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Correction of Billé and Rogna (2021)

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1. Correction of Billé and Rogna (2021)

1.1. Time-varying Marginal Effects

The long-term marginal effects of equation (7) in the paper Billé and Rogna (2021) are the following

$$\begin{aligned}\frac{\partial \mathbb{E}(\mathbf{y}_t)}{\partial \mathbf{x}_{1,t}} &= [(1 - \phi) \mathbf{I} - (\rho + \gamma) \mathbf{W}]^{-1} [(\beta_1 + \beta_6) \mathbf{I} + 2\beta_2 \text{diag}(\mathbf{x}_{1,t}) \mathbf{I} + \beta_{10} \text{diag}(\mathbf{x}_{2,t-1}) \mathbf{I} + \beta_{11} \text{diag}(\mathbf{x}_{3,t-1}) \mathbf{I}] \\ \frac{\partial \mathbb{E}(\mathbf{y}_t)}{\partial \mathbf{x}_{2,t}} &= [(1 - \phi) \mathbf{I} - (\rho + \gamma) \mathbf{W}]^{-1} [\beta_3 + \beta_7] \\ \frac{\partial \mathbb{E}(\mathbf{y}_t)}{\partial \mathbf{x}_{3,t}} &= [(1 - \phi) \mathbf{I} - (\rho + \gamma) \mathbf{W}]^{-1} [\beta_4 + \beta_8] \\ \frac{\partial \mathbb{E}(\mathbf{y}_t)}{\partial \mathbf{x}_{4,t}} &= [(1 - \phi) \mathbf{I} - (\rho + \gamma) \mathbf{W}]^{-1} [\beta_5 + \beta_9]\end{aligned}\tag{1}$$

2. Results and Discussion

2.1. Discussion on the Marginal Effects

Table A.1 and Figure B.1 replace part of the Table B5 and Figure C4 in Billé and Rogna (2021).

Regarding the *time-invariant marginal effects* in Table A.1, we now note that a variation of signs can be found in all the macro-areas. In Europe, the higher are dryness (only in the short-term), wetness and the price of agricultural outputs (in both), the greater is the N-fertilization in both the cell itself and in the neighbour cells. The same is true in South America for dryness, wetness only in the long-term and price of agricultural outputs only in the short one. Finally, in South East Asia only for wetness and in Africa only for the price, both in the short-term.

Looking at Figure B.1, there is now a bigger difference between the short and long terms effects. In particular, the magnitude of the long-term effects is lower than the one of the short-term effects in all the macro-regions, except for Africa. The temporal mean values for Europe, South America, South-East Asia and Africa, respectively, are now around $\{3.004668e - 02; 4.657553e - 02; -5.929949e - 03; 3.248210e - 02\}$ for

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long-term direct effects, while $\{5.748275e - 05; 3.613537e - 05; -7.461870e - 06; 1.850549e - 05\}$ for long-term indirect effects. The magnitude of the indirect effects is still so trivial in all the macro-regions compared to the one of the direct effects. Moreover, the time-varying total marginal effects are still always positive in all the macro-regions, with the exception of South East Asia where they are always negative. The long-term effect in South-East Asia, however, has decreased its magnitude till becoming very modest. Another sensible difference can be found in Africa where the cumulative effect of the *GDP* is now higher than it was before. Given the relatively low level of development of this region, a significant dependence of fertilizer application from *GDP* is expected. The new magnitude, therefore, is more in line with theoretical expectations.

Appendix A. Tables

Table A.1: Time-invariant Marginal Effects from SDPD model in eq. (2) of Billé and Rogna (2021).

<i>SDPD Model</i>					
Macro-area	Variable	Effect	Direct	Indirect	Total
Europe	DRY_t	short	0.008805291	1.741442e-05	0.008822705
		long	-0.055389999	-1.059658e-04	-0.055495965
	WET_t	short	0.018056484	3.571070e-05	0.018092195
		long	0.046786393	8.950634e-05	0.046875899
	PAO_t	short	0.001537706	3.041156e-06	0.001540748
		long	0.002533960	4.847681e-06	0.002538808
South America	DRY_t	short	0.016041268	1.158859e-05	0.016052856
		long	0.011524841	8.941506e-06	0.011533782
	WET_t	short	-0.012714951	-9.185577e-06	-0.012724137
		long	0.022371473	1.735683e-05	0.022388830
	PAO_t	short	0.002005386	1.448737e-06	0.002006834
		long	-0.003222405	-2.500091e-06	-0.003224905
South-East Asia	DRY_t	short	-0.006582302	-8.971406e-06	-0.006591273
		long	-0.0087400632	-1.099797e-05	-0.0087510611
	WET_t	short	0.002888857	3.937393e-06	0.002892794
		long	-0.0004083121	-5.137953e-07	-0.0004088259
	PAO_t	short	-0.001650949	-2.250175e-06	-0.001653199
		long	-0.0028126756	-3.539301e-06	-0.0028162149
Africa	DRY_t	short	-1.710115e-03	-1.064206e-06	-0.0017111797
		long	-4.427220e-03	-2.522235e-06	-0.0044297425
	WET_t	short	-1.595053e-03	-9.926028e-07	-0.0015960461
		long	-3.748384e-03	-2.135495e-06	-0.0037505196
	PAO_t	short	2.893142e-04	1.800404e-07	0.0002894943
		long	-7.063726e-05	-4.024280e-08	-0.0000706775

Appendix B. Figures



Figure B.1: Time-varying Short-term (on the left) and Long-term (on the right) Total Marginal Effects from Model in eq. (2) of Billé and Rogna (2021) with respect to *GDP* for (a-b) Europe, (c-d) South America, (e-f) South-East Asia, and (g-h) Africa, respectively. The Total Effects are split into the Direct (in pink) and Indirect (in green) Effects.