Summary
A New Approach for Mediation Analysis: Is Baron and Kenny's Method Still Valid?

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Baron and Kenny's (1986) causal steps approach has been widely used by scholars in mediation analyses. Yet, recently, some scholars have begun to argue that Baron and Kenny's approach is not an appropriate method for mediation analysis (Fritz and MacKinnon, 2007; Gürbüz, 2021; Hayes, 2018). Instead, the use of contemporary methods based on bootstrapping would yield more valid and reliable results in the analysis of mediation models (Fritz and MacKinnon, 2007; Gürbüz, 2021; Hayes, 2018; Hayes and Rockwood, 2017; Preacher and Selig, 2012; Williams and MacKinnon, 2008). Methodical studies on the differences between these two approaches are scarce. The aim of the present study is to (1) discuss the basic assumptions of both the causal steps approach and the contemporary approach in mediation analysis (2) to show the differences between the results of the two competing approaches by using real data set.

Theoretical Background
Simple Mediation Model: Direct Effect, Indirect Effect, and Total Effect

A simple mediation model consists of one independent variable (X) and one dependent variable (Y) as well as one mediator variable (M). The mediator variable carries or conveys the effect of the independent variable to the dependent variable (Gürbüz, 2021; Gürbüz and Şahin, 2018). Working as a mechanism between the dependent and the independent variable, the mediator variable help explain the independent variable's effect on the dependent variable (Baron & Kenny, 1986). The mediator variable helps explore the mechanism of how and why the relationship between the independent and dependent variables occurs. In a simple mediation model (Figure 1), the direct effect (c') is the effect of X on Y while controlling for M, the indirect effect ($a.b$) is the effect of X on Y carried by M, and finally the total effect (c) is the effect of X on Y or the sum of the direct effect and the indirect effect.
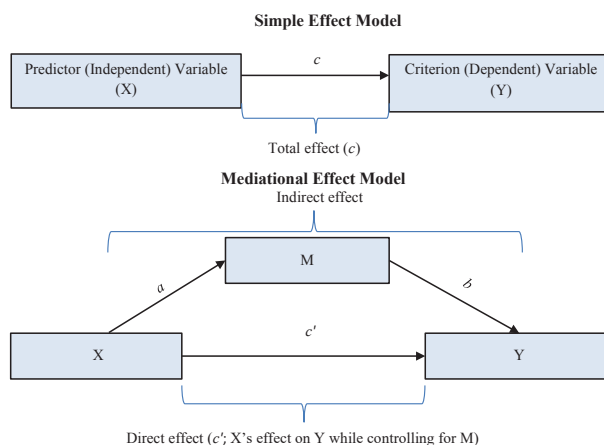

Figure 1. Simple Mediation Model and effects

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Traditional Approach in Mediation Analysis: Baron and Kenny Method

According to Baron and Kenny (1986), a proposed mediation model must meet several requirements to be statistically supported. Also known as the traditional approach, the causal steps approach (i.e., the Baron and Kenny method) requires the completion of the steps described below to test a mediation model (Baron and Kenny,1986). The former step(s) is (are) the prerequisite(s) of the conducting of the forthcoming step(s).

1. X must predict Y significantly (path *c*),
2. X must predict M significantly (path *a*),
3. When X and M are both added to the regression model, M must predict Y significantly (path *b*). In this third regression model, if it would be found that the relationship between X and Y turns out not to be significant, it is concluded that there is full mediation. On the other hand, if it would be found that the relationship between X and Y is significant but there is a decrease in the amount of the relationship, it is concluded that there is partial mediation (Baron and Kenny,1986; Gürbüz and Şahin, 2018).

Criticism by Contemporary Scholars for Baron and Kenny's Causal Steps Approach

Contemporary scholars criticize the causal steps approach popularized by Baron and Kenny (1986). According to those scholars, the traditional approach has some flaws that cannot be acceptable in scientific studies. First, the decision of the existence of an indirect effect is reached by conducting a set of null hypothesis tests which have a high potential of Type I (α) or Type II (β) errors (Hayes, 2018). But contemporary scholars suggest that the test of the mediation analysis be based on and focus on directly the indirect effect of X on Y via M (e.g., Gürbüz, 2021; Fritz and MacKinnon, 2007; Preacher and Hayes, 2004). Second, there is no need to test and prove the presence of the effect of X on Y when testing the mediation models (total effect; path *c*). Even when the total effect is not statistically different from zero, X may have an indirect effect on Y via M, that is, there may be an indirect effect even in the absence of the total effect (Cerin and MacKinnon, 2009; Gürbüz, 2021; Hayes, 2009; MacKinnon, 2008; Rucker, Preacher, Tormala, and Petty, 2011; Shrout and Bolger, 2002; Zhao, Lynch, and Chen 2010). Third, Sobel Test (Sobel, 1982) is argued to be rigid and unreliable (MacKinnon, Lockwood, and Williams, 2004). Fourth, the description of full mediation and partial mediation is not appropriate for the mediation analysis (Darlington & Hayes, 2018; Rucker et al., 2011).

Contemporary or New Approach for Mediation Analysis

The contemporary approach for mediation analysis has different argumentations for testing mediational hypotheses (Fritz and MacKinnon, 2007; Gürbüz, 2021; Hayes, 2018; MacKinnon, Lockwood, Hoffman, and West, 2002; Preacher and Hayes, 2004).

1. There is no need or the total effect (*c*) to be statistically significant. Although the total effect is not statistically significant, the indirect effect can be statistically significant.
2. It is not necessary that the effect of X on M (path *a*) is statistically significant.
3. It is not necessary that the effect of M on Y (path *b*) when controlling for X is statistically significant.
4. The description of full mediation and partial mediation is not appropriate. The quantification of the effects of direct, indirect, and total effects is more appropriate for the description of the nature of the mediation models.
5. The direct effect and the total effect may be statistically insignificant while the indirect effect is statistically significant. So, the insignificance of the direct effect and/or the total effect is not related to the conclusion of whether the mediation model is statistically significant.
6. The significance of indirect effect should be tested by bootstrapping (or at least Monte Carlo method; Preacher and Selig, 2012), and the Sobel Test should be abandoned.
7. To reach a conclusion of the significance of a mediation model, the only requirement is the approval of a significant indirect effect. If the product of a and *b* (*a.b*) is statistically significant as the result of the bootstrapping, we can conclude that the mediation model we test is statistically significant. There are no additional requirements.

Method

Sample

In the current study, we followed two approaches (i.e., the causal steps approach and the contemporary approach) separately to contrast and compare the mediation analysis results by using real data set borrowed from an empirical study by Pollack, Vanepps, and Hayes (2012) published in *The Journal of Organizational Behavior* (Hayes, 2019b). Pollack et al. (2012) collected the data from 262 participants and measured the participants' economic stress about the current economy, their depressive affect and finally their entrepreneurial withdrawal
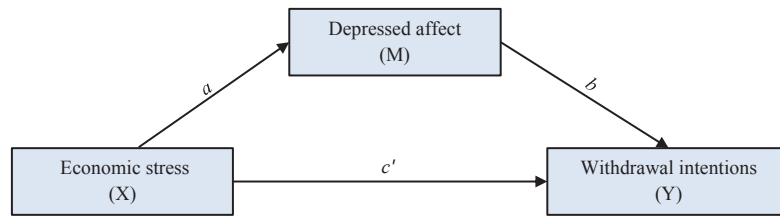
Figure 2. Mediation Model in Pollack et al.'s (2012) study

intentions. They hypothesized that economic stress (X) results in an inclination to withdraw from entrepreneurial activities (Y) as well as this relationship is mediated by the entrepreneurs' depressed affect (M) which is produced by the economic stress. In other words, the experience of stress results in feelings of depressed affect, and the depressed affect leads to the intention to withdraw from entrepreneurial activities.

Materials

Economic stress. Pollack et al. (2012) used a 2-item measure to assess economic stress (sample item: "How has the recent economic climate affected your business?") by using a 7-point scale that ranged from 1 (very negatively) to 7 (very positively).

Depressed affect. Pollack et al. (2012) measured the depressed affect by six items adapted from the Multiple Affect Adjective Check List (MAACL; Lubin, Zuckerman, and Woodward, 1985) (sample item: "Regarding your business, over the past year, did you experience any of the following emotions?") with a 5-point scale that ranged from 1 (not at all) to 5 (extremely).

Withdrawal intentions. Pollack et al. (2012) created a 3-item scale (sample item: "avoid entrepreneurial positions,") to assess entrepreneurs' intentions about whether to continue working as an entrepreneur in the next year using a 7-point scale that ranged from 1 (strongly disagree) to 7 (strongly agree).

The detailed information on the instruments used to collect data can be found in Pollack et al. (2012). The-

oretical model of the mediational model is depicted in Figure 2.

Procedures and Analytical Approaches

In the current study, we conducted two separate mediation analyses by following two separate approaches. In order to test the proposed mediation model by following the procedures of Baron and Kenny (1986), we used IBM SPSS 23. We also conducted mediation analyses following the procedures of the contemporary approach by using IBM SPSS PROCESS macro (Hayes, 2018, 2019a; Hayes and Matthes, 2009; Preacher, Rucker, and Hayes, 2007).

Results

The descriptive statistics are presented in Table 1. The reliability coefficients can be derived from Pollack et al. (2012).

We tested the proposed simple mediation model firstly by following Baron and Kenny's (1986) causal steps approach. According to Baron and Kenny (1986), the first step is to test whether there is a statistically significant relationship between the predictor variable (X; economic stress) and the criterion variable (Y; withdrawal intentions) by conducting a regression analysis. The result of the first step regression analysis is presented in Table 2. As is seen, the resulting coefficient of the relationship between the two variables is not significant ($B = .056$, $p > .05$), suggesting that there is no need/necessity

Table 1. Descriptive Statistics and Correlations (n = 262)

Variables	M	SD	1	2	3
1. Economic stress	4.62	1.42			
2. Depressive affect	1.60	.72	.34**		
3. Withdrawal intentions	2.32	1.25	.06	.42**	

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 2. Causal Steps Approach (First Step Regression Analysis Results) (n = 262)

		Withdrawal intentions (Y)	
		Coeff.	S.E.
Economic stress (X)	c	.056	.054
Constant	i_Y	2.062***	.262
		$R^2 = .04$	
		$F (1; 260) = 1.072; p = .302$	

*Note 1. *p < .05, **p < .01, ***p < .001*
Note 2. S. E.: Standard Error

to conduct the second step and that there is not any effect of X on Y that can be mediated. According to the causal steps approach, we should stop the mediation analysis and conclude that the proposed mediation model is not significant.

The proposed simple mediation model secondly is tested by following a contemporary approach with 5000 re-sampling bootstrapping. The result of the mediation analysis followed by the contemporary approach is shown in Table 3. According to SPSS PROCESS output using bootstrapping; the direct effect is not significant ($c' = -.077$; $t [259] = -1.467$; $p = .144$; BootLLCI $= -.180$, BootULCI $= .026$) as well as the total effect is not significant ($c = c' + a.b = -.077 + .133 = .056$; $t [260] = 1.035$; $p = .302$; BootLLCI $= -.051$, BootULCI $= .163$), but the indirect effect ($a.b = .173 * .769 = .133$) is significant ($a.b = .133$; BootLLCI $= .0719$, BootULCI $= .201$). As the result of the contemporary mediation analysis approach, we conclude that the indirect effect

of economic stress on entrepreneurs' withdrawal intentions is significant, and that, regardless of the insignificant total effect (c) of economic stress on withdrawal intentions we can conclude that the proposed mediation model is significant (i.e., depressed affect mediates the relationship between economic stress and withdrawal intentions). The resulting indirect effect value ($a.b = .133$) can be interpreted as two individuals who differ by one unit in economic stress level are expected to differ by 0.133 units in their withdrawal intentions as the result of the inclination for those feeling more economic stress to have a more depressed affect (as a is positive), which in turn, leads to higher withdrawal intentions (as b is positive). In terms of completely standardized effects, it can be seen in the SPSS PROCESS output that the completely standardized indirect effect is .152 ($ab_{cs} = 0.152$), completely standardized direct effect is -.088 ($c'_{cs} = -0.088$), and finally completely standardized direct effect is .064 ($c_{cs} = 0.064$ or $c_{cs} = c'_{cs} + ab_{cs} = -0.088 + 0.152 = 0.064$).

Table 3. Contemporary Approach (Regression Analyses Results) (n = 262)

		Criterion Variables					
		Depressive affect (M)				Withdrawal intentions (Y)	
Criterion Variables		Coeff.	S.E.			Coeff.	S.E.
Economic Stress (X)	a	.173***	.030		c'	−.077	.052
Depressive affect (M)	−	−	−		b	.769***	.103
Constant	i_M	.799***	.143		i_Y	1.447***	.252
		$R^2 = .116$				$R^2 = .180$	
		$F (1; 260) = 33.999; p < .001$				$F (2; 259) = 28.495; p < .001$	

*Note 1. *p < .05, **p < .01, ***p < .001*
Note 2. S.E.: Standard Error

Based on the results obtained from the contemporary approach, the indirect effect was significant whereas the direct effect and the total effect were insignificant, revealing that depressed affect mediated the effect of economic stress on the withdrawal intentions.

Discussion

In this paper, we aimed to (2) discuss the basic assumptions of both the causal steps approach and the contemporary approach in mediation analysis and (2) use a real data set to compare these two methods. The logic of the causal stages approach has been employed in the great majority of published research in the past, however, its popularity has been waning among scholars.

Being insufficient for the test of complex mediation models, containing flaws in testing procedures and test results, imposing strict rules, unreliable and rigid nature of the Sobel Test are among the most substantive criticisms about Baron and Kenny approach. In psychological and behavioral sciences, the increasingly well-accepted mediation analysis approach is the contemporary approach, bootstrapping method (Bollen and Stine, 1990; Fritz and MacKinnon, 2007; Hayes, 2018; Hayes and Rockwood, 2017; MacKinnon, Fairchild and Fritz, 2007; MacKinnon et al., 2004; Shrout and Bolger, 2002; Preacher and Hayes, 2004, 2008b; Preacher and Selig, 2012; Williams and MacKinnon, 2008). According to the contemporary approach, if the product of a and b (a.b) is significant as the result of the bootstrapping analysis, we can conclude that the mediation model or the indirect is significant. There are no additional requirements.

The simple mediation model tested in the current study is found to be insignificant when we use Baron and Kenny method, but the same model is found to be significant when we follow the contemporary approach. If we had decided based on the result of the former approach (i.e., Baron and Kenny method), we would have reached a misleading result and would have concluded that our mediation model is not supported. As a result, it can be stated that it would be more appropriate to follow the rules of the contemporary approach rather than the causal steps approach, and to interpret as well as report the results of mediation analysis in accordance with the contemporary approach when conducting mediation analysis.

In agreement with others (Fritz and MacKinnon, 2007; Gürbüz, 2021; Hayes, 2018; Hayes and Rockwood, 2017; Preacher and Selig, 2012; Williams and MacKinnon, 2008), we propose that the indirect effects still can occur even the criteria (i.e., path a, path b, path c) of the causal stages approach are not met. Moreover, the criterion for a significant total effect of X on Y before analyzing indirect effects can be dropped. Thus, the product of a and b (a.b) is significant as the result of the bootstrapping analysis, we can conclude that the mediation model or the indirect is significant. However, we also suggest that linkage between X and M (a path) and the linkage between M and Y(b path) are especially useful for theoretically justifying research hypotheses during the hypothesis and theory development phase.