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Correction to "Local limit theorem and distribution of periodic orbits of Lasota-Yorke transformations with infinite Markov partition"

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The proof of Theorem 6.1 in [2] has the following error. The choice of y_J in the 8th line from the bottom of p. 336 is not suitable to estimate $\sup_{(s,t)\in W(s_0,t_0)}|II|$ because

$$(*)\qquad \sum_{J\in\mathcal{P}_n, T^kJ=J'} G_k(y_J)EY_{J'}(y_J)=L^kEY_{J'}(T^ky_J)$$

does not hold if we put $y_J=x_J$. If we would choose y_J as in Baladi and Keller [1], we could carry out the estimation in the same manner as in [1].

First of all, we give a suitable choice of y_J. Let $\mathcal{K}=\{K_1, \cdots, K_p\}$ be the finite set of the intervals appearing as $T\,\mathrm{Int}\,J$ for some $J\in\mathcal{P}$ (see (L-Y. 1) in [2, p. 313]). We note that $T^n\,\mathrm{Int}\,J\in\mathcal{K}$ for any $J\in\mathcal{P}_n$ by the Markov property of T. Choose $a_j\in K_j$ for $j=1, 2, \cdots, p$ and we continue our discussion with fixing them. For each $J\in\mathcal{P}_n$, $y_J\in J$ should be chosen so that $T^ny_J=a_j$ if $T^n\,\mathrm{Int}\,J=K_j$. Then it is clear that $Ty_J=y_{J'}$ holds whenever $J\in\mathcal{P}_n$, $J'\in\mathcal{P}_{n-1}$, and $T\,\mathrm{Int}\,J=\mathrm{Int}\,J'$. Thus the present choice of y_J guarantees the validity of (*).

Next, the author would like to give the estimate of $\sup_{(s,t)\in W(s_0,t_0)}|II|$ by using the correctly chosen y_J for the reader unfamiliar with the argument in [1]. Note that the constants C_8, C_9, and C_{10} below can be chosen to be independent of $(s, t)\in W(s_0, t_0)$ although they are possibly different from those in [2]. In addition, we write $TJ=J'$ instead of $T\,\mathrm{Int}\,J=\mathrm{Int}\,J'$ and so on for the notational convenience. Now we have

$$II=\sum_{J\in\mathcal{P}_n} EL^n\chi_J(x_J)=\sum_{J\in\mathcal{P}_n, T^nJ\supset J}\sum_{k=0}^{n-1} G_k(x_J)EY_{T^kJ}(x_J)$$

$$=\sum_{J\in\mathcal{P}_n, T^nJ\supset J}\sum_{k=0}^{n-1}(G_k(x_J)-G_k(y_J))EY_{T^kJ}(x_J)$$

$$+\sum_{J\in\mathcal{P}_n,T^nJ\supset J}\sum_{k=0}^{n-1}G_k(y_J)(EY_{T^kJ}(x_J)-EY_{T^kJ}(y_J))$$

$$+\sum_{J\in\mathcal{P}_n,T^nJ\supset J}\sum_{k=0}^{n-1}G_k(y_J)EY_{T^kJ}(y_J)$$

$$=II_1+II_2+II_3\,.$$

Then we have

$$\begin{aligned}|II_1| &\leqq \sum_{k=0}^{n-1}\sum_{J'\in\mathcal{P}_{n-k}}\sum_{J\in\mathcal{P}_n,T^kJ=J'}|(G_k(x_J)-G_k(y_J))EY_{J'}(x_J)|\\ &\leqq \sum_{k=0}^{n-1}\sum_{J'\in\mathcal{P}_{n-k}}\bigvee_{J'}G_k\|EY_{J'}\|_{BV}\\ &\leqq C_8 n\tilde{\theta}^n\,,\end{aligned}$$

and

$$\begin{aligned}|II_2| &\leqq \sum_{k=0}^{n-1}\sum_{J'\in\mathcal{P}_{n-k}}\sum_{J\in\mathcal{P}_n,T^kJ=J'}|G_k(y_J)(EY_{J'}(x_J)-EY_{J'}(y_J))|\\ &\leqq \sum_{k=0}^{n-1}\sum_{J'\in\mathcal{P}_{n-k}}\operatorname{ess.sup}|G_k|\,\|EY_{J'}\|_{BV}\\ &\leqq C_9 n\tilde{\theta}^n\end{aligned}$$

in virtue of the inequalities (6.16), (6.17), and (6.21) in [**2**].

It remains to show the estimate $|II_3|\leqq C_{10}n\tilde{\theta}^n$. But it is easy to see that the estimation starting from the last line of p. 336 in [**2**] does work since (*) holds for the correctly chosen y_J. Hence we obtain the desired estimate.

References

[1] V. Baladi and G. Keller, Zeta functions and transfer operators for piecewise monotone transformations, Comm. Math. Phys., **127** (1990), 459-477.

[2] T. Morita, Local limit theorem and distribution of periodic orbits of Lasota-Yorke transformations with infinite Markov partition, J. Math. Soc. Japan, **46** (1994), 309-343.

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