

# Did TARP Banks Get Competitive Advantages?

Allen N. Berger and Raluca A. Roman

## Internet Appendices

### Appendix X – Lerner Index Calculation

We proxy market power by the Lerner Index for GTA, and calculate it as observed price-cost margin divided by price (e.g., Lerner (1933), Brucker (1970), (1972), Benston (1972), de Guevara, Maudos, and Perez (2005), Berger, Klapper, and Turk-Ariss (2009), Jimenez, Lopez, and Saurina (2013)). The LERNER\_GTA is calculated as

$$(X.1) \quad \text{LERNER\_GTA}_{it} = \frac{\text{PRICE}_{it} - \text{MC}_{it}}{\text{PRICE}_{it}}$$

A firm in perfect competition has an index value of 0 and thus no market power (as PRICE = MC), while a firm with market power has a positive index.

We consider  $\text{PRICE}_{it}$  as the price of GTA proxied by the ratio of total revenues (interest and non-interest income) to GTA for a bank  $i$  at a time  $t$  and  $\text{MC}_{it}$  represents marginal cost of total assets for a bank  $i$  at time  $t$ . In order to get  $\text{MC}_{it}$  for each bank for each point in time, we take the derivative from the following estimated translog cost function:

$$(X.2) \quad \ln(\text{COST}_{it}) = \theta_0 + \theta_1 \ln \text{GTA}_{it} + \frac{\theta_2}{2} \ln \text{GTA}_{it}^2 + \sum_{k=1}^3 \gamma_k \ln W_{k,it} + \sum_{k=1}^3 \mathbf{f}_k \ln \text{GTA}_{it} \ln W_{k,it} \\ + \sum_{k=1}^3 \sum_{j=1}^3 \gamma_{kj} \ln W_{k,it} \ln W_{j,it} + \theta_3 \text{TIME}_t + \mu_{it},$$

where  $i$  represents banks and  $t$  represents time in quarters,  $\text{COST}_{it}$  is total operating plus financial costs,  $W_{k,it}$  represents input prices:  $W_{1,it}$  is the ratio of personnel expenses to GTA (proxy for input price of labor),  $W_{2,it}$  is the ratio of interest expenses to total deposits and money market funding (proxy for input price of all funds) and  $W_{3,it}$  is the ratio of other operating and administrative expenses to GTA (proxy for input price of fixed capital), and  $\text{TIME}_t$  is a vector of time fixed effects. The  $W_{k,it}$  are average prices in the market because we want to allow individual banks to have different prices to reflect their individual market power. To construct the input prices  $W_{k,it}$ , we calculate the weighted average of the input prices for all local markets in which the bank operates, where the weights are the ratios of the deposits of bank  $i$  in the local markets over the bank total deposits.<sup>1</sup> Marginal cost for GTA is finally determined as:

$$(X.3) \quad \text{MC}_{it} = \frac{\text{COST}_{it}}{\text{GTA}_{it}} \left[ \hat{\theta}_1 + \hat{\theta}_2 \ln \text{GTA}_{it} + \sum_{k=1}^3 \hat{\phi}_k \ln W_{k,it} \right]$$

where the  $\hat{\theta}$ 's indicate estimated coefficients

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<sup>1</sup> As an alternative method in unreported results, we construct the weighted average of the input prices using as weights the proportions of branches that banks have in the local markets in which they operate. Results are robust to this alternative method.

## Appendix Y – Other Robustness Tests

### *Y.1 Effects by Size Classes*

As discussed above, size may be a source of economic strength for a bank and could offer a better competitive position on the market, and thus effects of TARP may differ by bank size. We split the banks according to their size in GTA into three different classes: small banks ( $GTA \leq \$1$  billion), medium banks ( $\$1 \text{ billion} \leq GTA < \$3 \text{ billion}$ ) and large banks ( $GTA > \$3 \text{ billion}$ ) and create the following three size dummies: SMALL, MEDIUM, and LARGE. We interact these size dummies with the TARP\_RECIPIENT dummy and obtain the following interaction terms:  $SMALL \times TARP\_RECIPIENT$ ,  $MEDIUM \times TARP\_RECIPIENT$ ,  $LARGE \times TARP\_RECIPIENT$ . We then create interaction terms between the previously obtained variables and our POST\_TARP dummy:  $SMALL \times TARP\_RECIPIENT \times POST\_TARP$ ,  $MEDIUM \times TARP\_RECIPIENT \times POST\_TARP$ ,  $LARGE \times TARP\_RECIPIENT \times POST\_TARP$ . We similarly create variables for the two types of TARP banks.

We rerun our regressions using these new variables to understand the impact of various class sizes on our results. Table Y.1 Panel A, columns 1-2 present the results for the market share regressions and Table Y.1 Panel A, columns 3-4 show the results for market power. Table Y.1 Panel B reports results from a test for the equality of coefficients for the two types of TARP recipients. The regressions show that the greater the bank size, the higher the competitive advantage the TARP banks can obtain in terms of both market share and market power. When

splitting between TARP banks that repaid and those that did not, we find that for those banks that did not repay, again the greater the bank size the higher the competitive advantage of TARP banks. For banks that repaid, the results are again stronger for the large banks than for the small banks, but the results for the medium banks are mixed.

### *Y.2 Excluding Involuntary Participants*

Most of the banks voluntarily participated in the TARP program, however there are a few that were involuntary – they were required to participate in the program at its inception. We classify the following eight banks as involuntary participants: Citigroup, JP Morgan, Wells Fargo, Morgan Stanley, Goldman Sachs, Bank of New York, Bank of America, and State Street Bank.<sup>1</sup> Since we would like to ensure that our results are not driven by the involuntary participants, we rerun our analysis using a sample that excludes them in Table Y.2 Panel A, columns 1 - 4, and report the tests of equality between the two types of TARP groups in Panel E. The results are qualitatively similar to our main findings.

### *Y.3 Excluding Banks Subject to Stress Tests (SCAP and CCAR)*

The U.S. Banks 2009 Stress Tests aka Supervisory Capital Assessment Program (SCAP) was a mandatory program applied to 19 banking organizations with assets exceeding \$100 billion that

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<sup>1</sup> We exclude Merrill Lynch from the original 9 involuntary recipients because it is not a bank.

cover about 2/3 of U.S. banking assets and about half of loans.<sup>2</sup> It was conducted by Federal Bank Regulatory Agencies (FED, FDIC, OCC) from February 25, 2009 to late April 2009 and it was designed to ensure that large banking organizations had enough capital to withstand the recession and a more adverse scenario that might occur over the rest of 2009 and 2010. These organizations had to have or raise enough capital to meet capital requirements under a more adverse scenario, or else the Treasury would provide the capital. A possible consequence of the SCAP program was to essentially publicize that the 19 biggest banking organizations were too-big-to-fail (TBTF) to assure the public of the safety of the financial system. Given this special treatment of banks under SCAP, we worry that our competitive advantage for TARP banks might be driven by this subsample of banks. These same banking organizations were also subject to the Comprehensive Capital Analysis and Review (CCAR) stress tests in 2011 and 2012, which may also impact their competitive advantages. Therefore, we reestimate our regressions by using a sample which excludes banks that were subject to the SCAP and CCAR stress tests. Table Y.2 Panel B, columns 1 - 4 report the estimation results and Panel E reports the tests of equality between the two types of TARP groups. We find that our main results continue to hold.

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<sup>2</sup> These were 19 banks, including Bank of America, Citigroup, Goldman Sachs, JP Morgan Chase, Morgan Stanley, Wells Fargo, Bank of NY Mellon, BB&T, Fifth Third Bancorp, Keycorp, PNC Financial, Regions Financial, SunTrust Banks, U.S. Bancorp, Ally Financial, American Express Company, Capital One Financial, Metlife, and State Street.

#### *Y.4 Capitalization Ratio*

The level of capital a bank has prior to infusion can impact the competitive advantage that the TARP recipients can get. Banks with a higher level of capital prior to infusion may have a better ability to use the extra capital to expand and acquire less well capitalized peers (e.g., Berger and Bouwman (2013)). We group banks according to whether they had low equity to assets ratio ( $EQCAP\_08Q3 \leq 7\%$ ) or high capital ( $EQCAP\_08Q3 > 7\%$ ) before the TARP program started (2008:Q3) and regression estimates are shown in Table Y.2 Panel C, columns 1-8 and Panel E reports the tests of equality between the two types of TARP groups. Looking at the regression results, we find that only banks with a higher capitalization ratio gained competitive advantages in terms of market share and market power as indicated by the positive coefficients for the DID terms.

#### *Y.5. HHI*

We also group banks according to their local market concentration. This is proxied by HHI\_DEPOSITS for the local markets in which the bank is present. We consider three groups for the bank concentration: unconcentrated ( $HHI \leq 1,000$ ), moderately concentrated ( $1000 < HHI \leq 1,800$ ), and highly concentrated ( $HHI > 1,800$ ).

Our results for the three subsamples are reported in Table Y.2 Panel D, columns 1-12 and Panel E reports the tests of equality between the two types of TARP groups. Results suggest that the most competitive advantages given by TARP were gained by the banks in the highly

concentrated category, followed by the moderately concentrated category. Therefore, the more concentrated the local banking market, the higher increase in competitive advantage a bank gets.

**TABLE Y.1: Effects of TARP on Bank Competition by Size Class**

Table Y.1 reports tests for the impact of TARP on competition by bank size classes. We report difference-in-difference (DID) regression estimates for banks with interactions of the key terms with different bank sizes: SMALL (GTA  $\leq$  1 Billion), MEDIUM (1 Billion  $<$  GTA  $\leq$  3 Billion) and LARGE (GTA  $>$  3 Billion). The measures of competitive advantage are *Market Share* (proxied by LOCAL\_MARKET\_SHARE\_ASSETS) and *Market Power* (proxied by LERNER\_GTA). TARP\_RECIPIENT is a dummy variable equal to one if the bank was provided TARP capital support, POST\_TARP is a dummy equal to one in 2009-2012, the period after TARP program initiation. TARP\_RECIPIENT\_REPAID is a dummy equal to one if the bank repaid in 2009-2010. TARP\_RECIPIENT\_NOT\_REPAID, which is a dummy equal to one if the bank did not repay in 2009-2010. All models include time fixed effects. Panel C reports the tests of equality for the effects of TARP on two types of TARP banks: TARP banks that repaid early and TARP banks that did not. The estimation results are for 2005-2012. All variables are defined in Table 1. Robust *t*-statistics are reported in parentheses. \*, \*\*, and \*\*\* indicate significance at 10%, 5%, and 1% levels, respectively.

Panel A. *Regression parameters*

<i>Dependent Variable:</i>	<i>Market Share</i>		<i>Market Power</i>	
<i>Independent Variables:</i>	1	2	3	4
SMALL $\times$ TARP_RECIPIENT	-0.013*** (-13.318)		-0.025*** (-6.497)	
MEDIUM $\times$ TARP_RECIPIENT	-0.012*** (-10.216)		0.001 (0.133)	
LARGE $\times$ TARP_RECIPIENT	-0.005* (-1.821)		0.010 (1.205)	
SMALL $\times$ POST_TARP $\times$ TARP_RECIPIENT	0.001 (0.563)		0.022*** (4.264)	
MEDIUM $\times$ POST_TARP $\times$ TARP_RECIPIENT	0.007*** (5.388)		0.031*** (3.450)	
LARGE $\times$ POST_TARP $\times$ TARP_RECIPIENT	0.017*** (4.671)		0.111*** (11.467)	
SMALL $\times$ TARP_RECIPIENT_NOT_REPAID		-0.013*** (-13.120)		-0.025*** (-5.808)
MEDIUM $\times$ TARP_RECIPIENT_NOT_REPAID		-0.011*** (-8.601)		0.001 (0.192)
LARGE $\times$ TARP_RECIPIENT_NOT_REPAID		-0.017*** (-11.323)		-0.003 (-0.283)
SMALL $\times$ POST_TARP $\times$ TARP_RECIPIENT_NOT_REPAID		-0.000 (-0.096)		0.016*** (2.837)
MEDIUM $\times$ POST_TARP $\times$ TARP_RECIPIENT_NOT_REPAID		0.008*** (5.344)		0.026** (2.568)
LARGE $\times$ POST_TARP $\times$ TARP_RECIPIENT_NOT_REPAID		0.020*** (9.026)		0.130*** (8.944)



SMALL × TARP_RECIPIENT_REPAID	-0.013***			-0.029***
	(-4.182)			(-3.745)
MEDIUM × TARP_RECIPIENT_REPAID	-0.015***			-0.000
	(-8.624)			(-0.033)
LARGE × TARP_RECIPIENT_REPAID	0.007			0.022**
	(1.609)			(2.100)
SMALL × POST_TARP × TARP_RECIPIENT_REPAID	0.009*			0.075***
	(1.705)			(6.449)
MEDIUM × POST_TARP × TARP_RECIPIENT_REPAID	0.003			0.056***
	(1.303)			(3.103)
LARGE × POST_TARP × TARP_RECIPIENT_REPAID	0.013**			0.093***
	(2.081)			(7.361)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Time Fixed Effects</i>	Yes	Yes	Yes	Yes
<i>No. of obs.</i>	178,604	178,604	178,604	178,604
<i>Adj. R<sup>2</sup></i>	0.219	0.220	0.453	0.453

Panel B. *Tests of the Equality of the Effects of TARP for the Two Types of TARP Banks*

	<i>Market Share</i>	<i>Market Power</i>
<i>t-stat:</i>		
Effect for Small TARP Banks (GTA ≤ 1 Billion) that Repaid Early = Effect for Small TARP Banks (GTA ≤ 1 Billion) that Did Not Repay Early	1.685*	4.657***
<i>t-stat:</i>		
Effect for Medium TARP Banks (1 Billion < GTA ≤ 3 Billion) that Repaid Early = Effect for Medium TARP Banks (1 Billion < GTA ≤ 3 Billion) that Did Not Repay Early	1.828*	1.435
<i>t-stat:</i>		
Effect for Large TARP Banks (GTA > 3 Billion) that Repaid Early = Effect for Large TARP Banks (GTA > 3 Billion) that Did Not Repay Early	0.959	1.936*

**TABLE Y.2: Effects of TARP on Bank Competition: Subsamples Analysis**

Table Y.2 reports additional subsample tests for analyzing the impact of TARP on competition. Panel A columns 1-4 report difference-in-difference (DID) regression estimates from a sample that excludes involuntary participants. Panel B columns 1-4 report difference-in-difference (DID) regression estimates from a sample that excludes banks subject to stress-tests (SCAP and CCAR). Panel C columns 1-8 report difference-in-difference (DID) regression estimates for banks with low capitalization ( $EQCAP\_08Q3 \leq 7\%$ ) and high capitalization ( $EQCAP\_08Q3 > 7\%$ ). Panel D columns 1-12 report difference-in-difference (DID) regression estimates for banks with different local concentration: *Unconcentrated*, which represents banks for which HHI is below 1,000 points, *Moderately Concentrated*, which covers banks for which HHI is between 1,000 and 1,800 points, and *Highly Concentrated*, those for which the HHI is in excess of 1,800 points. The measures of competitive advantage are *Market Share* (proxied by LOCAL\_MARKET\_SHARE\_ASSETS) and *Market Power* (proxied by LERNER\_GTA). TARP\_RECIPIENT is a dummy variable equal to one if the bank was provided TARP capital support, POST\_TARP is a dummy equal to one in 2009-2012, the period after TARP program initiation. TARP\_RECIPIENT\_REPAID is a dummy equal to one if the bank repaid in 2009-2010. TARP\_RECIPIENT\_NOT\_REPAID, which is a dummy equal to one if the bank did not repay in 2009-2010. All models include time fixed effects. Panel E reports the tests of equality for the effects of TARP on two types of TARP banks: TARP banks that repaid early and TARP banks that did not. The estimation results are for 2005-2012. All variables are defined in Table 1. Robust *t*-statistics are reported in parentheses. \*, \*\*, and \*\*\* indicate significance at 10%, 5%, and 1% levels, respectively.

Panel A. *Excluding TARP Involuntary Participants*

<i>Dependent Variable:</i>	<i>Market Share</i>		<i>Market Power</i>	
<i>Independent Variables:</i>	1	2	3	4
TARP_RECIPIENT	-0.013*** (-16.679)		-0.022*** (-6.518)	
POST_TARP × TARP_RECIPIENT	0.004*** (4.324)		0.037*** (8.801)	
TARP_RECIPIENT_NOT_REPAID		-0.013*** (-16.035)		-0.023*** (-6.195)
TARP_RECIPIENT_REPAID		-0.013*** (-7.299)		-0.012** (-1.997)
POST_TARP × TARP_RECIPIENT_NOT_REPAID		0.003*** (3.023)		0.029*** (6.006)
POST_TARP × TARP_RECIPIENT_REPAID		0.010*** (4.160)		0.080*** (10.051)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Time Fixed Effects</i>	Yes	Yes	Yes	Yes
<i>No. of obs.</i>	178,408	178,408	178,408	178,408
<i>Adj. R<sup>2</sup></i>	0.223	0.223	0.452	0.452

Panel B. *Excluding Banks Subject to the Stress Tests (SCAP and CCAR)*

<i>Dependent Variable:</i>	<i>Market Share</i>		<i>Market Power</i>	
<i>Independent Variables:</i>	1	2	3	4
TARP_RECIPIENT	-0.013*** (-16.529)		-0.022*** (-6.463)	
POST_TARP × TARP_RECIPIENT	0.004*** (4.075)		0.036*** (8.410)	
TARP_RECIPIENT_NOT_REPAID		-0.013*** (-15.921)		-0.023*** (-6.138)
TARP_RECIPIENT_REPAID		-0.013*** (-7.107)		-0.012** (-2.099)
POST_TARP × TARP_RECIPIENT_NOT_REPAID		0.003*** (2.920)		0.028*** (5.768)
POST_TARP × TARP_RECIPIENT_REPAID		0.009*** (3.774)		0.079*** (9.753)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Time Fixed Effects</i>	Yes	Yes	Yes	Yes
<i>No. of obs.</i>	178,101	178,101	178,101	178,101
<i>Adj. R<sup>2</sup></i>	0.223	0.223	0.452	0.452

Panel C. *Subsamples by Capitalization Level (EQCAP\_08Q3)*

<i>Dependent Variable:</i>	<i>Market Share</i>				<i>Market Power</i>			
	1	2	3	4	5	6	7	8
	<i>Poorly Capitalized</i>		<i>Highly Capitalized</i>		<i>Poorly Capitalized</i>		<i>Highly Capitalized</i>	
<i>Independent Variables:</i>	EQCAP_08Q3 ≤ 7%		EQCAP_08Q3 > 7%		EQCAP_08Q3 ≤ 7%		EQCAP_08Q3 > 7%	
TARP_RECIPIENT	0.029***		-0.016***		0.040***		-0.026***	
	(4.483)		(-20.133)		(3.476)		(-7.599)	
POST_TARP × TARP_RECIPIENT	0.009		0.005***		-0.019		0.040***	
	(0.832)		(5.068)		(-1.206)		(9.285)	
TARP_RECIPIENT_NOT_REPAID		-0.005		-0.015***		0.043***		-0.027***
		(-1.383)		(-16.907)		(3.278)		(-7.223)
TARP_RECIPIENT_REPAID		0.122***		-0.021***		0.031		-0.013**
		(6.133)		(-18.753)		(1.615)		(-2.131)
POST_TARP × TARP_RECIPIENT_NOT_REPAID		0.003		0.003***		-0.014		0.030***
		(0.679)		(3.112)		(-0.794)		(6.212)
POST_TARP × TARP_RECIPIENT_REPAID		0.039		0.012***		-0.034		0.087***
		(1.159)		(7.723)		(-1.166)		(10.829)
<i>Controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Time Fixed Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>No. of obs.</i>	7,176	7,176	171,428	171,428	7,176	7,176	171,428	171,428
<i>Adj. R<sup>2</sup></i>	0.144	0.187	0.225	0.225	0.575	0.575	0.447	0.447

## Panel D. Subsamples by Local Concentration (HHI)

<i>Dependent Variable:</i>	<i>Market Share</i>						<i>Market Power</i>					
	1	2	3	4	5	6	7	8	9	10	11	12
	<i>Unconcentrated</i>		<i>Moderately Concentrated</i>		<i>Highly Concentrated</i>		<i>Unconcentrated</i>		<i>Moderately Concentrated</i>		<i>Highly Concentrated</i>	
<i>Independent Variables:</i>	<i>HHI ≤ 1000</i>		<i>1000 &lt; HHI ≤ 1,800</i>		<i>HHI &gt; 1800</i>		<i>HHI ≤ 1000</i>		<i>1000 &lt; HHI ≤ 1,800</i>		<i>HHI &gt; 1800</i>	
TARP_RECIPIENT	-0.007*** (-7.489)		-0.016*** (-15.421)		-0.033*** (-8.646)		-0.021*** (-3.717)		-0.024*** (-5.074)		-0.056*** (-5.915)	
POST_TARP × TARP_RECIPIENT	0.001 (0.847)		0.006*** (4.279)		0.027*** (5.870)		0.022*** (3.097)		0.049*** (8.324)		0.075*** (6.310)	
TARP_RECIPIENT_NOT_REPAID		-0.008*** (-10.668)		-0.015*** (-13.752)		-0.040*** (-10.455)		-0.023*** (-3.682)		-0.027*** (-5.350)		-0.033*** (-2.949)
TARP_RECIPIENT_REPAID		0.002 (0.386)		-0.017*** (-7.739)		-0.005 (-0.595)		-0.009 (-0.869)		0.001 (0.143)		-0.125*** (-9.626)
POST_TARP × TARP_RECIPIENT_NOT_REPAID		0.004*** (3.642)		0.003* (1.929)		0.024*** (4.936)		0.018** (2.281)		0.042*** (6.278)		0.039*** (2.704)
POST_TARP × TARP_RECIPIENT_REPAID		-0.015*** (-2.834)		0.020*** (4.951)		0.046*** (4.485)		0.049*** (3.524)		0.082*** (7.519)		0.196*** (12.085)
<i>Controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Time Fixed Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>No. of obs.</i>	84,627	84,627	68,181	68,181	25,796	25,796	84,627	84,627	68,181	68,181	25,796	25,796
<i>Adj. R<sup>2</sup></i>	0.095	0.096	0.073	0.074	0.252	0.253	0.526	0.527	0.398	0.398	0.436	0.436

## Panel E. Tests of the Equality of the Effects of TARP for Different Types of TARP recipients

	<i>t-stat:</i>	<i>Market Share</i>	<i>Market Power</i>
<u>Excluding Involuntary Participants</u>	Effect for TARP Banks that Repaid Early = Effect for TARP Banks that Did Not Repay Early	2.604***	5.673***
<u>Excluding Banks Subject to the Stress Tests</u>	Effect for TARP Banks that Repaid Early = Effect for TARP Banks that Did Not Repay Early	2.328**	5.559***
<u>Poorly Capitalized</u> <u>EQCAP_08Q3 ≤ 7%</u>	Effect for TARP Banks that Repaid Early = Effect for TARP Banks that Did Not Repay Early	1.068	0.600
<u>Highly Capitalized</u> <u>EQCAP_08Q3 &gt; 7%</u>	Effect for TARP Banks that Repaid Early = Effect for TARP Banks that Did Not Repay Early	4.691***	6.133***
<u>Unconcentrated</u> <u>HHI &lt; 1000</u>	Effect for TARP Banks that Repaid Early = Effect for TARP Banks that Did Not Repay Early	3.393***	2.007**
<u>Moderately Concentrated</u> <u>1000 &lt; HHI &lt; 1,800</u>	Effect for TARP Banks that Repaid Early = Effect for TARP Banks that Did Not Repay Early	4.140***	3.162***
<u>Highly Concentrated</u> <u>HHI &gt; 1800</u>	Effect for TARP Banks that Repaid Early = Effect for TARP Banks that Did Not Repay Early	2.019**	7.288***

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