingly inefficient earnings management. This was further reinforced by the results of the study of Sari & Martani (2010) who found that there was a tendency for family companies to carry out aggressive tax actions compared to non-family companies. In addition, related to the diversity of ownership categories in the capital market, Wiranata & Nugrahanti (2013) examined the influence of diversity of ownership on the performance of companies in the capital market in Indonesia. The results showed that foreign ownership had a positive effect on company performance. Meanwhile, government ownership, institutional ownership and managerial ownership were found to have no effect on company performance, and family ownership was found to have a negative effect on company performance. Seeing the phenomenon in the Indonesian capital market, a further analysis is needed regarding the condition of public share ownership and tax avoidance practices in the Indonesian capital market by considering the existence of its controlling shareholders.

Data analysis was conducted with independent t test. The analysis was carried out by different tests of public share ownership and tax avoidance practices. Testing is also to analyze whether the incentives provided affect in public share ownership and corporate tax avoidance practices.

4. Results

This research is intended to evaluate empirically the effect of incentives on the differences in public share ownership and corporate tax avoidance practices before and after 2008 with the two above-mentioned regulations. This is based on the opinion of Sautner and Villalonga (2010) who found that in countries where public companies have concentrated ownership structures, certain tax policies issued by regulators can have an impact on controlling shareholders. Morck (2005) who shows that in the United States, the ownership structure of the company is slowly changing from concentrated to scattered, as a result of certain taxation policies imposed by the government in the early twentieth century.

However, the results of the study by the Bapepam-LK Study Team (2011) found that in addition to business expansion, improved management performance and diversification of financing sources, the release of shares to the public in the Indonesian capital market was also more influenced by the decision of its controlling shareholders. The study team stated that the implementation of Government Regulation No. 81 of 2007 and Minister of Finance Regulation No. 238/PMK.03/2008 has not been effective in enhancing public share ownership in the Indonesian Capital Market. This was mainly caused by the composition of the controlling shareholders in the company.

Wiranata and Nugrahanti (2013) found that company performance in the Indonesian capital market depends on the group of shareholders. Foreign ownership has a positive effect on company
performance, while government ownership, institutional ownership and managerial ownership are found no effect on company performance. Lastly, family ownership was found to have a negative effect on company performance. Thus, to examine the effect of differences in the composition of controlling shareholders on public share ownership, including the practice of tax avoidance in company, the samples in this research were divided into two groups, namely groups whose ownership is by domestic parties (including the Indonesian government) and groups whose ownership is foreign parties. The results of testing using the independent sample t-test can be shown in table 1.

Table 1. Independent Sample t-test Testing Results for Majority shareholder Differences Against the Composition of Public Ownership and Corporate Tax Avoidance Practices

<table>
<thead>
<tr>
<th>Majority/Controlling Shareholders</th>
<th>Obs.</th>
<th>OP</th>
<th>ETR</th>
<th>CashETR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev</td>
<td>Mean</td>
<td>Std. Dev</td>
</tr>
<tr>
<td>Domestic</td>
<td>163</td>
<td>0.260</td>
<td>0.144</td>
<td>0.283</td>
</tr>
<tr>
<td>Foreign</td>
<td>157</td>
<td>0.241</td>
<td>0.180</td>
<td>0.289</td>
</tr>
<tr>
<td>Total</td>
<td>320</td>
<td>0.250</td>
<td>0.162</td>
<td>0.286</td>
</tr>
<tr>
<td>t-statistic</td>
<td>1.048</td>
<td>-0.4995</td>
<td>-1.234</td>
<td></td>
</tr>
<tr>
<td>Degree of freedom</td>
<td>298.526</td>
<td>319.524</td>
<td>302.749</td>
<td></td>
</tr>
<tr>
<td>Ha, diff &lt; 0</td>
<td>0.852</td>
<td>0.308</td>
<td>0.109</td>
<td></td>
</tr>
<tr>
<td>Ha, diff ≠ 0</td>
<td>0.295</td>
<td>0.617</td>
<td>0.218</td>
<td></td>
</tr>
<tr>
<td>Ha, diff &gt; 0</td>
<td>0.147</td>
<td>0.691</td>
<td>0.891</td>
<td></td>
</tr>
</tbody>
</table>

Tax avoidance, proxied by effective tax rate (ETR). Tax avoidance is defined as the total tax burden divided by pre-tax profit, and the cash effective tax rate (CETR) (Abdullah et al., 2019), which is paid taxes divided by profit before tax, while public share ownership is measured by PO (Public Ownership) which is the proportion of public share ownership. Tests have been carried out using either the assumption of the variance of the two groups (homogeneity of variance) as well as using Welch’s t-test which does not assume homogeneity of variance (Welch, 1951 in Latan 2014). However, the results of both tests showed the same results.

The results revealed that the company sample used in this study was more controlled by domestic parties compared to foreign parties. However the difference was only a little. This is evidenced by the mean value between the two which is not much different. Company controlled by domestic parties has mean of 0.260 and those controlled by foreign parties has mean value of 0.241. This indicates that the two groups of majority shareholders are worthy of comparison. However, the test results show that both the proportion of public share ownership and tax avoidance practices in the two groups do not have a significant difference. Associated with previous findings, the findings revealed that the proportion of public share ownership in both groups of companies are still low and have not reached the target desired by the government in a minimum limit of 40% of total shares. Likewise, the results of the practice of tax avoidance in the two groups revealed no significant difference in the practice of tax avoidance of both groups. This means that the application of regulations regarding public share ownership, regulations on tax incentives and level of regulator supervision should be treated equally in both groups of companies.

In addition, related to the analysis of the effectiveness of the implementation of Government Regulation No. 81 of 2007 and Minister of Finance Regulation No. 238/PMK.03/2008 in increasing public share ownership in the Indonesian Capital Market, a paired sample t-test was conducted. The results are shown in table 2.
Table 2. Paired Sample t-test Testing Results of the Difference Between Public Ownership and Corporate Tax Avoidance Practices

<table>
<thead>
<tr>
<th>Tax Incentive Regulations for Issuers</th>
<th>Obs.</th>
<th>OP</th>
<th>ETR</th>
<th>CashETR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev</td>
<td>Mean</td>
<td>Std. Dev</td>
</tr>
<tr>
<td>Before</td>
<td>80</td>
<td>0.245</td>
<td>0.160</td>
<td>0.330</td>
</tr>
<tr>
<td>After</td>
<td>80</td>
<td>0.257</td>
<td>0.167</td>
<td>0.255</td>
</tr>
<tr>
<td>Diff.</td>
<td>80</td>
<td>-0.011</td>
<td>0.908</td>
<td>0.074</td>
</tr>
<tr>
<td>t-statistic</td>
<td></td>
<td>-0.132</td>
<td></td>
<td>4.238</td>
</tr>
<tr>
<td>Degree of freedom</td>
<td></td>
<td>79</td>
<td></td>
<td>79</td>
</tr>
<tr>
<td>Ha, diff &lt; 0</td>
<td></td>
<td>0.130</td>
<td></td>
<td>1.000</td>
</tr>
<tr>
<td>Ha, diff ≠ 0</td>
<td></td>
<td>0.260</td>
<td></td>
<td>0.000***</td>
</tr>
<tr>
<td>Ha, diff &gt; 0</td>
<td></td>
<td>0.869</td>
<td></td>
<td>0.000***</td>
</tr>
</tbody>
</table>

* **, **, * = significant P-value of 1%, 5%, 10%.

The results show that the increase in the proportion of public share ownership after 2 years of enactment of two regulations is very small. The value is only 0.006, which is not statistically significant compared to the proportion of public share ownership in 2008. This can be interpreted that government regulations that encourage an increase in public share ownership with the scheme of granting tax incentives do not get a significant response by companies in the capital market. This finding is different with the results of research conducted by Sautner and Villalonga (2010) and Morck (2005).

However, what is interesting from the results of this study as shown in table 2 is that compared to before the enactment of the regulation, there were significant differences in the practice of corporate tax avoidance. Compared to the public share ownership that is still below 40%, this result further reinforces the notion that the regulation is more utilized by companies to practice corporate tax avoidance than to obtain tax incentives through increasing public share ownership. The application of regulations regarding the provision of tax incentives that are reflected by the proportion of public share ownership, is at least likely to lead to trade-offs with government efforts to improve corporate tax compliance and reduce tax avoidance practices carried out by the company. For this reason, there needs to be a clear separation between scheme to increase the proportion of public share ownership with scheme to provide tax incentives to companies in the capital market.

5. Conclusion

This study seeks to evaluate the effect of government regulations on the public ownership and tax avoidance practices. The regulation is the basis for regulators to enact the provision of incentives for go public companies and to expand the public share ownership in the Indonesia capital market. The results found that the regulation has not been effective in increasing public share ownership in the Indonesian capital market. The results of this study showed that the regulation was mainly treated as company trade-off with the government’s efforts to increase tax revenues and reduce the practice of tax avoidance. The results indicate that the greater public share ownership leads to the increasing practice of corporate tax avoidance. Therefore, it is necessary to review the tax incentive scheme to publicly listed companies in order to be effective in increasing public share ownership in Indonesia. For this reason, a clear separation between scheme to increase the proportion of public share ownership and scheme to provide tax incentives to companies in the capital market is needed. In the context of tax avoidance, there are significant differences before and after the enactment of regulations. Regarding the existence of domestic parties and foreign parties as the controlling shareholder/majority, the results of this study indicate that there are no significant differences in the ownership of public shares and tax avoidance practices in two groups. This study have implications for the government and capital market regulators to review Government Regulation No. 81 of 2007 as
a basis for expanding the composition of the public in a public company. There is also a need to review the specifications, Minister of Finance Regulation No. 237/PMK.03/2008, in terms of the amount of public share ownership and the number of shareholders. It is evident that the average public shareholding is still around 25 percent, still far with the minimum limit of 40 percent.

In connection with the existence of trade-off with the aim of stipulating the regulation, it is recommended a clear separation between the scheme to increase the proportion of public share ownership with scheme to provide tax incentives to companies in the capital market. Related to evaluating the rules regarding tax incentives intended for public companies or to other capital market players, further research is expected to conduct empirical research to evaluate other tax rules, such as the impact of changes in income tax rates for dividend-receiving taxpayers from the original tariffs. This is for example linked to progressive income taxes with the highest rate of up to 35%, to 10%, resulting from the expansion of costs that can be deducted from gross income. This is also a consequence of other special incentives or rules for certain industries, such as agriculture, the mining industry, infrastructure and transportation and finance. The limitations in this study is that it only used two methods of measuring tax avoidance practices from several measures of tax avoidance practices as mapped by Hanlon and Heitzman (2010). Hence, future studies are expected to analyze tax avoidance by using different measures.

Reference


Appendix

Results of Testing of Independent Sample t Test

```
. ttest op, by (cpsp_1) unequal welch
Two-sample t test with unequal variances

<table>
<thead>
<tr>
<th>Group</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>163</td>
<td>0.2602454</td>
<td>0.0112943</td>
<td>0.1441962</td>
<td>0.2379423 - 0.2825485</td>
</tr>
<tr>
<td>2</td>
<td>157</td>
<td>0.2410828</td>
<td>0.0143731</td>
<td>0.1800946</td>
<td>0.2126918 - 0.2694738</td>
</tr>
</tbody>
</table>

. ttest etr, by (cpsp_1) unequal welch
Two-sample t test with unequal variances

<table>
<thead>
<tr>
<th>Group</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>163</td>
<td>0.2839264</td>
<td>0.0080659</td>
<td>0.1029769</td>
<td>0.2679988 - 0.299054</td>
</tr>
<tr>
<td>2</td>
<td>157</td>
<td>0.2896815</td>
<td>0.0082274</td>
<td>0.1030896</td>
<td>0.27343 - 0.3059331</td>
</tr>
<tr>
<td>combined</td>
<td>320</td>
<td>0.28675</td>
<td>0.0057529</td>
<td>0.1029109</td>
<td>0.2753316 - 0.2980684</td>
</tr>
<tr>
<td>diff</td>
<td>0.0057551</td>
<td>0.0115216</td>
<td>-0.028423</td>
<td>0.0169127</td>
<td></td>
</tr>
</tbody>
</table>

diff = mean(1) - mean(2)  \quad t = -0.4995  \quad \text{Welch's degrees of freedom} = 319.524

H_0: \text{diff} = 0  \quad H_1: \text{diff} \neq 0  \quad H_1: \text{diff} > 0
Pr(T < t) = 0.3089  \quad Pr(|T| > |t|) = 0.6178  \quad Pr(T > t) = 0.6911

. ttest etr, by (cpsp_1) unequal welch
Two-sample t test with unequal variances

<table>
<thead>
<tr>
<th>Group</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>163</td>
<td>0.2677914</td>
<td>0.0110465</td>
<td>0.1410325</td>
<td>0.2459777 - 0.2896051</td>
</tr>
<tr>
<td>2</td>
<td>157</td>
<td>0.2896178</td>
<td>0.0130043</td>
<td>0.1729676</td>
<td>0.2623503 - 0.3168053</td>
</tr>
<tr>
<td>combined</td>
<td>320</td>
<td>0.2785</td>
<td>0.0088125</td>
<td>0.1576421</td>
<td>0.2611621 - 0.2958379</td>
</tr>
<tr>
<td>diff</td>
<td>-0.0218264</td>
<td>0.0176801</td>
<td>-0.0566178</td>
<td>0.012965</td>
<td></td>
</tr>
</tbody>
</table>

diff = mean(1) - mean(2)  \quad t = -1.2345  \quad \text{Welch's degrees of freedom} = 302.749

H_0: \text{diff} = 0  \quad H_1: \text{diff} < 0  \quad H_1: \text{diff} > 0
Pr(T < t) = 0.1090  \quad Pr(|T| > |t|) = 0.2100  \quad Pr(T > t) = 0.8910
```
Results of Paired Sample t Test

. ttest bop == aop

Paired t test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>bop</td>
<td>80</td>
<td>0.245875</td>
<td>0.017903</td>
<td>0.1607117</td>
<td>0.2101059, 0.2816441</td>
</tr>
<tr>
<td>aop</td>
<td>80</td>
<td>0.257375</td>
<td>0.0187021</td>
<td>0.1677711</td>
<td>0.2284193, 0.2966007</td>
</tr>
<tr>
<td>diff</td>
<td>80</td>
<td>-0.0115</td>
<td>0.101556</td>
<td>0.0908344</td>
<td>-0.0317142, 0.0097142</td>
</tr>
</tbody>
</table>

mean(diff) = mean(bop - aop)

Ho: mean(diff) = 0

degrees of freedom = 79

Ha: mean(diff) < 0

Ha: mean(diff) != 0

Ha: mean(diff) > 0

Pr(T < t) = 0.1304

Pr(|T| > |t|) = 0.2609

Pr(T > t) = 0.8696

. ttest betr == aetr

Paired t test

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<th>Std. Dev.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>betr</td>
<td>80</td>
<td>0.3305</td>
<td>0.0150147</td>
<td>0.1342952</td>
<td>0.3061414, 0.3603859</td>
</tr>
<tr>
<td>aetr</td>
<td>80</td>
<td>0.255625</td>
<td>0.0073709</td>
<td>0.0659275</td>
<td>0.2405935, 0.2702965</td>
</tr>
<tr>
<td>diff</td>
<td>80</td>
<td>0.074875</td>
<td>0.0176669</td>
<td>0.1580177</td>
<td>0.0397099, 0.1100401</td>
</tr>
</tbody>
</table>

mean(diff) = mean(betr - aetr)

Ho: mean(diff) = 0

degrees of freedom = 79

Ha: mean(diff) < 0

Ha: mean(diff) != 0

Ha: mean(diff) > 0

Pr(T < t) = 1.0000

Pr(|T| > |t|) = 0.0001

Pr(T > t) = 0.0000

. ttest betrc == aetric

Paired t test

<table>
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<tr>
<th>Variable</th>
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<th>Std. Dev.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>betrc</td>
<td>80</td>
<td>0.301625</td>
<td>0.0166521</td>
<td>0.1489409</td>
<td>0.2604790, 0.3347702</td>
</tr>
<tr>
<td>aetric</td>
<td>80</td>
<td>0.247875</td>
<td>0.0138307</td>
<td>0.1233777</td>
<td>0.2203290, 0.2754282</td>
</tr>
<tr>
<td>diff</td>
<td>80</td>
<td>0.05375</td>
<td>0.020201</td>
<td>0.1806385</td>
<td>0.0135409, 0.0939591</td>
</tr>
</tbody>
</table>

mean(diff) = mean(betrc - aetric)

Ho: mean(diff) = 0

degrees of freedom = 79

Ha: mean(diff) < 0

Ha: mean(diff) != 0

Ha: mean(diff) > 0

Pr(T < t) = 0.9953

Pr(|T| > |t|) = 0.0094

Pr(T > t) = 0.0047