

Does Tobacco Affect Economy?

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Abstract

Objective: The still debatable contribution of tobacco to the economy demands further discussion as tobacco remains controversial commodity due to its adverse health impacts. This paper aims to investigate the relationship between tobacco and the economy using macroeconomics indicators such as unemployment, inflation, and GDP growth. As a comparison, we include the tobacco price bands in USA because the sector is one of dominant affecting the economy and the price in some main areas in America is incredibly competitive. **Methods:** This paper use tobacco data and Macroeconomics Indicators from Euromonitor International and World Bank Data. We extend linear regression models by controlling both the serial correlation and endogeneity bias problems. We also observe the properties in the ARMA(2,2) data generating process. **Results:** We document that tobacco tends to affect the USA's future economy but not Indonesia. In our robustness check, we conduct a SUR analysis to control the contemporaneous correlations among Asian markets. We further document that tobacco variables tend not to affect the economy in the Asian markets. **Conclusion:** Our results show that the contribution of tobacco commodity to the economy is overstated. Therefore, the comprehensive and massive tobacco control implementations should be undertaken hence is relevant to put into actions.

Keywords: Tobacco- Indonesia- Price Band- GDP- Inflation- Unemployment- ARMA

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Introduction

Academics have thoroughly investigated how commodities affect the economy. Some examples from recent papers discuss how commodities trigger economic growth (De V. Cavalcanti et al., 2015) and global economic activity (Mont'Alverne Duarte et al., 2021), affect real GDP (Charfeddine and Barkat, 2020), and contribute to real and nominal shocks (Kim and Zhang, 2020). However, none of them try to explore how tobacco, a hot commodity, affects the economy. This is surprising because tobacco has a huge market size. The US market size of tobacco was more than 30 billion USD in 2011 (Zheng et al., 2017), whereas the global market size in 2018 was estimated at around 814 billion USD (British American Tobacco, 2020).

Tobacco's sector contribution has been positive to the economy in many tobacco-producing countries. In China, out of the seven food industries with significant market power, the tobacco industry has the largest return to scale to the economy (Dai et al., 2018). Moreover, in an even smaller producer such as Malawi, a positive shock to tobacco prices yielded a positive return to the country's GDP (Bangara and Dunne, 2018). This also applies to

Zimbabwe, in which tobacco remains a predominant sector of the country's economy (Newfarmer and Pierola, 2015).

Despite some supporting research showing positive tobacco's contribution to the economy, recent pieces of literature also provide counterfactual evidence. The study in Bangladesh using hypothetical scenarios on tobacco-free economy found that tobacco consumption reduction is beneficial to the GDP (Husain and Khondker, 2016). In addition, previous research also provides evidence on the indirect negative economic impact of tobacco, primarily through health effects. The study in 27 industrialized countries showed that tobacco and alcohol contribute more to mortality and the loss of potential years of life lost (PYLL) (Park and Nam, 2019). The same even applied for a developed country in which a study in Belgium found that a hypothetical reduced tobacco use scenario could increase the healthy life years as well as decreasing unhealthy life-years among adults (Otavova et al., 2019).

In this paper, we analyze the relationship between tobacco and economic indicators. We construct our methods more robust in two steps. First, we argue that a strong relationship must demonstrate that current tobacco variables provide useful information regarding future economic changes. While this relationship can

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be simply examined using the standard ordinary least squares (OLS) of lagged series, we need to overcome any possible endogeneity bias. We follow Liu et al. (2020) to verify that our inferences are relatively free from the bias (Liu et al., 2020). We argue that their work is important because they can partially solve the problem, namely Meese-Rogoff puzzle, on the economic models that produce less accurate forecasts than the random walk's benchmark. Second, we perform an estimation of the best data-generating process for the economic variables and tobacco variables. We follow Nguyen et al. (2020) in retrieving any evidence of whether those variables exhibit similar or different properties (Nguyen et al., 2020). Their method can strongly demonstrate whether commodities follow (or do not follow) stock markets. As tobacco is also a commodity, we argue that it is reasonable to follow their models into our empirical analysis.

The remaining paper is organized as follows: Section 2 provides an overview of the tobacco market. Section 3 describes the methods used to investigate the relationship between tobacco and the economy. Section 4 discusses the examined tobacco price bands and macroeconomic variables and presents the empirical results. The concluding comments are presented in Section 5.

Materials and Methods

Tobacco market

The history of tobacco commodity and tobacco farming could be traced long since est—6,000 BCE. Tobacco is a native American commodity which later introduced globally throughout the 15th to 17th centuries (Shafey et al., 2009). In the early tradition of indigenous Americans, tobacco leaves were either used for smoking or ceremonial and medicinal purposes before commercially traded as a commodity in the 17th century (Boriss and Kreith, 2007). The claim that tobacco could be utilized for medicinal purposes is believed to be one of the main reasons that tobacco and smoking culture later became easily accepted, and tobacco became a commonly grown commodity (Rowley, 2003).

Despite being widely traded globally for centuries, tobacco plants have mostly been solely utilized for cigarette manufacture following the smoking culture. The chemical reaction arising from burned cigarettes contains toxic, carcinogenic, and addictive substances that are harmful to health (Centers for Disease Control and Prevention, 2010). Hence, it became a somewhat controversial commodity. The negative stigma resulting from single tobacco use for a cigarette has undermined its unique features for alternative use. An essential and valuable part of tobacco is that it is an oilseed crop that can provide renewable resources for biofuel and biomass (Grisan et al., 2016). Moreover, as history suggested, when deservedly utilized, the tobacco plant might have some benefits for medicinal purposes, especially when the nicotine content is isolated (Charlton, 2004). Hence, given its current market size and marketability, especially in developing countries, tobacco, with its controversial nature but inherited distinctive features, would be an important commodity to be discussed.

The tobacco market is incredibly huge in certain areas in America – where it was originated – China, India, Indonesia, and some European and African countries. Unfortunately, the vast size is controlled by only a few companies globally, indicating an oligopoly practice in the industry. This is especially true following the fact that the current tobacco demand mainly comes from the cigarette manufacturing industry that only comprises a small number of world-leading companies. In 2019 alone, the size of the sale of five prominent tobacco companies shared 41.69% of the total global tobacco market, with Phillip Morris International (PMI) as the number one company having 14.2% of the full global size (Conway, 2020). Given that leading tobacco companies are operating under cigarette manufacturing, this would be a growing concern if tobacco utilization – which is found to be a multifunctional plant commodity – is about to be shifted shortly following tobacco control regulations.

The current issue in tobacco commodity trade in the past two decades emerged due to the global agreement on the Framework Convention on Tobacco Control (FCTC). FCTC, a global measure to control cigarette consumption and increase public health quality, eventually reduces demand for tobacco commodity and, hence, has an inherent effect on the worldwide tobacco market. Since the implementation of FCTC in 2005, the world tobacco use prevalence has shown a significant decrease from 29.68% in 2007 to 23.83% in 2018 (World Bank, 2021). The decreasing demand for cigarettes simultaneously reduces the industry's need for a tobacco plant (Suprihanti et al., 2018). In the recent decade, global tobacco production has been declining after reaching its peak in 2012, with consistent trends in significant tobacco-producing countries like China, India, and Brazil (Shah et al., 2019). Nevertheless, some small developing countries such as Zimbabwe and Mozambique still highly dependent on tobacco as one of their priority commodities (Lown et al., 2016; Labonté et al., 2018). In a sense that numbers of farmers and workers are still relying on the tobacco industry, the government tobacco control efforts – that have been argued to lead to a decreasing in certain groups' welfare – remain debatable. This made tobacco an important commodity to be studied. Given its negative impact on health and its allegedly positive contribution to the economy, the tobacco commodity will be a unique commodity to be discussed.

The debates on tobacco as an agricultural commodity involved multisectoral policymakers as well as the tobacco industry. It is in the public health sector's interest to reduce tobacco production. On the other hand, this invited conflicting views of the economic stakeholders believing that tobacco has a positive contribution to the economy. This problematic issue leads to the difficulty in achieving a consensus on tobacco control efforts among the stakeholders in some developing countries like Indonesia. Therefore, to study how important the tobacco role as a commodity to the economy it would be a strategic issue in mending the policymaking domain.

How tobacco affect macroeconomic variables?

We closely follow Liu et al. (2020) in analyzing

whether tobacco affect macroeconomic variables. First, we begin by performing the standard OLS regression as follow:

$$\Delta M_t = \alpha + \beta \Delta TC_{t-1} + \epsilon_t \quad (1)$$

where ΔM denotes the change in the macroeconomic variables, ΔM refers to the change in the tobacco prices. We apply the Newey-West method to compute the standard errors to account for the serial correlation. Then, we do a test whether our estimates are relatively from the endogeneity bias (Stambaugh, 1999) as follows:

$$\Delta TC_t = \rho \Delta TC_{t-1} + \epsilon_t \quad (2)$$

$$\epsilon_t = \gamma \epsilon_t + \eta_t \quad (3)$$

If we fail to reject the null hypothesis ($H_0: \gamma = 0$), we can conclude that there is no endogeneity bias.

Do tobacco exhibit financialization or hedging?

We closely follow Nguyen et al. (2020) in analyzing whether tobacco exhibit financialization or hedging. First, we use ARMA(2,2), following their observation that certain commodities' level depends on the level of their 2 months lagged observations only. We follow the standard Box-Jenkins procedure to select the best ARMA model for tobacco.

$$\Delta M \text{ or } TC_t = \varphi_0 + \sum_{i=1}^2 \varphi_i \Delta M \text{ or } TC_{t-i} + \xi_t + \sum_{j=1}^2 \theta_j \xi_{t-j} \quad (4)$$

Then, we compare the estimates of ARMA class of tobacco with those of macroeconomic variables. If tobacco exhibit similar ARMA coefficients, we can conclude that they are financialized into the macroeconomic variables. Integration means that a commodity is financialized. Financialization implies that tobacco integrates into macroeconomics variables, whereas hedging implies that tobacco does not integrate into the macroeconomic variables.

A robustness check: seemingly unrelated regression (SUR)

We realize that relatively small series in Indonesia and global (proxied by USA and Asian) markets might cause concern in our inferences. Therefore, we perform longitudinal data analysis for a number of Asian countries (including Indonesia but excluding USA) in equation (1). It is not unusual to see linkages in commodity cross-markets (Adhikari and Putnam, 2020). Among Asian tobacco markets, we could reasonably expect that the error terms are correlated across equations (McGregor, 2017). A possible economic explanation can be found in (Parajuli et al., 2018). While each Asian tobacco market operates somewhat independently, the trade policy and market events for tobacco might influence all markets contemporaneously. Indeed, a comparison between OLS and SUR analyzes in commodity markets has been performed by (Chen et al., 2018). We strongly believe that our SUR analysis will improve the quality of our inferences.

Data and Empirical Analysis

We use the annual series from 2006 to 2019 of GDP growth (GGDP), inflation (INFL), unemployment (UEMP), economy price band growth (EG), mid-price band growth (MG), and premium price band growth (PG) for Indonesia (INA) and USA (USA). For our robustness checks, we include those six variables (GGDP, INFL, UEMP, EG, MG, and PG) for a number of Asian countries: Azerbaijan (AZE), China (CHN), Hong Kong (HKG), India (IND), Japan (JPN), Malaysia (MYS), Pakistan (PAK), Singapore (SGP), South Korea (KOR), Thailand (THA) and Vietnam (VNM). We obtained those series from Euromonitor International and World Bank.

Results

Table 1 reports the parameter estimation results (coefficient and t-statistics) obtained from equation (1) between GGDP, INFL, UEMP and EG, MG, PG for INA and USA. We observe that in Indonesia (INA), most of the lagged one price band categories tend not to affect macro-economic variables. Only premium price band strongly affects unemployment. This indicates that tobacco does not have a significant impact on future Indonesia's economy. The results are different in the USA tobacco and economy. In the USA, tobacco tends to significantly affect the economy. Strong results are observed for the unemployment indicator. Mid and premium price bands negatively affect unemployment, whereas economy price band positively affect unemployment.

Table 2 reports the parameter estimation results (coefficient and t-statistics) obtained from equation (3) to test the possible endogeneity bias between each macroeconomic variable (GGDP, INFL, and UEMP) and category price band (EG, MG, and PG). We observe that most price band categories, both in Indonesia and USA, do not exhibit endogeneity bias. Only a few relationships (GGDP-PG, UEMP-EG, and UEMP-MG) suffer from the bias. Like Liu et al. (2020), our tobacco model of the economy tends to be immune from the problem of endogeneity.

Table 3 reports the coefficients for the estimated ARMA(2,2) models for series of three different categories of price band and three different macroeconomics indicators. In Indonesia, we observe that both EG and PG exhibit similar patterns to UEMP. This finding indicates that economy and premium price bands might affect UEMP in the same year. Again, we do not find any evidence that any price band affects the GGDP.

Table 4 reports the parameter estimation results (coefficient and t-statistics) obtained from equation (1) using the seemingly unrelated regression (SUR) longitudinal analysis between GGDP, INFL, UEMP and EG, MG, PG for the 12 Asian countries. The results show that the price bands do not affect GDP growth (GGDP) and unemployment (UEMP). However, PG and MG have a significant effect on inflation (INFL) in Asian countries. This shows that if the logarithm of the price of MG increases by 1 unit, inflation in Asia will increase by 0.08, provided that the other independent variables are constant. Likewise, if PG increases by 1 logarithm unit, inflation in

Table 1. Parameter Estimation Results (Coefficient and t-Statistics) for Equation (1) †

| Equation (1): $\Delta M_t = \alpha + \beta \Delta TC_{t-1} + \epsilon_t$ | | | | | |
|--------------------------------------------------------------------------|-------|--------|---------------|-------|--------|
| Variable | Coef | t-Stat | Variable | Coef | t-Stat |
| GGDP-EG (INA) | 0.09 | 2.44 | GGDP-EG (USA) | 0.04 | 6.39 |
| α | 0.09 | 2.44 | α | 0.04 | 6.39 |
| β | 0.32 | 0.79 | β | -0.12 | -1.63 |
| GGDP-MG (INA) | 0.13 | 2.23 | GGDP-MG (USA) | 0.03 | 2.04 |
| α | 0.13 | 2.23 | α | 0.03 | 2.04 |
| β | -0.77 | -1.29 | β | -0.08 | -1.45 |
| GGDP-PG (INA) | 0.08 | 2.79 | GGDP-PG (USA) | 0.04 | 6.56 |
| α | 0.08 | 2.79 | α | 0.04 | 6.56 |
| β | 0.58 | 1.12 | β | 0.13 | 1.81 |
| INFL-EG (INA) | 0.05 | 4.6 | INFL-EG (USA) | 0.02 | 6.75 |
| α | 0.05 | 4.6 | α | 0.02 | 6.75 |
| β | -0.08 | -0.62 | β | -0.01 | -0.15 |
| INFL-MG (INA) | 0.05 | 7.19 | INFL-MG (USA) | 0.01 | 2.91 |
| α | 0.05 | 7.19 | α | 0.01 | 2.91 |
| β | 0.13 | 1.47 | β | -0.06 | -3.11 |
| INFL-PG (INA) | 0.05 | 6.87 | INFL-PG (USA) | 0.02 | 4.77 |
| α | 0.05 | 6.87 | α | 0.02 | 4.77 |
| β | 0.08 | 0.95 | β | 0.09 | 1.58 |
| UEMP-EG (INA) | 0.05 | 13.32 | UEMP-EG (USA) | 0.04 | 7.09 |
| α | 0.05 | 13.32 | α | 0.04 | 7.09 |
| β | 0.05 | 1.68 | β | -0.22 | 2.11 |
| UEMP-MG (INA) | 0.05 | 14.26 | UEMP-MG (USA) | 0.04 | 3.58 |
| α | 0.05 | 14.26 | α | 0.04 | 3.58 |
| β | 0.04 | 0.72 | β | -0.22 | -4.34 |
| UEMP-PG (INA) | 0.05 | 13.55 | UEMP-PG (USA) | 0.05 | 3.66 |
| α | 0.05 | 13.55 | α | 0.05 | 3.66 |
| β | 0.12 | 2.56 | β | -0.5 | -3.98 |

†Obtained from equation (1) between GGDP, INFL, UEMP and EG, MG, PG for INA and USA

Asian countries will increase by 0.04 units. Overall, our robustness test, as reported in Table 3, further justifies our previous results (Tables 1 and 2), demonstrating that tobacco variables tend not to affect the economy.

Discussion

Overall, we can conclude that 1. Tobacco tends to affect USA's future economy but not Indonesia. This finding refutes the claim that Indonesia's tobacco significantly contributes to the economy. 2. Mid and premium price bands tend to reduce future unemployment

Table 2. Parameter Estimation Results (Coefficient and t-statistics) for Equation (3) †

| Equation (3): $\epsilon_t = \gamma \epsilon_t + \eta_t$ | | | | | |
|---------------------------------------------------------|-------|--------|---------------|-------|--------|
| Variable | Coef | t-Stat | Variable | Coef | t-Stat |
| GGDP-EG (INA) | 0.64 | 1.26 | GGDP-EG (USA) | -0.1 | -0.98 |
| GGDP-MG (INA) | -0.54 | -0.88 | GGDP-MG (USA) | 0.12 | 1.64 |
| GGDP-PG (INA) | 0.13 | 0.19 | GGDP-PG (USA) | 0.36 | 2.21 |
| INFL-EG (INA) | 0.1 | 1.19 | INFL-EG (USA) | -0.06 | -0.86 |
| INFL-MG (INA) | 0.15 | 1.62 | INFL-MG (USA) | 0.04 | 0.82 |
| INFL-PG (INA) | 0.1 | 0.95 | INFL-PG (USA) | 0.12 | 1.04 |
| UEMP-EG (INA) | 0.05 | 0.78 | UEMP-EG (USA) | 0.18 | 2.01 |
| UEMP-MG (INA) | -0.02 | -0.3 | UEMP-MG (USA) | -0.15 | -2.44 |
| UEMP-PG (INA) | 0.07 | 1.05 | UEMP-PG (USA) | -0.02 | -0.12 |

†Obtained from equation (3) to test the possible endogeneity bias between each macroeconomic variable (GGDP, INFL, and UEMP) and category price band (EG, MG, and PG).

Table 3. The Coefficients for the Estimated ARMA(2,2) Models†

| | ϕ_1 (t-Stat) | ϕ_2 (t-Stat) | ξ_1 (t-Stat) | ξ_2 (t-Stat) | ϕ_0 (t-Stat) |
|------------|-------------------|-------------------|------------------|------------------|-------------------|
| EG (INA) | 0.45 (1.27) | -0.21 (-0.69) | -0.73 (-2.76) | 1.00 (2.93) | 0.01 (0.56) |
| MG (INA) | -0.52 (-1.23) | 0.13 (0.34) | 0.93 (2.33) | 0.56 (.168) | 0.04 (2.37) |
| PG (INA) | 0.30 (0.72) | -0.10 (-0.35) | -0.49 (1.54) | 1.00 (3.33) | 0.03 (1.87) |
| EG (USA) | -0.21 (-0.30) | -0.38 (-0.80) | 0.66 (0.92) | 1.00 (2.05) | 0.00 (0.07) |
| MG (USA) | 0.90 (0.92) | -0.23 (-0.27) | -0.80 (0.74) | -0.20 (-0.18) | -0.12 (-15.10) |
| PG (USA) | 0.63 (3.43) | -0.96 (-11.56) | -0.42 (-1.27) | 1.00 (1.23) | -0.04 (-7.00) |
| GGDP (INA) | -1.18 (-2.05) | -0.38 (-0.71) | 1.64 (0.82) | 0.95 (0.42) | 0.11 (2.83) |
| INFL (INA) | 0.28 (0.69) | 0.28 (0.72) | 0.00 (0.00) | 0.84 (1.26) | 0.07 (3.73) |
| UEMP (INA) | 1.91 (25.39) | -0.97 (-17.99) | -1.23 (-2.37) | 0.23 (0.52) | 0.06 (7.94) |
| GGDP (USA) | 1.05 (2.11) | -0.54 (-1.24) | -1.01 (-1.55) | 0.01 (0.02) | 0.04 (19.35) |
| INFL (USA) | 0.76 (0.81) | -0.20 (-0.27) | -0.95 (-0.93) | -0.05 (-0.05) | 0.02 (12.98) |
| UEMP (USA) | 15 (30) | 0.27 (0.62) | 1.34 (1.74) | 0.86 (1.00) | 0.06 (5.40) |

†For series of three different categories of price band and three different macroeconomics indicators

Table 4. Parameter Estimation Results (coefficient and t-statistics)†

| | Coef (t-stat) α | Coef (t-stat) β |
|-----------------|---------------------------|--------------------------|
| GGDP-EG (Asian) | 0.47 (0.60) | 3.80 (1.32) |
| GGDP-MG (Asian) | 0.59 (0.75) | 4.97 (0.87) |
| GGDP-PG (Asian) | 0.49 (0.61) | 1.93 (0.56) |
| INFL-EG (Asian) | 0.04 (12.39) | -0.02 (-1.62) |
| INFL-MG (Asian) | 0.04 (12.68) | 0.08 (3.46) |
| INFL-PG (Asian) | 0.04 (11.69) | 0.04 (2.62) |
| UEMP-EG (Asian) | 0.04 (27.86) | 0.00 (0.02) |
| UEMP-MG (Asian) | 0.04 (28.25) | 0.01 (1.55) |
| UEMP-PG (Asian) | 0.04 (27.73) | -0.01 (-0.97) |

†Obtained from equation (1) between GGDP, INFL, UEMP and EG, MG, PG for 12 Asian countries using the seemingly unrelated regression (SUR) longitudinal analysis

in the USA's economy.

We are strongly convinced that tobacco tends not to contribute to Indonesia's economic growth. On the other hand, in USA, we document that MG (PG) exhibits similar patterns to INFL (GGDP). Note that we might ignore GGDP and PG's relationship in the USA because it has an endogeneity problem (see Table 1: Bottom panel). These findings demonstrated that the mid price band might contribute to the price level increase, whereas the premium price band might contribute to the USA's economic growth.

The proponents of tobacco have a long-acclaimed number of arguments to support the tobacco commodity trade. One of the most widely argued claims is that tobacco is a crucial commodity for the economy, and hence, any tobacco control effort will be a backfire to the economy (Warner, 2000). The proponent of tobacco strongly believes that tobacco provided the nation with a vast job opportunity in manufacturing sectors, prospering the tobacco farmers and the nation's agricultural sector, as well as majorly contributing to the country's income through tax and tobacco trade.

The finding of this study serves as an opponent to the

commonly believed myth that tobacco is an important commodity to the economy. Given the different settings for tobacco commodity under different circumstances, tobacco will only be an important macroeconomic contributor to certain country while remain insignificant to other. Comparing USA and Indonesian case, this study shows that the claim of tobacco's importance to the economy is not one-size-fits-all argument.

Our analysis includes both lagged and current variables. In the lagged variable analysis, we control both the serial correlation and endogeneity bias problems. We observe the properties in the ARMA(2,2) data generating process in the current variable analysis. We document that tobacco tends to affect USA's future economy but not Indonesia. Our findings suggest that we shall refute the claim that Indonesia's tobacco significantly contributes to the economy. Our analysis is robust to the serial correlation and endogeneity issues. Examining the ARMA(2,2) stylized facts, we find that certain price bands might contribute to USA's economy but not Indonesia. We conclude that tobacco tends not to contribute to Indonesia's economic growth.

We perform a robustness check by conducting longitudinal data analysis for a number of Asian countries. We perform a SUR analysis to factor contemporaneously correlations among Asian markets. In this SUR analysis, we further document that tobacco variables tend not to affect the economy. Our finding implies that our results are consistent not only in the Indonesian market but also in Asian markets.

This study signifies essential policy implications, especially in the case of Indonesia. Countries need to control tobacco, including strong enforcement rigorously. However, as Indonesia is one of the major tobacco-producing countries, tobacco control measures raised a conflicting interest, especially from the tobacco industry's interference. As the evidence in this study suggested that tobacco commodity does not significantly contribute to the economy, a massive and comprehensive tobacco control actions, therefore, would not be a threat to the economy and hence is relevant to be vastly implemented.

Author Contribution Statement

All authors have reviewed and approved the final manuscript. AA, RH, and DWRS conceptualized the study. RH, MH, and KM collected the necessary data for the study. RH and MH conducted the econometric analysis. RH and NA wrote the manuscript.

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Conflict of Interest

The authors declare no conflict of interest.

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