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

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

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).

SDPD Model					
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.