Macro-economic shocks and infant survival: A global perspective

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1 Abstract

Background: If income is protective of health, as has been suggested in a number of studies, then deviations from anticipated national income may have important ramifications for population health, including child survival. Two recent studies have looked at single country macro-economic cycles and found significant impacts of contractions in the national economy on the infant mortality rate (Paxson and Schady (2004) and Dehejia and Lleras-Muney (2004)).

Objectives: The objective of this paper is to utilize a global data set to determine the extent and severity of the link between macro-economic contractions and infant mortality in low- and middle- income countries. We pay particular attention to the heterogeneity of this relationship across many salient country-level dimensions.

Methods: We utilize Demographic and Health Survey (DHS) data from 59 low- and middle-income countries to investigate the co-variation of trend-deviations in per capita GDP and infant mortality. Through the use of time-series and non-parametric regression techniques we identify the effect of macro-economic contractions on IMR and we explore how the severity of the contractions and the country conditions mediate the impact of fluctuations in national income on child survival.

Findings: We find that there is a strong, significant, and statistically ro-

bust relationship between fluctuations in GDP per capita and IMR. These findings persist even after controlling for year to year changes in the annual composition of birth mothers. By far, the greatest harmful impacts occur for very large and negative deviations from expected national income. There are also important regional differences in the measured response, as well as differential population impacts depending on the socio-economic status of the mother.

Conclusions: Deviations from anticipated national income affect the survival of infants. This is especially true for large deviations, where macroeconomic shocks such as financial crises result on average in very large increases in the year to year infant mortality rate. Nevertheless there is substantial cross-country heterogeneity in this relationship.

Policy Implications: The heterogeneity in the cross-country relationship between deviations in national income and infant survival suggests that protective policies and programs may very well make a difference in times of economic contraction. Ongoing research is seeking to identify which of these protective policies and programs are most effective in insuring child survival.

2 Summary of Results to Date

Figure 1: Plots annual country level observations of log per capita Gross Domestic Product (GDP) and Log Infant Mortality Rate (IMR) for the 59 countries that make up the dataset. One can see from the fitted non-parametric regression line that there is a clear negative relationship between log IMR and log per Capita GDP, as expected.

Table 1: Shows the strong and significant relationship between fluctuations in log per capita GDP and IMR. The relationship is robust across various methods of trend accounting, with a stronger association for the more flexible specifications. For example, according to the quartic trend results, a 1% negative deviation from expected GDP growth is associated with a 0.6% rise in IMR over its historical trend.

Figure 2: The first panel (Panel 2a) depicts non-parametric regression lines for various methods of detrending. The results show that after controlling

for trends in both log IMR and log Per Capita GDP, there is a negative association between the two variables over the entire range of unanticipated fluctuation in log GDP. The second panel (Panel 2b) displays the density histograms for quartic detrended and changes in log per capita GDP. Although the observations are clustered around zero, the spread suggests significant fluctuations in per capita GDP.

Table 2: Examines how the severity of the unanticipated contraction or expansion in log per capita GDP affects changes in IMR. It shows that the greatest harmful impacts occur for very large negative deviations from expected national income. Large positive deviations also have a significant effect. Smaller deviations have no significant impact.

Table 3: Explores heterogeneity in the relation between detrended log IMR and detrended log per capita GDP along a variety of country and population characteristics. The results suggest that the highly educated and urban mothers are disproportionately negatively affected by surprise contractions in GDP. However, both high and low educated and urban and rural populations suffer during contractions and indeed the suggestive difference in this table is not significant in the statistical sense In addition, high IMR countries suffer greater impacts of fluctuations in log per capita GDP than low IMR countries.

Figure 3: Depicts the country level coefficient and 95% confidence interval from country specific regressions of detrended IMR on detrended log per capita GDP. The relatively small number of observations per country prevent these coefficients from being estimated with great precision. Nevertheless, a number of countries show a clear negative relationship, and the vast majority of countries have a point estimate less than zero.

Table 4: Shows that the strong and significant relationship between fluctuations in log per capita GDP and IMR persists even after controlling for characteristics of the mother and the birth child. In many of the specifications the coefficient drops by about half indicating that more vulnerable women are less able to defer fertility during crisis periods.

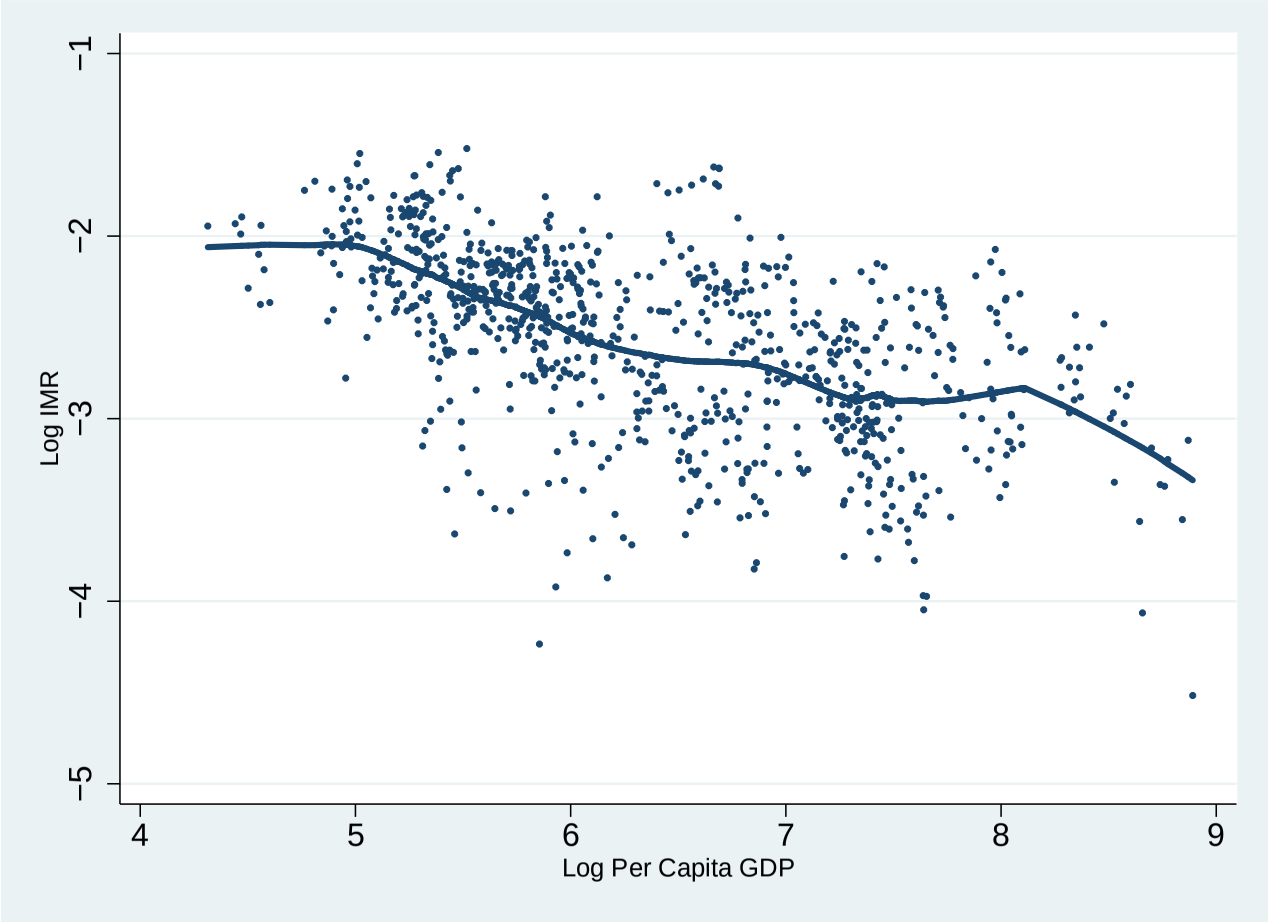
Table 5: Similar to Table 2, but now controlling for mother and birth child characteristics. Once again the results reveal that large negative deviations

from trend in log per capita GDP incur the largest IMR response. However in this case large positive deviations are also consistently significant, although generally not as strong.

Ongoing work: To complete this paper we are now investigating in more detail the substantial cross-country heterogeneity in the observed IMR response to unanticipated changes in national income, especially the response to large unanticipated changes in national income. This involves looking at specific country episodes across a variety of dimensions, including maternal health, cause of economic contraction, and protective policies in place at time of crisis.

3 Tables and Figures

Figure 1: Scatter Plot of Log IMR and Log Per Capita GDP
with Fitted Non-Parametric Regression Line



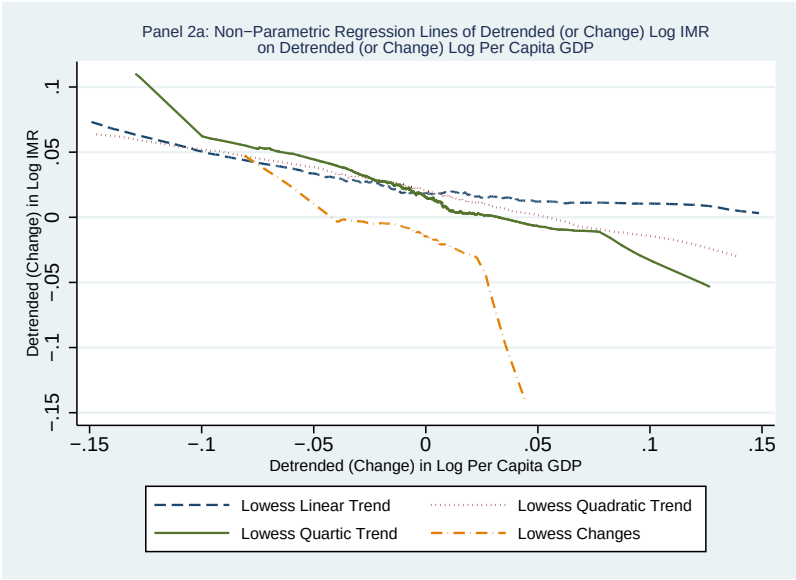
Annual country level observations of Log Per Capita GDP and Log IMR are depicted here.
A total of 897 observations from 59 countries.

Table 1: Detrended (or Change) Infant Mortality Rate (IMR) on Detrended (or Change) Log Per Capita GDP, by Various Methods of Trend Accounting

Dependent Variable	**Different Trends**						
	Δ Log Per Capita GDP	Linear	Quadratic	Cubic	Quartic	Hodrick-Prescott Filter (x=10)	Baxter King Filter (k=3)
Log IMR	-0.775	-0.248	-0.355	-0.484	-0.577	-0.516	-0.535
	[0.286]***	[0.141]*	[0.135]***	[0.163]***	[0.156]***	[0.177]***	[0.173]***
IMR	-1.771	-0.015	-0.028	-0.04	-0.042	-0.036	-0.038
	[0.827]**	[0.008]*	[0.010]***	[0.011]***	[0.009]***	[0.010]***	[0.010]***

All regressions are weighted and include a complete set of country indicators. Robust standard errors are shown in parentheses and are clustered at the country level.

Figure 2: Non-Parametric Relation Between Detrended IMR and Detrended Per Capita GDP for a Variety of Detrended Series



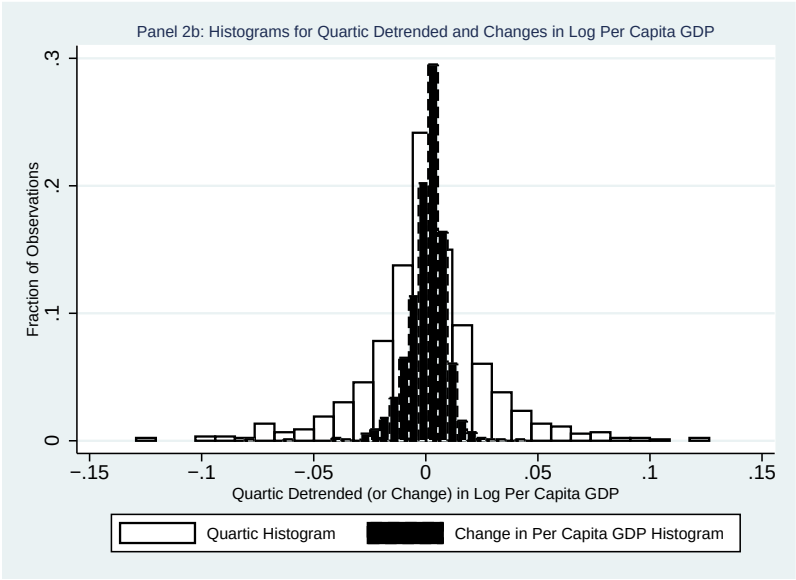


Table 2: Detrended Levels and Log Values of IMR on Various Spline Functions of Detrended GDP (Quartic Trend)

Standard Deviation of Detrended Per Capita GDP Series

$-\infty$	-2	-1.5	-1	-.5	0	.5	1	1.5	2	∞
Log IMR										
-0.77 [0.271]*** N=445						-0.389 [0.198]* N=452				
-0.509 [0.378] N=193			-1.809 [1.731] N=252			-0.029 [1.762] N=252		-0.372 [0.279] N=200		
-0.672 [0.456] N=96		-0.875 [0.852] N=349				-0.428 [0.717] N=356		-0.323 [0.291] N=96		
-1.122 [0.524]** N=49		-0.53 [0.582] N=396				-0.442 [0.432] N=402		-0.453 [0.291] N=50		
-1.699 [0.736]** N=30		-0.426 [0.500] N=415				-0.403 [0.335] N=425			-0.738 [0.275]** N=27	
IMR										
-0.07 [0.016]*** N=445						-0.014 [0.012] N=452				
-0.075 [0.026]*** N=193			-0.058 [0.080] N=252			-0.003 [0.080] N=252		-0.019 [0.015] N=200		
-0.093 [0.028]*** N=96		-0.042 [0.040] N=349				-0.013 [0.039] N=356		-0.024 [0.018] N=96		
-0.129 [0.028]*** N=49		-0.031 [0.027] N=396				-0.017 [0.026] N=402		-0.034 [0.021] N=50		
-0.176 [0.034]*** N=30		-0.03 [0.023] N=415				-0.016 [0.021] N=425			-0.055 [0.026]** N=27	

Table 3: Detrended Levels and Log Values of IMR on Detrended Log Per Capita GDP (Quartic Trend) Conditioned on Various Country and Population Characteristics

	Per Capita GDP			**IMR**			**Education**			**Urban/rural**		
	Low	**High**	**Dif**	**Low**	**High**	**Dif**	**Low**	**High**	**Dif**	**Rural**	**Urban**	**Dif**
Log	-0.487	-0.624	Pvalue:	-0.305	-0.708	Pvalue:	-0.526	-0.86	Pvalue:	-0.507	-0.777	Pvalue:
	[0.197]**	[0.222]***	0.641	[0.315]	[0.192]***	0.308	[0.197]**	[0.224]****	0.225	[0.182]**	[0.238]***	0.340
Levels	-0.05	-0.037	Pvalue:	-0.015	-0.065	Pvalue:	-0.042	-0.041	Pvalue:	-0.047	-0.033	Pvalue:
	[0.019]**	[0.008]***	0.546	[0.012]	[0.017]***	0.026	[0.012]***	[0.008]***	0.951	[0.014]***	[0.009]***	0.431

All regressions are weighted and include a complete set of country indicators. Robust standard errors are shown in parentheses and are clustered at the country level. Low/high levels of Per Capita GDP (IMR) are grouped by below/above median values of Per Capita GDP (IMR) within the sample of country year cells. IMR rates for low/high education are grouped by below/above median education within each country year cell. IMR rates for urban/rural are grouped by the mother's urban/rural status at the time of the survey.

Figure 3: Country Level Regressions of Detrended IMR on Detrended Log Per Capita GDP (Quartic Trend): Coefficient Estimates and 95% Confidence Intervals for Log Per Capita GDP

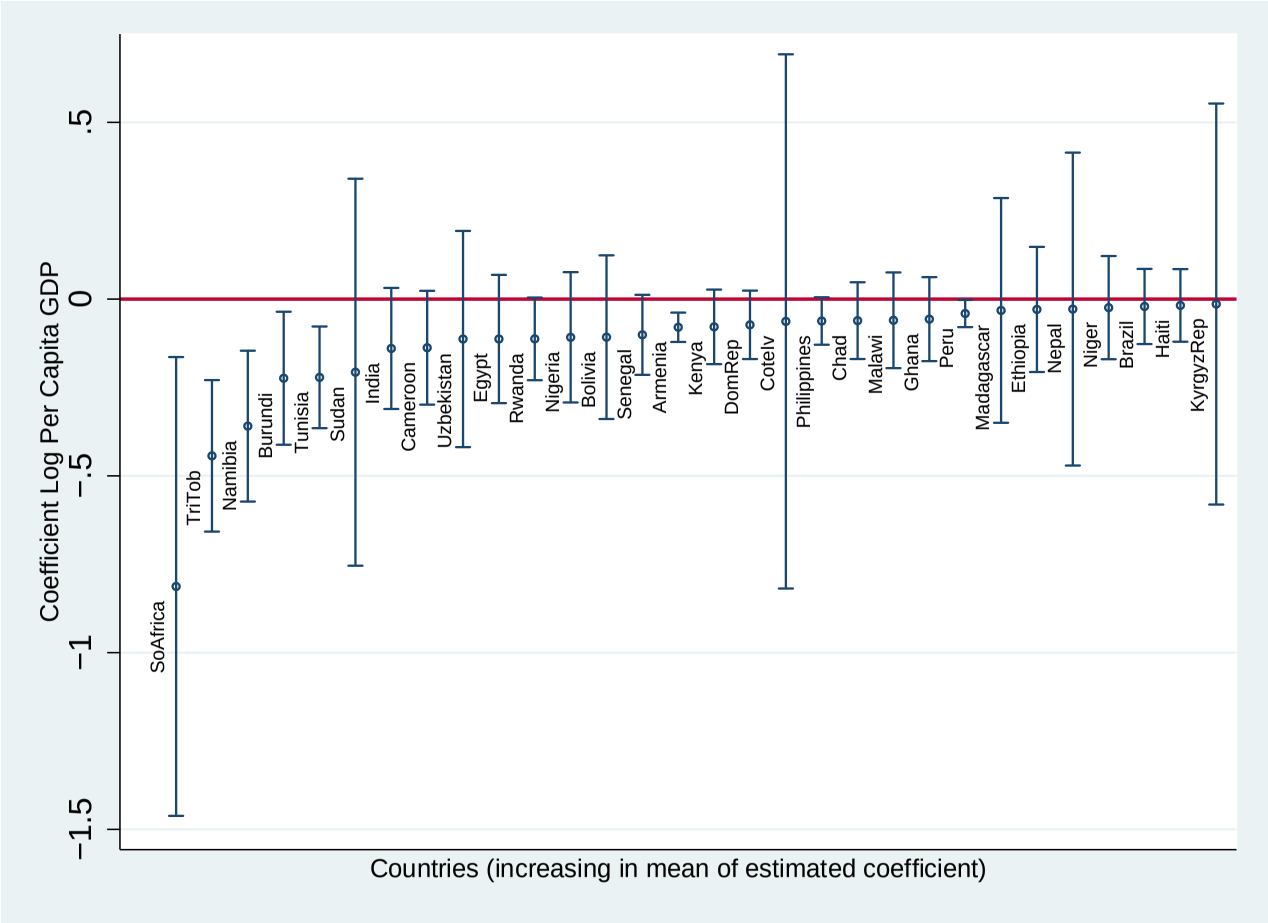


Figure 3 cont: Country Level Regressions of Detrended IMR on Detrended Log Per Capita GDP (Quartic Trend): Coefficient Estimates and 95% Confidence Intervals for Log Per Capita GDP

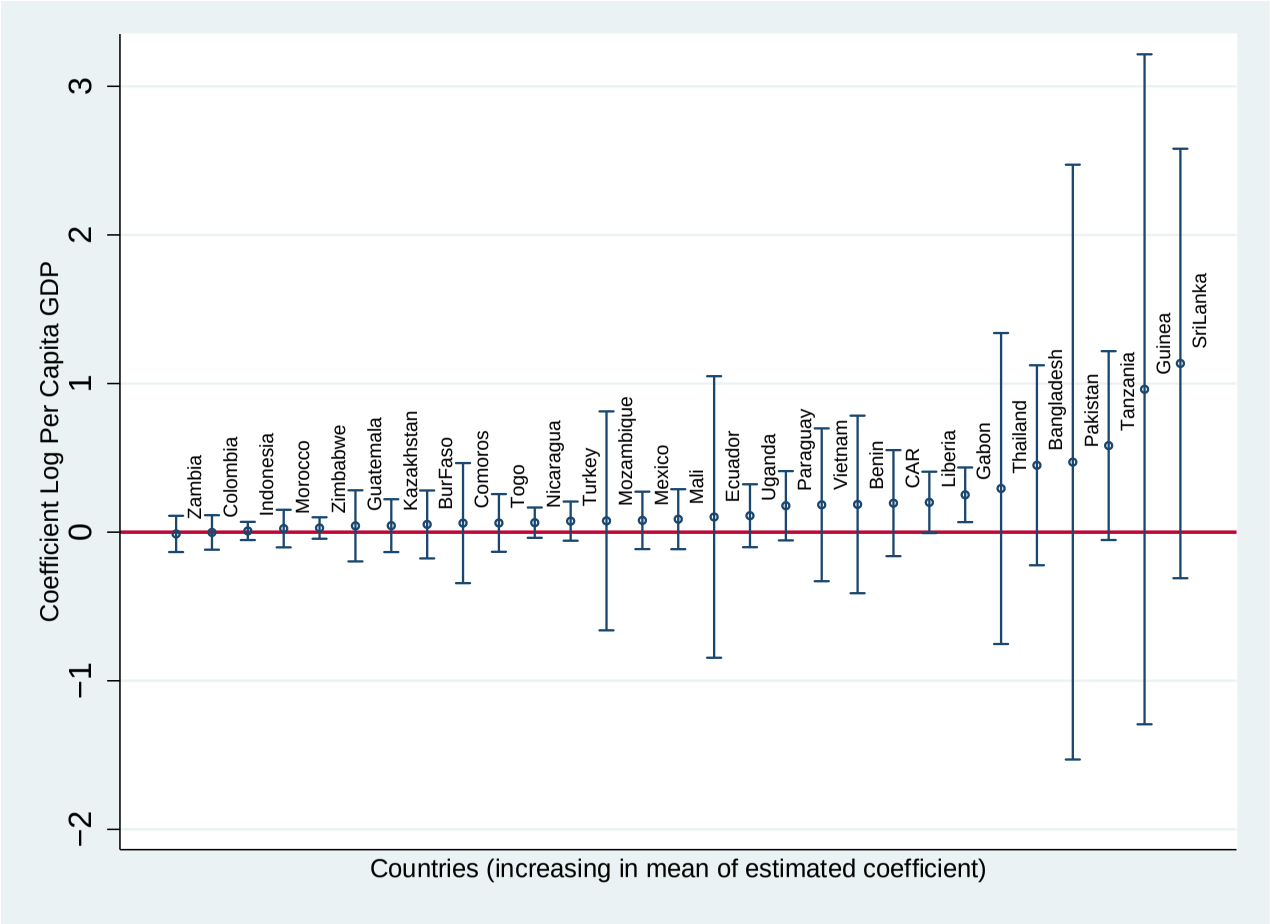


Table 4: Detrended (or Change) Net Infant Mortality Rate (IMR) on Detrended (or Change) Log Per Capita GDP, by Various Methods of Trend Accounting

Dependent Variable	**Different Trends**						
	Δ Log Per Capita GDP	Linear	Quadratic	Cubic	Quartic	Hodrick-Prescott Filter (x=10)	Baxter King Filter (k=3)
Log IMR	-0.555	-0.066	-0.148	-0.263	-0.329	-0.281	-0.494
	[0.229]**	[0.053]	[0.056]**	[0.101]**	[0.076]***	[0.088]***	[0.176]***
IMR	-1.006	-0.01	-0.021	-0.036	-0.041	-0.036	-0.037
	[0.457]**	[0.008]	[0.008]**	[0.013]***	[0.009]***	[0.011]***	[0.011]***

All regressions are weighted and include a complete set of country indicators. Robust standard errors are shown in parentheses and are clustered at the country level. The net regressions hold constant the following population characteristics: mother's years of education, mother's age at childbirth, birth order of the child, gender of the child and whether or not the child was a multiple birth.

Table 5: Detrended Levels and Log Values of IMR on Various Spline Functions of Detrended GDP (Quartic Trend)

Standard Deviation of Detrended Per Capita GDP Series

<table>
<tr><th>$-\infty$</th><th>-2</th><th>-1.5</th><th>-1</th><th>-.5</th><th>0</th><th>.5</th><th>1</th><th>1.5</th><th>2</th><th>∞</th></tr>
<tr><td colspan="11">Log IMR</td></tr>
<tr><td colspan="6">-0.35
[0.119]***
N=445</td><td colspan="5">-0.308
[0.106]***
N=442</td></tr>
<tr><td colspan="5">-0.329
[0.209]
N=187</td><td colspan="2">-.642
[0.685]
N=258</td><td colspan="2">-0.172
[0.769]
N=258</td><td colspan="3">-0.414
[0.135]
N=184</td></tr>
<tr><td colspan="4">-0.495
[0.276]*
N=83</td><td colspan="3">-0.178
[0.178]
N=362</td><td colspan="3">-0.337
[0.340]
N=354</td><td colspan="2">-0.338
[0.149]**
N=988</td></tr>
<tr><td colspan="3">-0.838
[0.376]***
N=42</td><td colspan="4">-0.051
[0.234]
N=403</td><td colspan="4">-0.385
[0.226]*
N=399</td><td colspan="2">-0.357
[0.128]***
N=43</td></tr>
<tr><td colspan="2">-1.1
[0.590]*
N=26</td><td colspan="5">-0.111
[0.201]
N=419</td><td colspan="4">-0.357
[0.199]*
N=423</td><td>-0.425
[0.116]***
N=19</td></tr>
<tr><td colspan="11">IMR</td></tr>
<tr><td colspan="6">-0.056
[0.014]***
N=445</td><td colspan="5">-0.027
[0.015]*
N=442</td></tr>
<tr><td colspan="5">-0.061
[0.025]**
N=187</td><td colspan="2">-0.062
[0.074]
N=258</td><td colspan="2">0.02
[0.077]
N=258</td><td colspan="3">-0.041
[0.018]**
N=184</td></tr>
<tr><td colspan="4">-0.086
[0.031]***
N=83</td><td colspan="3">-0.022
[0.039]
N=362</td><td colspan="3">-0.028
[0.040]
N=354</td><td colspan="2">-0.037
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N=988</td></tr>
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N=399</td><td colspan="2">-0.045
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N=43</td></tr>
<tr><td colspan="2">-0.184
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N=419</td><td colspan="4">-0.031
[0.026]
N=423</td><td>-0.059
[0.021]***
N=19</td></tr>
</table>

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