Dollar-Yuan Battle in the World Trade Network

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Abstract – From the Bretton Woods agreement in 1944 till the present day, the US dollar has been the dominant currency in the world trade. However, the rise of the Chinese economy led recently to the emergence of trade transactions in Chinese yuan. Here, we analyze mathematically how the structure of the international trade flows would favor a country to trade whether in US dollar or in Chinese yuan. The computation of the trade currency preference is based on the world trade network built from the 2010-2020 UN Comtrade data. The preference of a country to trade in US dollar or Chinese yuan is determined by two multiplicative factors: the relative weight of trade volume exchanged by the country with its direct trade partners, and the relative weight of its trade partners in the global international trade. The performed analysis, based on Ising spin interactions on the world trade network, shows that, from 2010 to present, a transition took place, and the majority of the world countries would have now a preference to trade in Chinese yuan if one only consider the world trade network structure.

Significance Statement – Taking only into account the network structure of the commercial flows, we determine whether a country would prefer to trade in US dollar or in Chinese yuan. The evolution of this trade currency preference is obtained along the last decade: The fraction of countries preferring firmly to trade in Chinese yuan increased from 34% in 2010 to 60% in 2020, and concerns at present all the Asian countries, Australia, the former Soviet Union, and almost all African and Latin American countries. European countries are also on the brink of a transition toward Chinese yuan preference. Our mathematical analysis focuses on the economical aspects of the international trade neglecting other purely geopolitical aspects.

Keywords: International trade; Commercial flows; Markov chains; Complex networks

In 1944, the Bretton Woods agreements established a system of payments based on the US dollar (USD). The USD effectively became the world currency, i.e., the standard to which every other currency was pegged [1]. Till now, the USD remained the dominant world trade currency and, as an example, the United Nations (UN) reports the world trade transactions between countries in USD [2]. However, the possible end of the dollar dominance is increasingly discussed as the Chinese yuan (CNY) is gradually becoming credible as a reserve currency [3–8]. Moreover, recently important trade transactions were considered to be realized in CNY instead of USD like oil sales from Saudi Arabia to China [9]. Thus, the growth of the Chinese economy [10] opens up the possibility for a country to prefer the CNY to the USD for their trade exchanges. In the present paper, we use a mathematical model mimicking the preference of world countries to trade in USD or CNY. This currency preference model is applied on the world trade network (WTN) built from the 2010-2020 UN Comtrade data [2]. Our analysis, based purely on trade relations without taking account of external political factors or other considerations, clearly shows that, during this decade, a USD-to-CNY transition took place with the result that the main part of the world countries would now prefer to trade in CNY instead of USD. The WTN is constructed from the UN Comtrade database [2] which provides the money matrix $\mathcal{M}$ encoding the transactions of all the commodities between all the countries. The money matrix element $M_{c'c}$ gives the total amount of commodities, expressed in USD of a given year, exported from the country c to the country c'. The UN Comtrade database concerns 194 countries for the period 2010-2020. The Markov chain of trade transactions is characterized by two WTN trade matrices $\mathcal{S}$ and $\mathcal{S}^*$ whose elements are $S_{c'c} = M_{c'c}/M_c^*$ and $S^*_{c'c} = M_{cc'}/M_c$. Here, $M_c^* = \sum_{c'} M_{c'c}$ ($M_c = \sum_{c'} M_{cc'}$) gives the total amount of commodities exported from (imported to) the country c to (from) the rest of the world. Consequently, the matrix element $S_{c'c}$ ($S^*_{c'c}$) gives the relative weight of the imports to (exports from) the country c' from (to) the country c. These matrix elements can be considered as link weights of a directed network (see e.g. [11]). By construction, the sum of each column of the matrices $\mathcal{S}$ and $\mathcal{S}^*$ is equal to 1, i.e., $\sum_{c'} S_{c'c} = 1$ and $\sum_{c'} S^*_{c'c} = 1$, ensuring the fact that the stochastic processes of the trade transactions, both in export and import directions, belong to the class of Markov chains. Let us define, for a given year, the total world trade volume by $M = \sum_c M_c = \sum_c M_c^*$. Then, a given country c can be characterized by its import trade probability $P_c = M_c/M$ and its export trade probability $P_c^* = M_c^*/M$. These probabilities characterize the global capability of a given country to import and to export, respectively. As an example, in 2019, the top 5 countries according to the import trade probability P_c are: 1. USA, 2. China, 3. Germany, 4. Japan, 5. UK,

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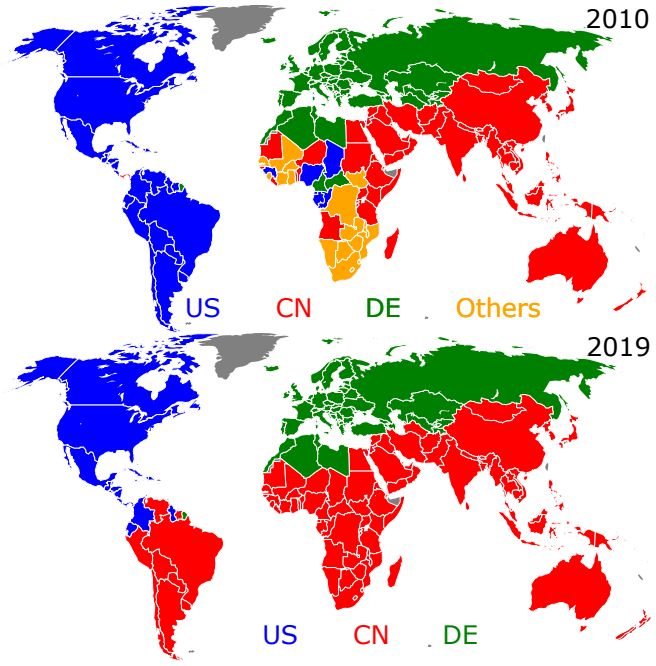

FIG. 1. Geographical distribution of clusters in the WTN for the years 2010 (left panel) and 2019 (right panel) obtained using the Louvain modularity method [12] with Dugué's algorithm [13]. Each cluster is labelled using the ISO2 code of the country with the best import and export trade probabilities P_c and P_c^*. The leaders of the clusters are the USA (blue), China (red), and Germany (green). The cluster Others (gold) gathers other small size clusters.

and the top 5 Countries according to the export trade probability P_c^* are: 1. China, 2. USA, 3. Germany, 4. Japan, 5. France.

In order to determine the trade currency preference (TCP) of the country c, i.e., whether the country c would prefer to trade in USD or in CNY with the other world countries, we assign to the country c an Ising spin $\sigma_c = \pm 1$. The value $\sigma_c = -1$ $(+1)$ indicates that the country c prefers to trade in USD (CNY). Thus, we obtain a network of interacting Ising spins (an Ising spin is attached to each country). The interaction energy of the country (spin) c is

$$E_c = \sum_{c' \neq c} \sigma_{c'} \left(S_{c'c} + S^*_{c'c}\right) \frac{\left(P_{c'} + P^*_{c'}\right)}{2}. \qquad (1)$$

which is the sum of all the energies of interaction of the country (spin) c with its direct trade partners (spins) c'. Each element of this sum is the product of two factors: the relative trade import-export flows between the country c and a direct trade partner c' (terms in the first bracket of (1)), and the global trade capability of the partner c' in the WTN (terms in the second bracket of (1)). The term $\sigma_{c'}$ in (1) indicates the preference of the commercial partner c' to perform trade in USD or CNY. Consequently, depending on the interactions with its commercial partners, we allow a country c to change its TCP: If $E_c < 0$ then the country c spin becomes $\sigma_c = -1$ (preference to trade in USD) and if $E_c > 0$ then the country c spin becomes $\sigma_c = +1$ (preference to trade in CNY). We keep USA and China always trading in USD and CNY respectively. We start with an initial fraction f_i of randomly chosen countries which prefer to trade in USD, we assign a -1 value to their spins. Consequently, the complementary fraction $1 - f_i$ of countries prefer to trade in CNY, we assign a $+1$ value to their spins. A first Monte Carlo shake allows to determine the energy E_{c_1} for a randomly picked spin σ_{c_1}. The spin σ_{c_1} flips or not according to the sign of the newly computed E_{c_1}, and consequently the TCP of the country c_1 either stay the same or possibly changes from one currency to the other (i.e., from USD to CNY or from CNY to USD). Then, with the obtained new configuration of spins, a second shake is performed for another randomly chosen spin σ_{c_2} $(c_2 \neq c_1)$, and so on. After 192 shakes, the trade currency preference for each country is determined (USA and China spins are always kept fixed). The ensemble of these shakes forms the first time step $\tau = 1$. We observe that after five consecutive time steps $(\tau > 5)$ the system converges to a fixed steady-state configuration of spins which stays unchanged for higher values of τ. This procedure is applied to $N_r = 10^4$ initial random spin configurations with a fixed fraction f_i of countries with initially a TCP for USD. We follow the evolution with τ of the fraction $f(\tau)$ of countries preferring to trade in USD till the steady-state f_f at $\tau = 10$ is obtained. The complementary fraction $1 - f_f$ gives then the fraction of countries preferring to trade in CNY once the steady-state is reached. An example of time evolution $f(\tau)$ is shown in Fig. S1 of the Supplementary Information.

We note that a similar approach has been used in [14] for the opinion formation on social networks.

RESULTS

As a preliminary step, let us characterize, for the years 2010 and 2019, the WTN using the Louvain method for cluster detection [12, 13]. The results presented in Fig. 1 show the existence of 3 main clusters formed around the USA, China and Germany. We observe that from 2010 to 2019 the size of the cluster around China extends significantly. Indeed, from 2010 to 2019, the US-cluster loses almost all of the South American countries to the benefit of the CN-cluster, and a dominant part of Africa enters the CN-cluster. Meanwhile, the cluster formed around Germany remains practically unchanged including the EU countries, the countries of the former Soviet Union, and most of the Maghreb. Examples of WTN clustering for other years of the considered decade are shown in Fig. S2 of the Supplementary Information.

However, this preliminary cluster analysis of the WTN, based on the maximization of the modularity [12, 13], does not determine the trade preference of the countries either for USD or CNY. The Monte Carlo procedure,

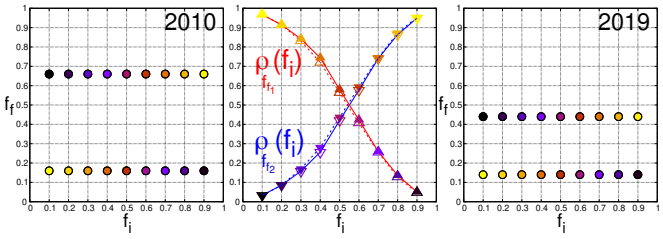

FIG. 2. Final fraction f_f of countries preferring to trade in USD as a function of the initial fraction f_i for the years 2010 (left panel) and 2019 (right panel). Left and right panels: for any initial fraction f_i, the Monte Carlo procedure converges toward one of two final fractions f_f. These two final fractions are $f_{f_1} = 0.16$ and $f_{f_2} = 0.66$ in 2010 (left panel) and $f_{f_1} = 0.14$ and $f_{f_2} = 0.44$ in 2019 (right panel). The color of a point (f_i,f_f) indicates the portion $\rho_{f_f}(f_i)$ of the $N_r = 10^4$ initial configurations, with a corresponding initial fraction f_i, which attain the final state with the corresponding final fraction f_f. The color ranges from black for $\rho_{f_f}(f_i) = 0$ (all the countries preferring to trade in CNY whether than in USD) to bright yellow for $\rho_{f_f}(f_i) = 1$ (all the countries preferring to trade in USD whether than in CNY). Middle panel: Portion $\rho_{f_f}(f_i)$ of the $N_r = 10^4$ initial configurations, the fraction f_i of which initially prefers to trade in USD, which attains the final state with the final fraction f_f. The red (blue) curve and the up (down) triangles correspond to the lowest (highest) value f_{f_1} (f_{f_2}) of the two final fractions f_f. The full (empty) symbols correspond to the year 2019 (2010).

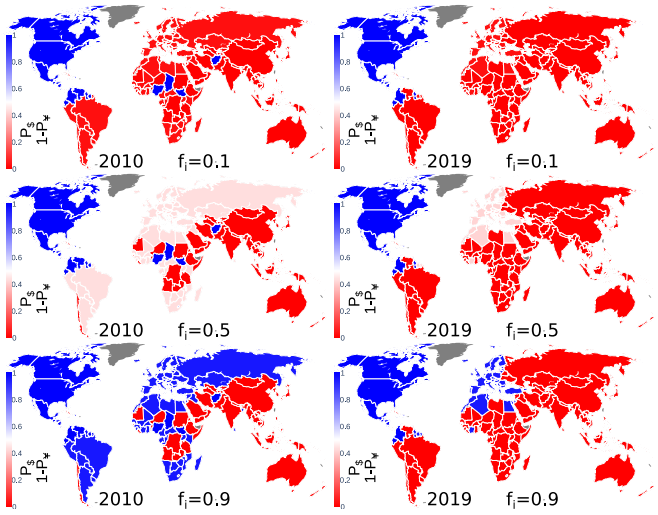

FIG. 3. World distribution of the trade currency preference probability for the years 2010 and 2019. Each panel corresponds to a given year and a given fraction f_i of countries preferring to initially trade in USD. Left (right) column panels correspond to the year 2010 (2019). The top, middle, and bottom rows correspond to $f_i = 0.1$, 0.5, and 0.9, respectively. Each country is characterized by a probability $P_\$$ to obtain a USD trade preference at the end of the Monte Carlo procedure. The CNY trade preference probability of a country is then $P_¥ = 1 - P_\$$. The color ranges from red for $P_\$ = 0$ and $P_¥ = 1$ to blue for $P_\$ = 1$ and $P_¥ = 0$. The average TCP probability $P_\$$ has been computed from $N_r = 10^4$ random initial TCP distributions.

described in the previous section, allows to obtain the final fraction f_f of world countries which prefers to trade in USD, and conversely the final fraction $1 - f_f$ of world countries which prefers to trade in CNY. Fig. 2 shows the final fraction f_f as a function of the fraction f_i of countries which initially prefer to trade in USD. For each value of f_i, we randomly picked $N_r = 10^4$ different configurations of spins. We observe that for any initial fraction f_i belonging to the interval $[0, 1]$, only two final fractions f_{f_1} and f_{f_2} can be reached. However, the probability that a given spin configuration reach one or the other final fraction values depends on the initial distribution of the TCPs over the countries. Let us take $f_{f_1} < f_{f_2}$. Quite naturally, higher (lower) is the initial fraction f_i, higher is the probability to obtain the highest (lowest) final value f_{f_2} (f_{f_1}). The middle panel of Fig. 2 gives, for the years 2010 and 2019, the probabilities $\rho_{f_{f_1}}(f_i)$ and $\rho_{f_{f_2}}(f_i)$ to obtain the final fraction f_{f_1} and f_{f_2} as a function of the initial fraction f_i. In 2010, see left panel of Fig. 2, each of the final fractions corresponded to a majority of countries with either a USD preference ($f_{f_2} = 0.66$) or a CNY preference ($f_{f_1} = 0.16$). This no longer the case in 2019, see right panel of Fig. 2, for which the two final fractions $f_{f_1} = 0.14$ and $f_{f_2} = 0.44$ are below 0.5 and give both a CNY preference for the majority of the world countries. In one decade and according to the sole structure of the WTN, we pass from a bipolar USD-CNY trade currency preference to a global domination of the CNY.

Let us define the TCP probability $P_\$(c)$ to obtain for the country c a USD preference at the end of the Monte Carlo procedure. The probability to obtain for the country c a CNY preference is then $P_¥(c) = 1 - P_\$(c)$. The probability $P_\$$ is obtained from the application of the Monte Carlo procedure to the $N_r = 10^4$ initial TCP distributions. Fig. 3 shows the TCP probability world distribution. The Fig. 3 left panels illustrate the above described bipolar USD-CNY trade currency preference which exists in 2010: for high (low) f_i most of the countries finally prefer USD (CNY). In 2019, Fig. 3 right panels, the CNY dominance is clearly observed. Indeed, even for high f_i, most of the countries finally prefer CNY over USD.

The reason of the bistability of the final outcomes f_f (see f_1 and f_2 in Fig. 2) can be understood from the analysis of the distribution of the USD or CNY trade preference over the countries. In fact, there are two groups of countries which keep, for any initial fraction f_i, a hard preference to trade in USD (the USD group) and in CNY (the CNY group). Otherwise stated, a country of the CNY (USD) group, independently of its initial TCP and of the initial TCPs of the other countries, will always ends up in the CNY (USD) group. A third group of swing states (the swing group) may change their TCP. Amazingly, depending on the initial configuration of countries which prefer to trade in USD or in CNY, the countries belonging to this swing group collectively adopt at the

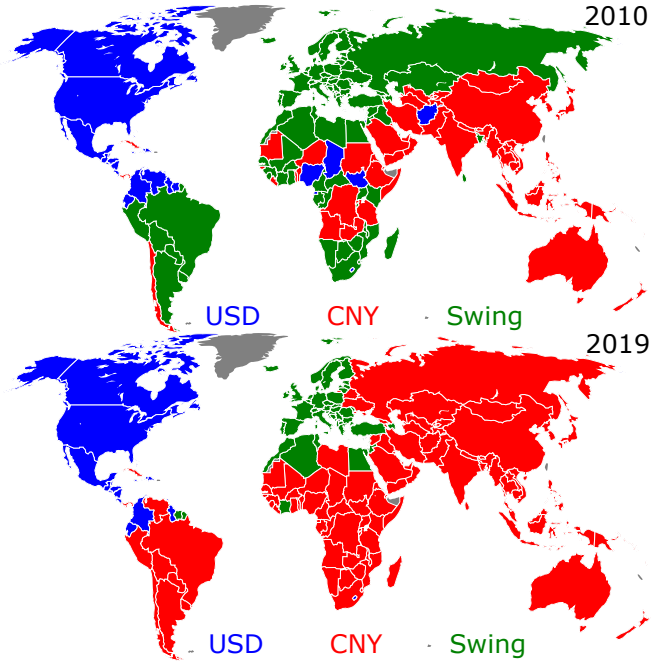

FIG. 4. World distribution of countries belonging to the USD group (blue, hard preference to trade in USD), the CNY group (red, hard preference to trade in CNY) and the swing group (green, the TCP can change between USD and CNY depending on the initial conditions). The world maps are shown for the years 2010 (left panel) and 2019 (right panel).

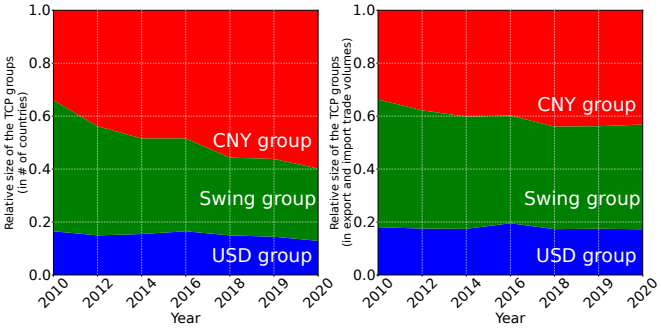

FIG. 5. Time evolution of the sizes of the trade currency preference groups. The 3 bands correspond to the USD group (blue), the CNY group (red), and the swing group (green). The width of a band corresponds to the size of the corresponding group expressed as: (left panel) the ratio between the countries belonging to the group over and the total number of countries, (right panel) the ratio between the total trade volume exchanged by the countries of the group and the total volume exchanged by all the world countries. The trade volumes are expressed in USD of the concerned year.

equilibrium either the USD or the CNY as trade currency. This swing states are collectively responsible for the final outcome: if they adopt USD (CNY) at the equilibrium, the final fraction f_f will be the highest (lowest) of the two possible fractions, i.e., f_2 (f_1). These three groups are shown on the world maps displayed in Fig. 4 for the years 2010 and 2019 (the world maps for the other years of the past decade are shown in Fig. S3 of the Supplementary Information). We clearly see that there is a drastic change from 2010 to 2019: a large number of countries passed from the swing group to the CNY group which has considerably increased in size during the last decade. Indeed, the former Soviet Union countries, almost all South America and Africa belong in 2019 to the CNY group. By contrast, from 2010 to 2019, the size of the USD group reduced only slightly loosing few countries: Venezuela, Nigeria, Chad, South Sudan, Equatorial Guinea, Afghanistan and Federated States of Micronesia switched to the CNY group and, Suriname and Israel to the swing group. In 2019, the swing group is mainly composed by EU countries, the UK and some Mediterranean countries (Turkey, Egypt, Morocco, Algeria, Tunisia and Israel). The lists of the countries belonging to the USD, CNY and swing groups in 2010 and in 2019 are given in Tables S1 to S6 of the Supplementary Information.

The time evolution over the last decade of the size of the three TCP groups is shown in Fig. 5. The left panel of Fig. 5 displays the fraction of countries belonging to each group and the right panel displays the fraction of the total volume of import and export exchanged by each group. From Fig. 5 left panel, we observe that the CNY group (red band) steadily grows along the decade from a fraction of 34% of the countries in 2010 to 60% in 2020. This growth of the CNY group is mainly compensated by the depletion of the swing group (green band) whose size drops from 50% of the countries in 2010 to 27% in 2020. Meanwhile, the size of the USD group (blue band) slightly decreased from 16% of the countries in 2010 to 13% in 2020. The trends are the same but less pronounced for the fraction of the trade volume exchanged by the different groups (see Fig. 5 right panel). The fraction of the trade volume exchanged by the CNY (swing) group increases (decreases) from 34% (49%) in 2010 to 43% (40%) in 2020. Meanwhile, the fraction of the trade volume exchanged by the USD group stayed quite constant during the decade (17% for both 2010 and 2020). Consequently, the number of countries switching during the last decade from the swing group to the CNY group represents 23% of the world countries but represents only 9% of the world trade volume. The CNY club increased but with somewhat less important new entrants in terms of trade volume exchanged.

Let us note that we obtain practically the same results if, instead of keeping China always trading in CNY and the USA always trading in USD, we keep China and the other BRICS (Brazil, Russia, India, South Africa) always trading in CNY and the USA and other Anglo-Saxon countries (Canada, UK, Australia, New Zealand) always trading in USD; see e.g., Figs. S4 and S5 in the Supplementary Information which are quite similar to Figs. 2 and 4. This result asserts the dominance of China and USA in the world trade network. We have also considered to replace the import trade probabilities P_c and the

export trade probabilities P_c^* in (1) by the PageRank and the CheiRank probabilities obtained from the Google matrix of the WTN. These probabilities allowing to measure the capability of a country to import or export products throughout the WTN were used to analyze the international trade [15, 16]. Such a replacement of the probabilities, i.e., of the centrality measures of the WTN, leads again to practically the same results (see e.g., Figs. S6 and S7 in Supplementary Information which are similar to Figs. 2 and 4).

CONCLUSION

The question addressed in the current work is the following one: assuming that only the WTN structure matters, what would be the trade currency preference for each country? Our analysis, performed by superimposing a Ising spin network on the WTN, clearly shows that the main part of the world would prefer to trade nowadays in CNY while in 2010 it would have preferred to trade in USD. We observe two final equilibrium states. In 2010, one of them characterizes an USD preference and the other one a CNY preference, whilst in 2019, both of the two final states characterize a CNY preference. Nowadays, according to the WTN structure, for any initial distributions of countries preferring to trade in USD and in CNY, the final state would always favor a world which preferentially trade in CNY. The bistability of the final state is due to a group of swing states which, depending on the initial distribution of the trade currency preferences over the countries, adopt all together a preference for either USD or CNY. Of course, our analysis is based on the mathematical treatment of the trade flows between the world countries and does not take into account any geopolitical relations between the countries. But, it is often claimed that economics determines politics and thus we argue that the obtained results demonstrate a drastic change in the international trade with a transition from dollar dominance to yuan dominance.

ACKNOWLEDGMENTS

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Supplementary Information

Dollar-Yuan Battle in the World Trade Network

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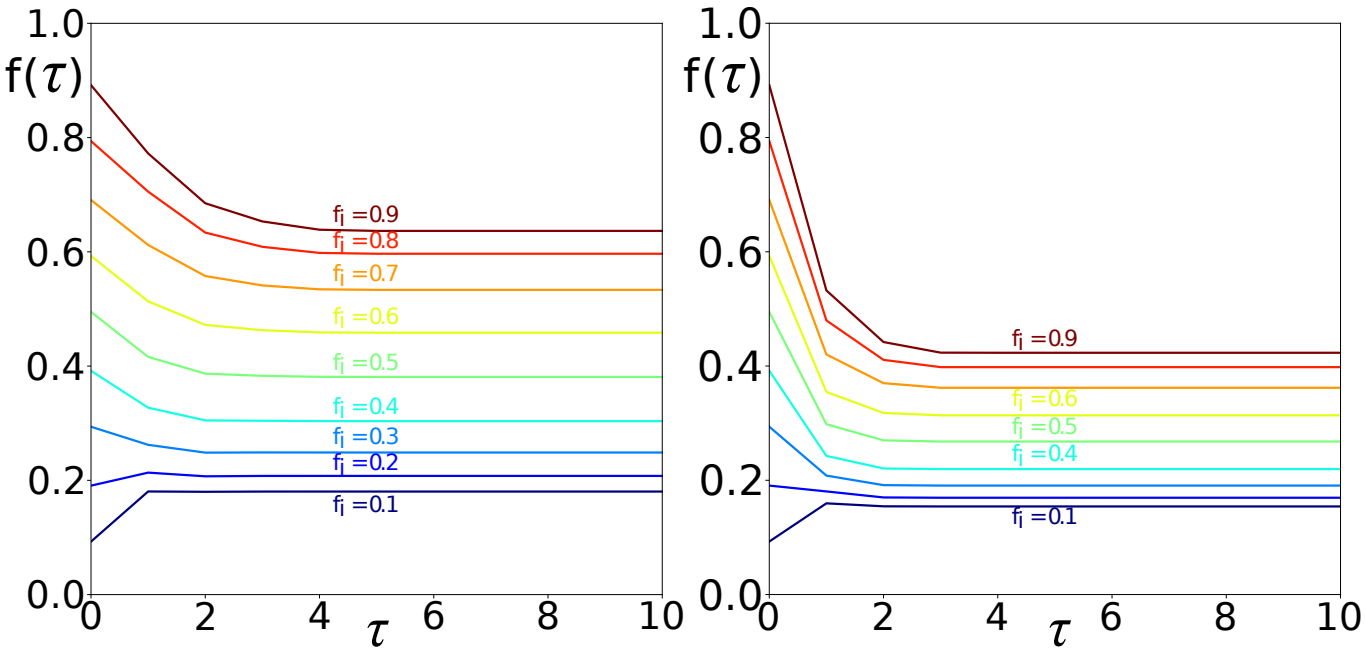

FIG. S1. Evolution of the averaged fraction $f(\tau)$ of countries with USD trade preference as a function of the number of Monte Carlo shake steps τ for the years 2010 (left panel) and 2019 (right panel). The average is performed over $N_r = 10^4$ spin configurations. The colors indicate the initial fraction f_i of countries with USD trade preference at $\tau = 0$.

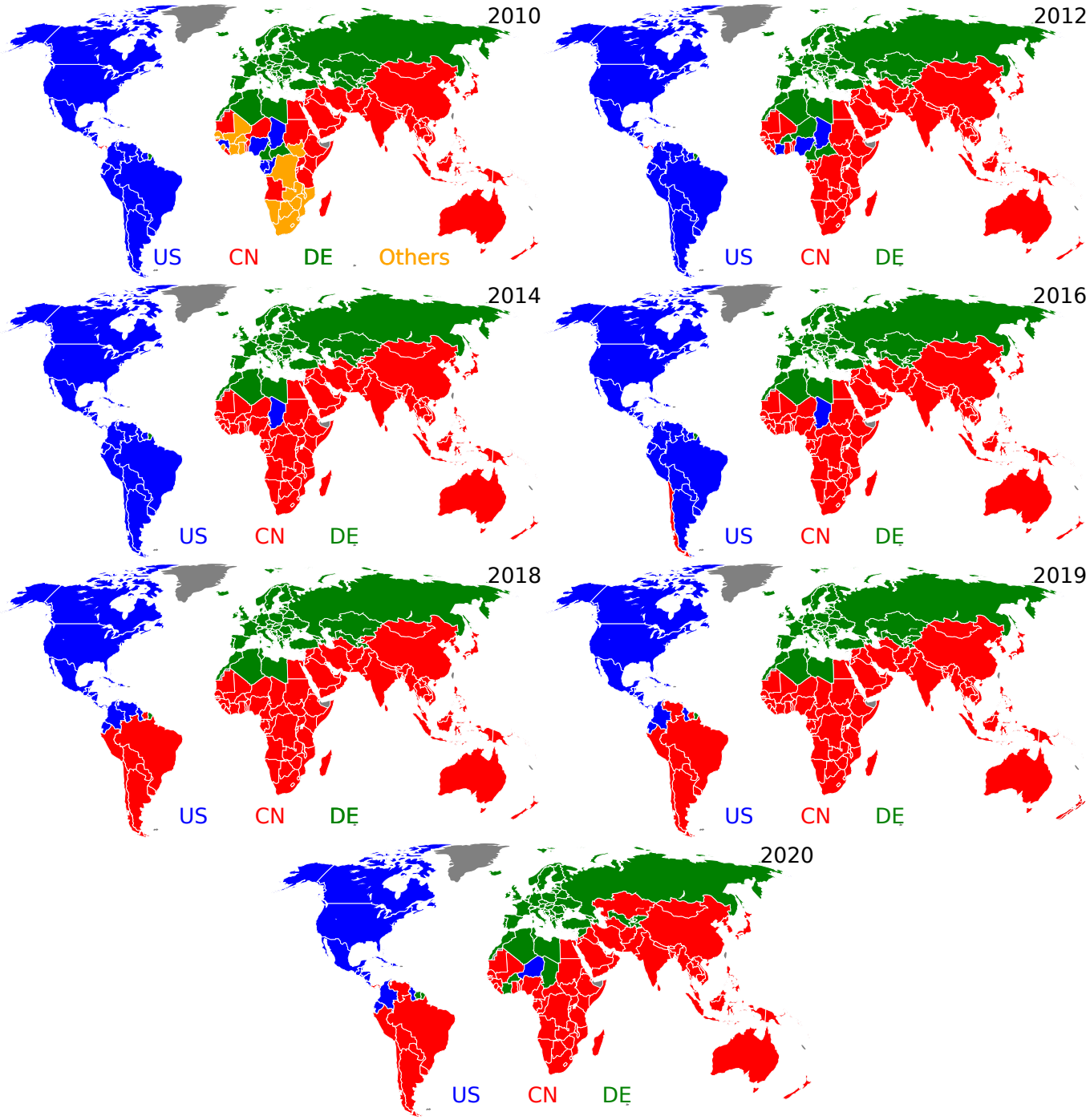

FIG. S2. Geographical distribution of clusters in the WTN for the years 2010, 2012, 2014, 2016, 2018, 2019 and 2020 obtained using the Louvain modularity method [12] with Dugué's algorithm [13]. Each cluster is labelled using the ISO2 code of the country with the best import and export trade probabilities P_c and P_c^*. For all the considered years, the leaders of the clusters are the USA (blue), China (red), and Germany (green). The cluster Others (gold) gathers other small size clusters.

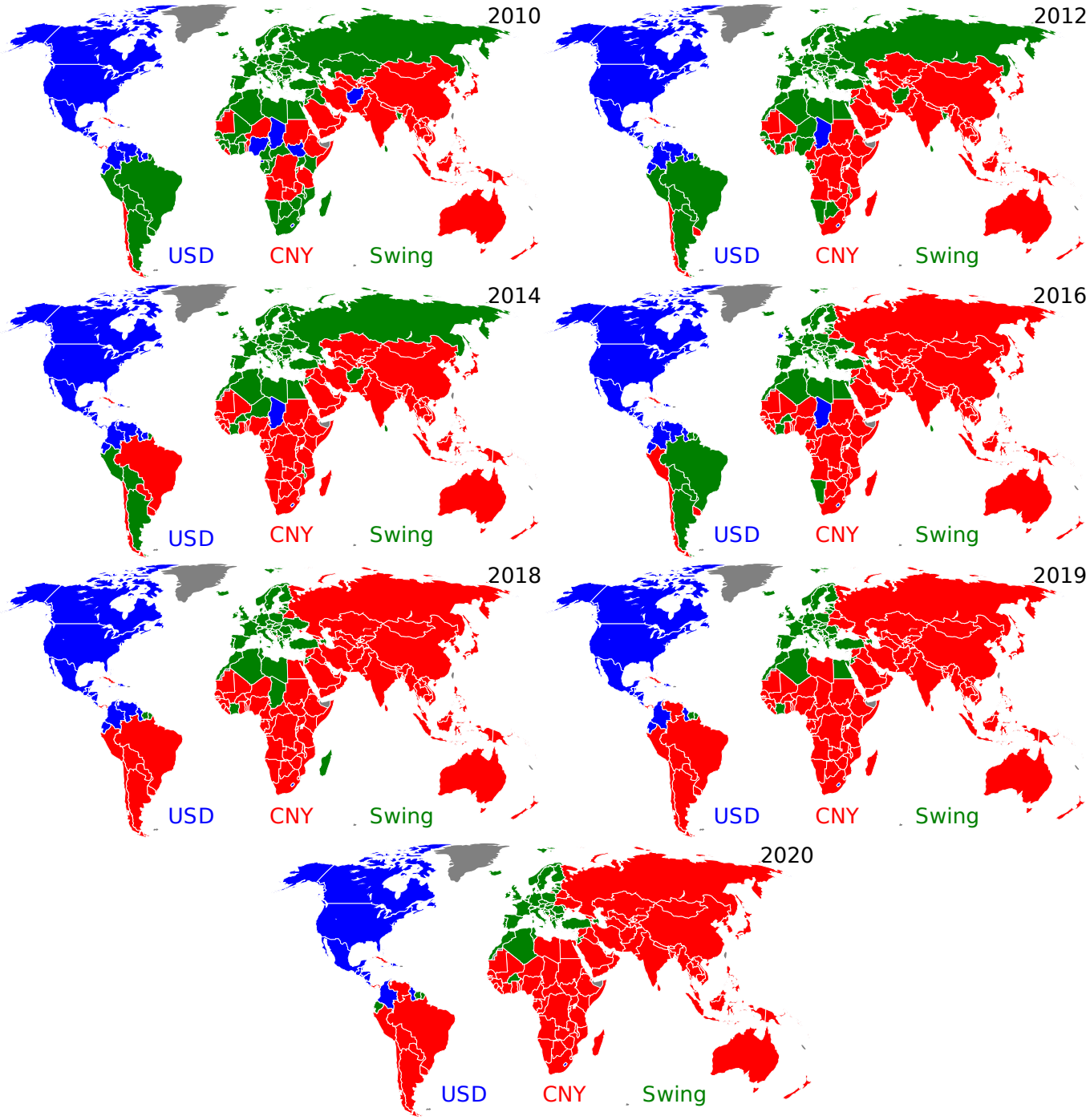

FIG. S3. World map distribution of countries belonging to the USD group (blue, hard preference to trade in USD), the CNY group (red, hard preference to trade in CNY) and the swing group (green, the TCP can change between USD and CNY depending on the initial conditions). The world maps are shown for the years 2010, 2012, 2014, 2016, 2018, 2019 and 2020.

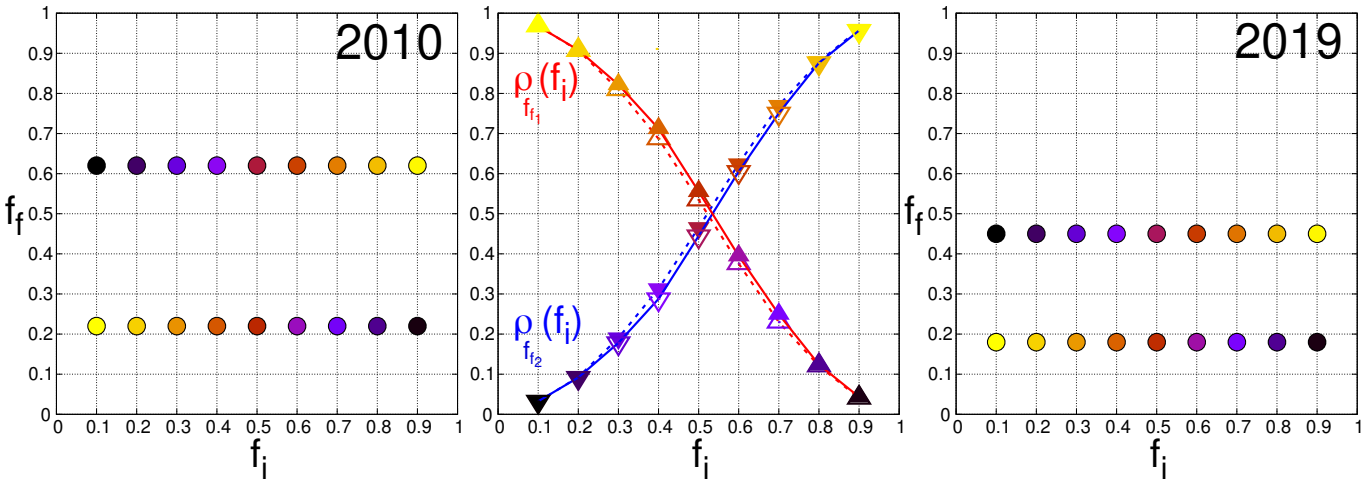

FIG. S4. Same as Fig. 2 but keeping always USA, Canada, UK, Australia, New Zealand trading in USD and China, Brazil, Russia, India, South Africa in CNY. Final fraction f_f of countries preferring to trade in USD as a function of the initial fraction f_i for the years 2010 (left panel) and 2019 (right panel). Left and right panels: for any initial fraction f_i, the Monte Carlo procedure converges toward one of two final fractions f_f. These two final fractions are $f_{f_1} = 0.22$ and $f_{f_2} = 0.62$ in 2010 (left panel) and $f_{f_1} = 0.18$ and $f_{f_2} = 0.45$ in 2019 (right panel). The color of a point (f_i,f_f) indicates the portion $\rho_{f_f}(f_i)$ of the $N_r = 10^4$ initial configurations, with a corresponding initial fraction f_i, which attain the final state with the corresponding final fraction f_f. The color ranges from black for $\rho_{f_f}(f_i) = 0$ (all the countries preferring to trade in CNY whether than in USD) to bright yellow for $\rho_{f_f}(f_i) = 1$ (all the countries preferring to trade in USD whether than in CNY). Middle panel: Portion $\rho_{f_f}(f_i)$ of the $N_r = 10^4$ initial configurations, the fraction f_i of which initially prefers to trade in USD, which attains the final state with the final fraction f_f. The red (blue) curve and the up (down) triangles correspond to the lowest (highest) value of the two final fractions f_f. The full (empty) symbols correspond to the year 2019 (2010).

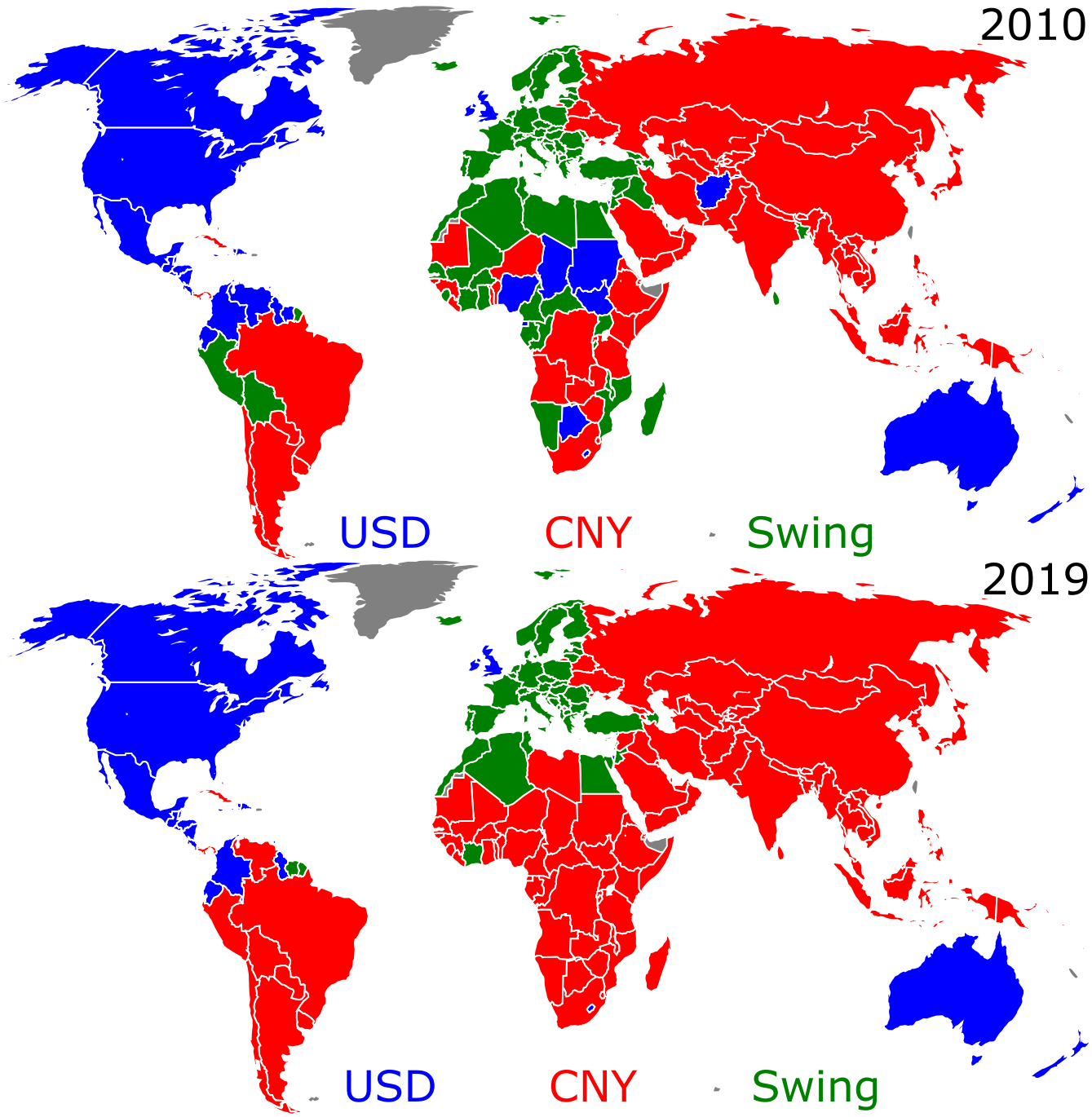

FIG. S5. Same as Fig. 4 but keeping always USA, Canada, UK, Australia, New Zealand trading in USD and China, Brazil, Russia, India, South Africa in CNY. World map distribution of countries belonging to the USD group (blue, hard preference to trade in USD), the CNY group (red, hard preference to trade in CNY) and the swing group (green, the TCP can change between USD and CNY depending on the initial conditions). The world maps are shown for the years 2010 (left panel) and 2019 (right panel).

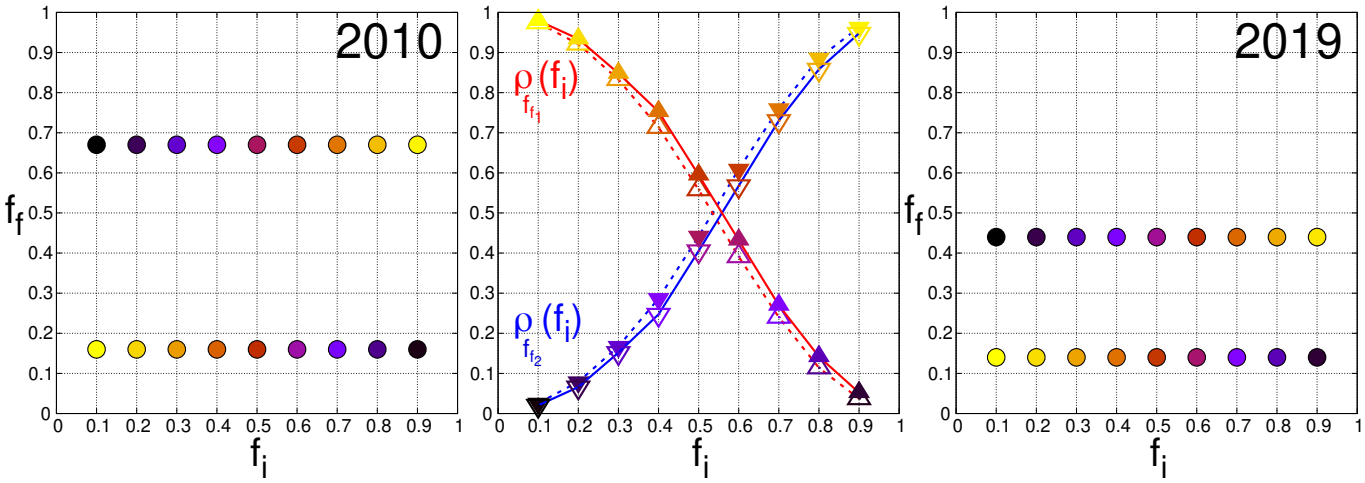

FIG. S6. Same as Fig. 2 but replacing the import trade probabilities P_c and the export trade probabilities P_c^* in (1) by the PageRank and the CheiRank probabilities obtained from the Google matrix of WTN. Final fraction f_f of countries preferring to trade in USD as a function of the initial fraction f_i for the years 2010 (left panel) and 2019 (right panel). Left and right panels: for any initial fraction f_i, the Monte Carlo procedure converges toward one of two final fractions f_f. These two final fractions are $f_{f_1} = 0.16$ and $f_{f_2} = 0.67$ in 2010 (left panel) and $f_{f_1} = 0.14$ and $f_{f_2} = 0.44$ in 2019 (right panel). The color of a point (f_i,f_f) indicates the portion $\rho_{f_f}(f_i)$ of the $N_r = 10^4$ initial configurations, with a corresponding initial fraction f_i, which attain the final state with the corresponding final fraction f_f. The color ranges from black for $\rho_{f_f}(f_i) = 0$ (all the countries preferring to trade in CNY whether than in USD) to bright yellow for $\rho_{f_f}(f_i) = 1$ (all the countries preferring to trade in USD whether than in CNY). Middle panel: Portion $\rho_{f_f}(f_i)$ of the $N_r = 10^4$ initial configurations, the fraction f_i of which initially prefers to trade in USD, which attains the final state with the final fraction f_f. The red (blue) curve and the up (down) triangles correspond to the lowest (highest) value of the two final fractions f_f. The full (empty) symbols correspond to the year 2019 (2010).

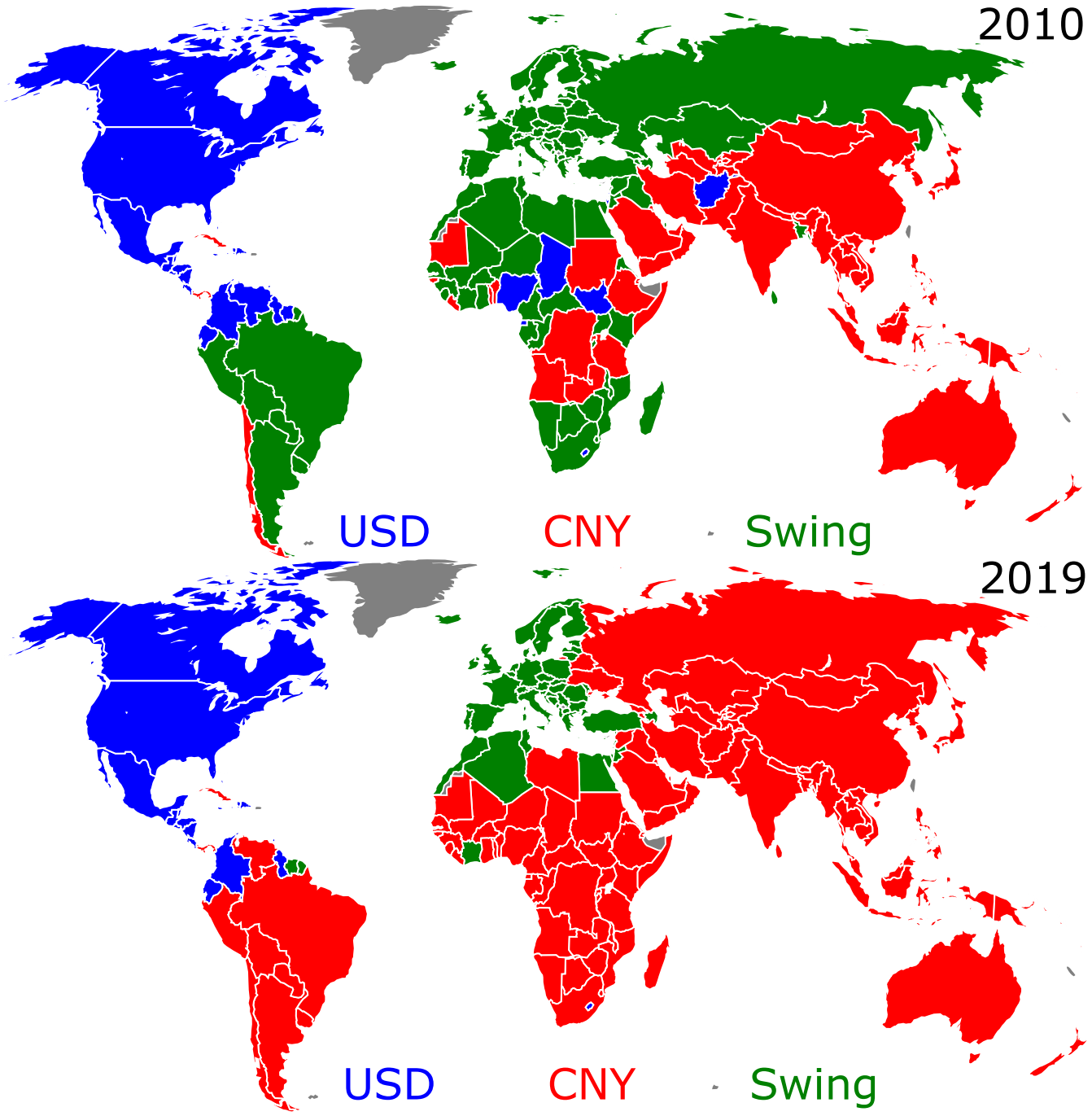

FIG. S7. Same as Fig. 4 but replacing the import trade probabilities P_c and the export trade probabilities P_c^* in (1) by the PageRank and the CheiRank probabilities obtained from the Google matrix of WTN. World map distribution of countries belonging to the USD group (blue, hard preference to trade in USD), the CNY group (red, hard preference to trade in CNY) and the swing group (green, the TCP can change between USD and CNY depending on the initial conditions). The world maps are shown for the years 2010 (left panel) and 2019 (right panel).

TABLE S1. List of the 32 countries belonging to the USD group in 2010. The trade currency preference of these countries is always USD at the end of the relaxation process. The countries are sorted by descending value of $\max(P_c, P_c^*)$, i.e. the maximum value between the relative import volume P_c and the relative export volume P_c^*, and, in case of tie, by descending value of P_c^*. The red (green) colored countries switch to the CNY (Swing) group in 2019. The countries are represented by their ISO2 codes.

Countries of the USD group in 2010

1. US	9. GT	17. JM	25. GQ
2. MX	10. DO	18. GY	26. TD
3. CA	11. HN	19. BS	27. SS
4. IL	12. SV	20. HT	28. LC
5. NG	13. NI	21. SR	29. KN
6. CO	14. VE	22. BB	30. DM
7. EC	15. TT	23. LS	31. GD
8. CR	16. AF	24. BZ	32. FM

TABLE S2. List of the 66 countries belonging to the CNY group in 2010. The trade currency preference of these countries is always CNY at the end of the relaxation process. The countries are sorted by descending value of $\max(P_c, P_c^*)$, i.e. the maximum value between the relative import volume P_c and the relative export volume P_c^*, and, in case of tie, by descending value of P_c^*. The blue colored countries switch to the USD group in 2019. The countries are represented by their ISO2 codes.

Countries of the CNY group in 2010

1.	CN	18.	PK	35.	MR	52.	MV
2.	JP	19.	OM	36.	KG	53.	BT
3.	KR	20.	KH	37.	PG	54.	GM
4.	SG	21.	MM	38.	BJ	55.	DJ
5.	IN	22.	UZ	39.	CU	56.	SB
6.	VN	23.	BH	40.	YE	57.	TL
7.	AE	24.	CD	41.	LR	58.	ER
8.	MY	25.	AO	42.	RW	59.	GW
9.	TH	26.	ZM	43.	TM	60.	VU
10.	AU	27.	PA	44.	MH	61.	WS
11.	SA	28.	LA	45.	NP	62.	KI
12.	ID	29.	TZ	46.	TJ	63.	PW
13.	PH	30.	SD	47.	NE	64.	TV
14.	CL	31.	MN	48.	SO	65.	NR
15.	NZ	32.	BN	49.	KP	66.	TO
16.	KW	33.	ET	50.	CW		
17.	IR	34.	TG	51.	AG		

TABLE S3. List of the 96 countries belonging to the Swing group in 2010. The trade currency preference of these countries is for all of them either CNY or USD at the end of the relaxation process. The countries are sorted by descending value of $\max(P_c, P_c^*)$, i.e. the maximum value between the relative import volume P_c and the relative export volume P_c^*, and, in case of tie, by descending value of P_c^*. The red (blue) colored countries switch to the CNY (USD) group in 2019. The countries are represented by their ISO2 codes.

Countries of the Swing group in 2010

1.	DE	25.	UA	49.	LY	73.	BF
2.	FR	26.	AR	50.	JO	74.	MG
3.	NL	27.	IQ	51.	PY	75.	GN
4.	IT	28.	BD	52.	CI	76.	ML
5.	GB	29.	KZ	53.	UY	77.	UG
6.	BE	30.	SI	54.	BA	78.	CG
7.	CH	31.	GR	55.	MZ	79.	MW
8.	ES	32.	PE	56.	MK	80.	PS
9.	RU	33.	EG	57.	KE	81.	FJ
10.	PL	34.	BG	58.	BO	82.	GA
11.	BR	35.	DZ	59.	NA	83.	SZ
12.	CZ	36.	QA	60.	IS	84.	SC
13.	TR	37.	MA	61.	MT	85.	SY
14.	AT	38.	LT	62.	CY	86.	ME
15.	SE	39.	BY	63.	SN	87.	SL
16.	HU	40.	RS	64.	BW	88.	BI
17.	ZA	41.	HR	65.	GE	89.	VC
18.	IE	42.	LU	66.	LB	90.	AD
19.	DK	43.	EE	67.	AL	91.	CV
20.	NO	44.	TN	68.	AM	92.	CF
21.	SK	45.	LV	69.	MD	93.	KM
22.	RO	46.	GH	70.	CM	94.	SM
23.	FI	47.	AZ	71.	MU	95.	ST
24.	PT	48.	LK	72.	ZW	96.	PN

TABLE S4. List of the 28 countries belonging to the USD group in 2019. The trade currency preference of these countries is always USD at the end of the relaxation process. The countries are sorted by descending value of $\max(P_c, P_c^*)$, i.e. the maximum value between the relative import volume P_c and the relative export volume P_c^*, and, in case of tie, by descending value of P_c^*. The red (green) colored countries belonged to the CNY (Swing) group in 2010. The countries are represented by their ISO2 codes.

Countries of the USD group in 2019

1. US	8. DO	15. BS	22. LC
2. MX	9. HN	16. HT	23. VC
3. CA	10. SV	17. BB	24. KN
4. CO	11. NI	18. LS	25. WS
5. EC	12. TT	19. BZ	26. DM
6. CR	13. JM	20. CW	27. GD
7. GT	14. GY	21. AG	28. TO

TABLE S5. List of the 109 countries belonging to the CNY group in 2019. The trade currency preference of these countries is always CNY at the end of the relaxation process. The countries are sorted by descending value of $\max(P_c, P_c^*)$, i.e. the maximum value between the relative import volume P_c and the relative export volume P_c^*, and, in case of tie, by descending value of P_c^*. The blue (green) colored countries belonged to the USD (Swing) group in 2010. The countries are represented by their ISO2 codes.

Countries of the CNY group in 2019

1.	CN	29.	IR	57.	BN	85.	SY
2.	JP	30.	PK	58.	CM	86.	NE
3.	KR	31.	OM	59.	VE	87.	SO
4.	SG	32.	KH	60.	ZW	88.	SL
5.	IN	33.	MM	61.	ET	89.	KP
6.	VN	34.	GH	62.	BF	90.	GQ
7.	RU	35.	UZ	63.	TG	91.	MV
8.	AE	36.	LK	64.	MR	92.	TD
9.	MY	37.	LY	65.	AF	93.	BI
10.	TH	38.	BH	66.	KG	94.	BT
11.	AU	39.	PY	67.	PG	95.	SS
12.	BR	40.	UY	68.	MG	96.	GM
13.	SA	41.	MZ	69.	BJ	97.	DJ
14.	ID	42.	KE	70.	GN	98.	SB
15.	ZA	43.	CD	71.	ML	99.	TL
16.	PH	44.	BO	72.	CU	100.	ER
17.	CL	45.	AO	73.	YE	101.	CF
18.	NG	46.	ZM	74.	UG	102.	GW
19.	UA	47.	NA	75.	LR	103.	KM
20.	AR	48.	PA	76.	RW	104.	VU
21.	IQ	49.	LA	77.	CG	105.	FM
22.	BD	50.	SN	78.	TM	106.	KI
23.	KZ	51.	TZ	79.	MW	107.	PW
24.	NZ	52.	BW	80.	MH	108.	TV
25.	PE	53.	GE	81.	NP	109.	NR
26.	KW	54.	SD	82.	GA		
27.	QA	55.	MN	83.	TJ		
28.	BY	56.	AM	84.	SZ		

TABLE S6. List of the 57 countries belonging to the Swing group in 2019. The trade currency preference of these countries is for all of them either CNY or USD at the end of the relaxation process. The countries are sorted by descending value of $\max(P_c, P_c^*)$, i.e. the maximum value between the relative import volume P_c and the relative export volume P_c^*, and, in case of tie, by descending value of P_c^*. The blue colored countries belonged to the USD group in 2010. The countries are represented by their ISO2 codes.

Countries of the Swing group in 2019

1.	DE	16.	DK	31.	HR	46.	MD
2.	FR	17.	NO	32.	LU	47.	MU
3.	NL	18.	SK	33.	EE	48.	PS
4.	IT	19.	RO	34.	TN	49.	FJ
5.	GB	20.	FI	35.	LV	50.	SR
6.	BE	21.	PT	36.	AZ	51.	SC
7.	CH	22.	IL	37.	JO	52.	ME
8.	ES	23.	SI	38.	CI	53.	AD
9.	PL	24.	GR	39.	BA	54.	CV
10.	CZ	25.	EG	40.	MK	55.	SM
11.	TR	26.	BG	41.	IS	56.	ST
12.	AT	27.	DZ	42.	MT	57.	PN
13.	SE	28.	MA	43.	CY		
14.	HU	29.	LT	44.	LB		
15.	IE	30.	RS	45.	AL		