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ЕКСПЛУАТАЦІЯ ТА РЕМОНТ ЗАСОБІВ ТРАНСПОРТУ

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ESTIMATION OF THE TIME OF THE VESSEL'S ARRIVAL AT PORT

Purpose. The paper aims at the assessment of the probability of the vessel’s arrival at the port at a specified time interval considering the different combination of the voyage charter-party (C/P) terms and their wordings. **Methodology.** The structure of the vessel's time in port was formed considering the C/P terms and their wordings. The time intervals for which it is actual to estimate the time of arrival were defined on the basis of the theory of transport processes and systems. The normal distribution law was used to estimate the probability of a vessel's arrival at a port at a specified time interval. **Findings.** The probability of the vessels arrival at the port of loading in the C/P in question was searched in three most actual situations: 1) the vessel's opening date is known; 2) the vessel's arrival to the port of discharging on previous C/P is known and 3) the vessels position on the passage to the port of discharging in previous voyage is known. For these three situation were estimate the probability of the duration of the time elements from the opening point and present position points to the port of loading in the C/P in question far as the C/P terms indicate the beginning and the duration of the laytime. **Originality.** For the first time the vessel's time in port was structured considering the C/P terms and their possible wordings, their impact on the time in port was determined, and the probability of vessel's arrival at specified time intervals was searched. **Practical value.** The obtained results can be used in voyage planning (during fixing the C/P and further voyage performance) by estimation the duration of the time in port considering the C/P terms and wordings of the beginning and duration of laytime and time of the vessel's arrival.

Keywords: vessel's voyage; vessel's time in port; voyage charter-party; voyage planning

Introduction

The vessel's time en route largely determines the duration of the passage between ports of loading and discharging and both with the voyage charter-party (C/P) terms on laytime (its beginning and duration) it does the total voyage time. This time, in its turn, is a basis for calculation of voyage expenses and that’s why it influences the efficiency of the voyage. For the shipowner, who carries the cargo under the voyage C/P, the issues of determining the time of the voyage are therefore of fundamental importance. But the most part of researches dedicated to the voyage planning implies the problem of the time en route indicating the slow steaming as an important factor of the voyage efficiency [6, 7, 8, 10, 11, 14, 15]. But the time en route is only the part of the total voyage time and it is no use of searching it just without the time in port as far as time en route (probably the vessel's speed on passage) determines the time of the vessel's arrival to the port for cargo handling. On the other hand, the duration of time in port depends on the appropriate terms of the C/P.

Purpose

The purpose of this study is the assessment of the probability of the vessel’s arrival at the port at a specified time interval, considering the C/P terms and their wordings, which is quite important both for negotiations before the C/P fixture and for voyage time planning and ensuring the voyage efficiency when performing the voyage. In order to

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achieve the purpose the following objectives are to be realized: definition of the impact of the appropriate C/P terms and their wordings on the structure and duration of the vessel's time in port; determination the situations, that are of practical importance for assessing the probability of the vessel arriving at a port at a specified time interval, and obtaining the appropriate calculation formulas; conducting statistical studies confirming the validity of using the normal distribution law for the elements of the voyage time in the processes of estimating the probability of a ship arriving at a port at a specified time interval.

Methodology

The definition of the impact of the appropriate C/P terms on the structure and the duration of the vessel's time in port was based on the analysis of the wording of the C/P terms and decomposition of the time in port depending on the possible combinations of the wordings of these terms. The determining of time intervals, for which it is expedient to determine the probability of the vessel's arrival at the ports of cargo handling, was formed on the main principles of the theory of transport processes and systems. The estimates of the probability of a vessel arriving at a port at a specified time interval were carried out taking into account the properties of the normal distribution law for the elements of the voyage time, the validity of which is confirmed by statistical studies.

Findings

General issues regarding the C/P terms which determine the duration of cargo handling and appropriate vessel's time in port are stipulated in [1, 2, 3, 5, 7, 9, 12, 13, 16-18]. These terms are the loading and discharging rates, terms on Notice of Readiness (NOR) tendering/accepting, including or excluding Sundays and Holidays in laytime days, Sunday time duration as itself. The initial point for time in port calculations is NOR terms – is how it's tendering/accepting stipulated in the C/P. There are two main variants: 1) NOR can be tendered whether the vessel in berth or not, whether in free pratique or not, whether in berth or not (www) or 2) NOR can be tendered after the port formalities on arrival, i.e. after the vessel's berthing. Rather important are wordings regarding the time of NOR tendering, i.e. there may be terms in C/P according to which NOR can be tendered only during office hours. That in fact will take some time waiting the office hours if the vessel arrives on day off. Table 1 shows the structure of the vessel's time in port considering the different wordings of C/P terms. As one can see, the C/P terms determining the duration of the elements of the time in port largely depends on the day of the week and time of arrival (before noon of after noon). For instance, when tendering NOR words in C/P as to be given on getting «free pratique», the waiting time t_{w} to tender NOR will be longer if the vessel arrives before noon (b. n.) on day off (w/e) compared with the vessel's arrival early in the morning on the first working day (w. d.). Similarly, the time between tendering/accepting of NOR will be less if the vessel arrives before noon on working day than if she arrives, for instance, the same day but closer to noon. If NOR can be tendered on www terms, the formalities take place during the «grace» period between tendering of NOR and the beginning of cargo handling. The impact of the terms that include/exclude Sundays and holidays as laytime is obvious. But the moment of the vessel's arrival is also important here – the vessel which arrived on Friday evening, for instance, will spend more time in port if the C/P fixed on SHEx terms than on SHInc.

Thus, even under the same C/P terms, which have a varying impact on the duration of time in port, actual duration of the time in port varies and is determined by the time of arrival of the vessel at the port. The decisive factors are:

1) The arrival of the vessel at the port before noon (b. n.) or afternoon (a. n.) which for NOR terms determines the initial point for t_{NOR};

2) The vessels staying in port during Sundays and holidays which (under SHEx in the C/P) determines the t_{SHEx}.

For estimating with reasonable certainty the possible structure and duration of time in port, the carrier must first assess the probability of the vessel's arrival at the port for cargo handling on a particular day or even within the specified time interval of a particular day. And this, in turn, depends on the duration of the vessel's previous voyage and the duration of the vessel's passage

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from the last port of call (port of loading) to the port of loading (discharging).

Thus, the estimation of the vessel’s time in port is based on a preliminary estimation of the duration of the previous voyage and the vessel’s passage to the port of loading/the duration of loading and passage to the port of discharging.

Table 1

Structure of vessel's time in port considering on combination of C/P terms and wordings

Combinations of C/P terms determining the vessel's time in port			Waiting time t_w	NOR acceptance time t_{NOR}	Formalities time t_f (arrival)	Cargo handling time t_{CH}	Sundays and Holidays t_{SH}	Formalities time t_f (departure)
www + SHEx	w.d.	–		t_{NOR} incl t_f	t_{NOR} incl t_f	t_{CH}	t_{SH}	t_f
		a.n.	–	t_{NOR} incl t_f	t_{NOR} incl t_f	t_{CH}	t_{SH}	t_f
	w/e	b.n.	–	t_{NOR} incl t_f	t_{NOR} incl t_f	t_{CH}	t_{SH}	t_f
		a.n.	–	t_{NOR} incl t_f	t_{NOR} incl t_f	t_{CH}	t_{SH}	t_f
www + SHInc	w.d.	b.n.	–	t_{NOR} incl t_f	t_{NOR} incl t_f	t_{CH}	–	t_f
		a.n.	–	t_{NOR} incl t_f	t_{NOR} incl t_f	t_{CH}	–	t_f
	w/e	b.n.	–	t_{NOR} incl t_f	t_{NOR} incl t_f	t_{CH}	–	t_f
		a.n.	–	t_{NOR} incl t_f	t_{NOR} incl t_f	t_{CH}	–	t_f
free pratique + SHEx	w.d.	b.n.	–	t_{NOR}	t_f	t_{CH}	t_{SH}	t_f
		a.n.	t_w	t_{NOR}	t_f	t_{CH}	t_{SH}	t_f
	w/e	b.n.	t_w	t_{NOR}	t_f	t_{CH}	t_{SH}	t_f
		a.n.	t_w	t_{NOR}	t_f	t_{CH}	t_{SH}	t_f
free pratique + SHInc	w.d.	b.n.	-	t_{NOR}	t_f	t_{CH}	–	t_f
		a.n.	t_w	t_{NOR}	t_f	t_{CH}	–	t_f
	w/e	b.n.	t_w	t_{NOR}	t_f	t_{CH}	–	t_f
		a.n.	t_w	t_{NOR}	t_f	t_{CH}	–	t_f

Mathematically, these temporal characteristics are continually variable, and it is possible to estimate the probabilities of one or another range of their values given 1) knowledge of the type and parameters of the distribution law of the above-mentioned durations of voyage time elements; 2) the availability of reliable information on the present position of the vessel.

A C/P is fixed usually both during the end of cargo handling and the vessel's opening, and much earlier. With significant time intervals between the barging the C/P terms and the planned beginning of the voyage, the assessing with a sufficient degree of certainty of the indicated elements of time is noted to be meaningless (and in this situation one can only rely on average data). So we consider three situations, in which it makes practical sense to assess the probability of a particular duration of the elements of the vessel’s time in port (fig. 1):

1) reliable information on the vessel's opening is known and it is required to estimate the probability of the vessel’s passage to the port of loading t_v;

2) reliable information is known about the arrival of the vessel at the port of discharging in the previous C/P and it is required to estimate the probability of the duration of the vessel’s time in

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port of discharging in the previous voyage and the vessel's passage to the port of loading t'_v;

3) reliable information about the position of the vessel on the passage to the port of discharging in the previous C/P is known and it is required to estimate the probability of the duration of the vessel's passage to the port of discharging, the vessel's time in the port of discharging in the previous voyage and the vessel's passage to the port of loading t''_v.

The identified above practical situations determine three versions of the problem of estimating the probability of the vessel arriving at the port of loading in the time interval (t_1, t_2) The assessment takes place at points A, B, C.

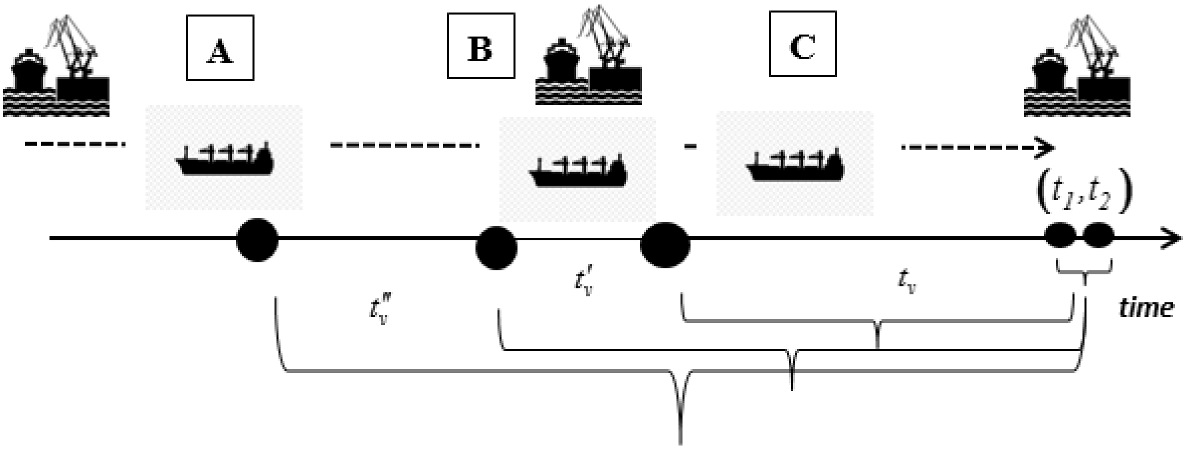

Fig. 1. Three situations, which are of practical sense to assess the probability of a duration the voyage time elements

It seems appropriate, the solution to this problem is associated with the determination of deterministic and probabilistic components in the structure of t_v, t'_v, t''_v and further evaluation of the probabilities of a certain range of values for the second component. This approach is taken as the basis for this study.

To authors opinion, the following formal descriptions for t_v, t'_v, t''_v are fair:

$$t_v = \frac{L}{\overline{V}} + \Delta t_v, \qquad (1)$$

where L – the passage length (miles), $\overline{V}$ – the average speed of the vessel on passage between ports, varies between allowable speeds of the vessel (miles/day).

In this case $\frac{L}{\overline{V}}$ is a deterministic value; Δt_v is a random component of the time interval t_v. The sense Δt_v – the additional time, which is formed under the impact of a variety of factors of different nature (in particular, these issues were considered in [4]), for example:

1) weather conditions that lead to the need to reduce the average speed at the transition or increase the length of the passage (changes in the route);

2) the need to wait in queue when passing channels, straits (in particular, the Bosporus). It should be noted that the expectation of the passage of the Bosporus by vessels is an important problem, especially in winter due to weather conditions.

Authors express t'_v as follows

$$t'_v = t_{CH} + t_v = \frac{Q}{M_{DR}} + \Delta t_{CH} + \frac{L}{\overline{V}} + \Delta t_v, \qquad (2)$$

where $t_{CH} = \frac{Q}{M_{DR}} + \Delta t_{CH}$ – the vessel's time in port of discharging in the previous voyage (days); Q – cargo discharged (VN); M_{DR} – discharging rates (MT/vessel/day); Δt_{CH} – a random component of the time in port of discharging in the previous voyage which occurs, for instance, as uncertainties in the duration of the formalities procedure (days).

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t''_v formalized by authors as

$$t''_v = t^*_v + t'_v = \frac{L^*}{\overline{\overline{V}}} + \Delta t^*_v + \frac{Q}{M_{DR}} + \Delta t_{CH} + \frac{L}{\overline{\overline{V}}} + \Delta t_v \qquad (3)$$

where $t^*_v = \frac{L^*}{\overline{\overline{V}}} + \Delta t^*_v$ – the time en route to the port of discharging in the previous voyage (days); L^* – voyage distance (miles), Δt^*_v – a random component of the time en route (days), takes place being influenced by factors similar to Δt_v

Thus, the assessment of the probability of the vessel's arrival at the port for the three situations and the time points of the A, B, C assessment comes to (4)-(6):

$$P\left(t_1 \le t_v \le t_2\right) \qquad (4)$$

$$P\left(t_1 \le t'_v \le t_2\right) \qquad (5)$$

$$P\left(t_1 \le t''_v \le t_2\right) \qquad (6)$$

where (t_1, t_2) - the set time interval.

Considering the presence in the structure of t_v, t'_v, t''_v deterministic and random components (4)-(6) are equivalent, respectively, to the following expressions:

$$P\left(t_1 - \frac{L}{\overline{\overline{V}}} \le \Delta t_v \le t_2 - \frac{L}{\overline{\overline{V}}}\right) \qquad (7)$$

$$P\left(t_1 - \frac{Q}{M_{DR}} - \frac{L}{\overline{\overline{V}}} \le \Delta t_v + \Delta t_{CH} \le t_2 - \frac{Q}{M_{DR}} - \frac{L}{\overline{\overline{V}}}\right) \qquad (8)$$

$$P\left(t_1 - \frac{Q}{M_{DR}} - \frac{L+L^*}{\overline{\overline{V}}} \le \Delta t_v + \Delta t_{CH} + \Delta t^*_v \le t_2 - \frac{Q}{M_{DR}} - \frac{L+L^*}{\overline{\overline{V}}}\right) \qquad (9)$$

In turn the problem of defining (7)-(9) is reduced to the problem of determining

$$P\left(t' \le \Delta t_v \le t''\right), \qquad (10)$$

$$P\left(t' \le \Delta t_v + \Delta t_{CH} \le t''\right), \qquad (11)$$

$$P\left(t' \le \Delta t_v + \Delta t_{CH} + \Delta t^*_v \le t''\right), \qquad (12)$$

where t' and t'' are formed after the transformation of the constraints in (7)-(9) considering the deterministic components in the structure of t_v, t'_v, t''_v.

Thus, to calculate (10)-(12), it is necessary to know the type and parameters of the distribution laws of random components in the constraint structure of the elements of the voyage time.

In studies of the probabilistic nature of the voyage time and its elements (for instance, [4]) the authors substantiate the validity of using the normal distribution law for the mathematical description of their behavior, in particular, the time en route and time in port. The authors [4] studied statistical data on the operation of bulk-carriers of up to 25000 tons of deadweight in the Black Sea-Mediterranean region. At the same time, the study was not connected with the total duration of the time en route or time in port, but with the study of their individual components (the time required to complete the formalities in the ports, the waiting time for the vessels starting the lay time), which essentially determine the probabilistic nature of the consolidated elements of the voyage time.

This conclusion is valid considering the fact that the speed of the vessel $\overline{V}$ and the cargo handling rates M_{DR}, for example, are not random values, but are formed as a result of the «purposeful» actions of the Master and the stevedoring company, respectively. In this case, due to, for example, weather conditions, the Master may be forced to slow steaming for a certain period of time, which is just a part of the Δt_v or Δt^*_v random component of the time en route.

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In particular, as a result of statistical studies of the time of port formalities (that is, in essence $\Delta t'_v$), the hypothesis about the normal distribution law of this quantity was confirmed with a sufficient degree of reliability. Fig. 2 shows the result of testing the hypothesis of the normal distribution law of waiting time for the beginning of the laytime. Also, as a result of studies of the vessel's time waiting for the beginning of the counting of the lay time, the validity of using the normal distribution law for Δt^*_v was verified (fig. 3).

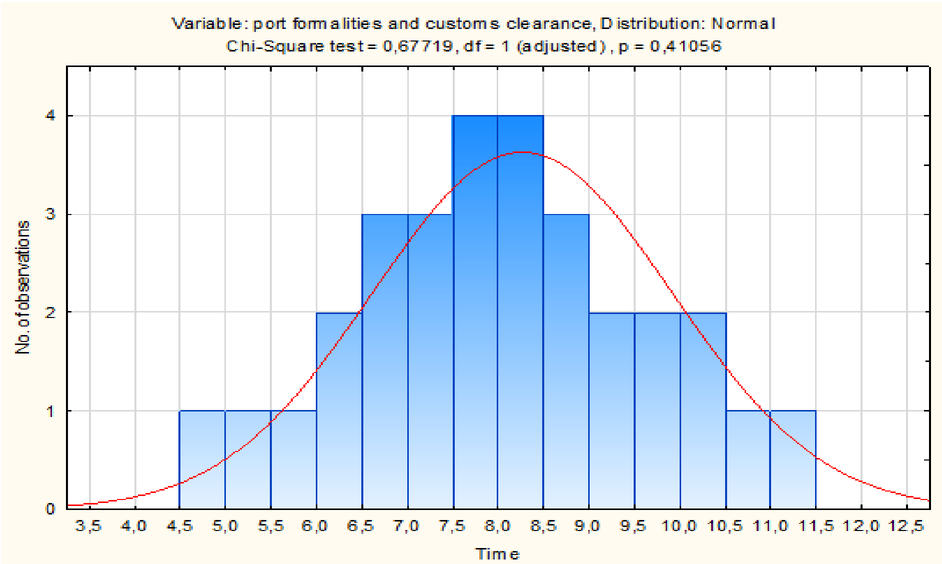

Fig. 2. The results of testing the hypothesis of the normal distribution law of waiting time for the beginning of the counting of the laytime

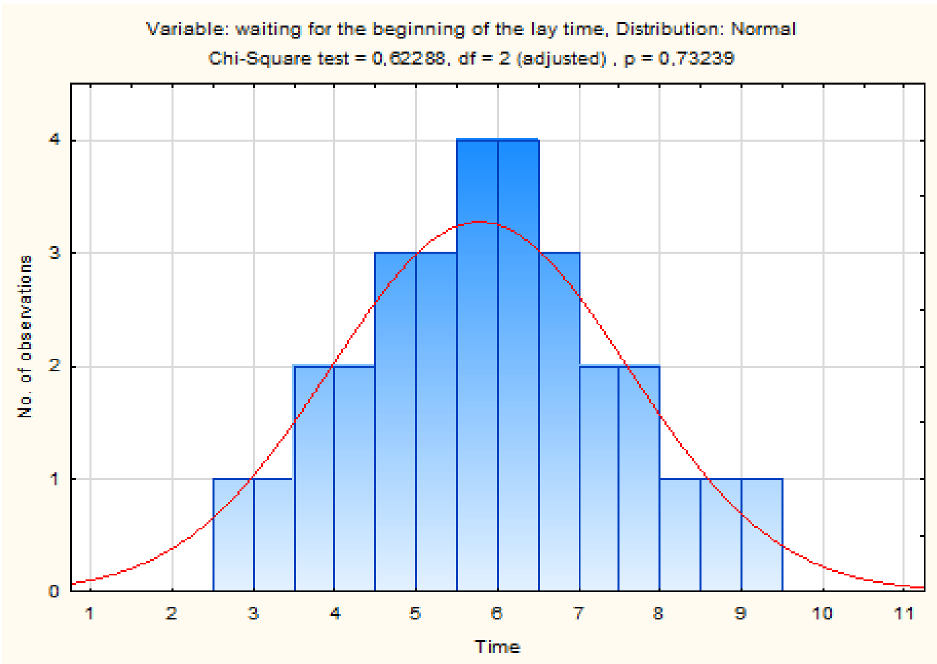

Fig. 3. The results of testing the hypothesis of the normal distribution law for Δt^*_v

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According to the obtained results, the p-value significantly exceeds 0.05 (usually the accepted level for testing hypotheses), therefore, the analyzed data do not contradict the normal distribution law. The following quantile-quantile graphs (Fig. 4) also provide visual confirmation that the data under consideration do not contradict the normal distribution law.

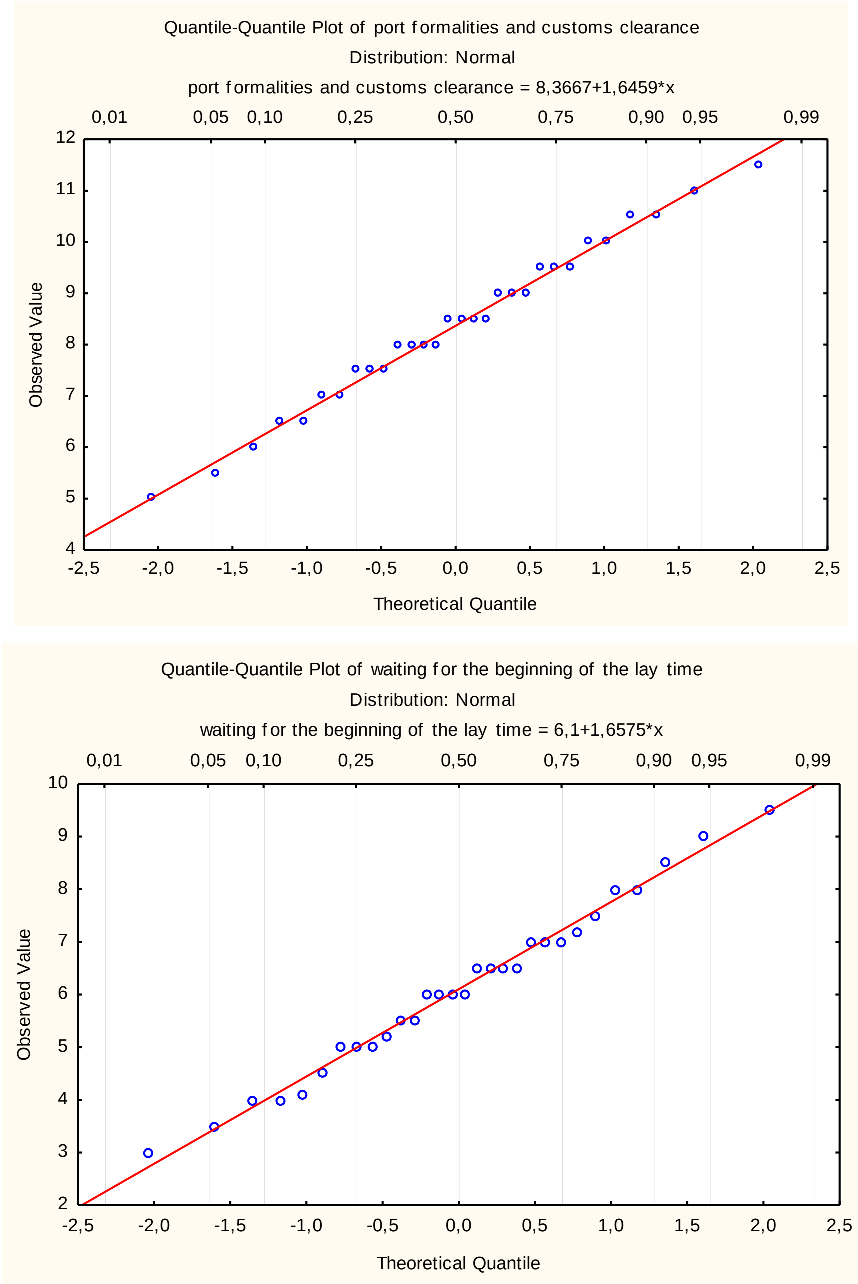

Fig. 4. Quantile-quantile graphs for normal distribution law and searched statistical sample

The homogeneity of the initial information is noted to be important for the «purity» of statistical studies. Therefore, to obtain reliable information on the distribution law parameters, it is necessary to systemize the source data (for example, by navigation regions, by season of work (summer, winter, autumn-spring), by countries of ports of

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call) since in fact the behavior Δt_v, Δt_{CH}, Δt_v^* is differentiated depending on the above factors.

Thus, the legitimacy of using the properties of the normal distribution law for the numerical estimate (10)-(12) is substantiated. Knowing the parameters of the laws of the distribution of random variables Δt_v, Δt_{CH}, Δt_v^*:

$$\left(M_{\Delta t_v}, \sigma_{\Delta t_v}\right), \tag{13}$$

$$\left(M_{\Delta t_{CH}}, \sigma_{\Delta t_{CH}}\right), \tag{14}$$

$$\left(M_{\Delta t_v^*}, \sigma_{\Delta t_v^*}\right), \tag{15}$$

where $M_{\Delta t_v}$, $M_{\Delta t_{CH}}$, $M_{\Delta t_v^*}$ – mathematical expectations, $\sigma_{\Delta t_v}$, $\sigma_{\Delta t_{CH}}$, $\sigma_{\Delta t_v^*}$ - standard deviations of the random value Δt_v, Δt_{CH}, Δt_v^* considering their independence and the properties of the composition of normal values authors obtain equivalent to (10)-(12) expressions (16)-(18)

$$P\left(t' \le \Delta t_v \le t''\right) = \Phi\left(\frac{t'' - M_{\Delta t_v}}{\sigma_{\Delta t_v}}\right) - \Phi\left(\frac{t' - M_{\Delta t_v}}{\sigma_{\Delta t_v}}\right), \tag{16}$$

$$P\left(t' \le \Delta t_v + \Delta t_{CH} \le t''\right) = \Phi\left[\frac{t'' - \left(M_{\Delta t_v} + M_{\Delta t_{CH}}\right)}{\sqrt{\sigma^2_{\Delta t_v} + \sigma^2_{\Delta t_{CH}}}}\right] - \Phi\left[\frac{t' - \left(M_{\Delta t_v} + M_{\Delta t_{CH}}\right)}{\sqrt{\sigma^2_{\Delta t_v} + \sigma^2_{\Delta t_{CH}}}}\right], \tag{17}$$

$$P\left(t' \le t_{CH} + \Delta t_v^* \le t''\right) = \Phi\left[\frac{t'' - \left(M_{\Delta t_v} + M_{\Delta t_{CH}} + M_{\Delta t_v^*}\right)}{\sqrt{\sigma^2_{\Delta t_v} + \sigma^2_{\Delta t_{CH}} + \sigma^2_{\Delta t_v^*}}}\right] - \Phi\left[\frac{t' - \left(M_{\Delta t_v} + M_{\Delta t_{CH}} + M_{\Delta t_v^*}\right)}{\sqrt{\sigma^2_{\Delta t_v} + \sigma^2_{\Delta t_{CH}} + \sigma^2_{\Delta t_v^*}}}\right], \tag{18}$$

where $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_0^x e^{-\frac{t^2}{2}} dt$ is a Laplas function.

If estimated at time points A, B, or C (Fig. 1) the probability of a vessel arriving at a port at a specified time interval is less than a specified value $0 \le p^* \le 1$, that is, it does not hold, respectively

$$P\left(t' \le t_v \le t''\right) \ge p^* \text{ or} \tag{19}$$

$$P\left(t' \le t_{CH} \le t''\right) \ge p^* \text{ or} \tag{20}$$

$$P\left(t' \le t_v + t_{CH} + t_v^* \le t''\right) \ge p^* \tag{21}$$

so next, the time in port of loading under the C/P in question should be estimated, taking into account arrivals after the set time interval, and this becomes the basis for the ship-owner to insist on certain C/P terms regarding the time in port or freight rate in order to ensure the required level of the voyage efficiency.

As noted above, the time of arrival of the vessel at the port of loading under the C/P in question affects the structure and duration of the vessels time in port, which naturally has a further effect on the time of arrival of the vessel at the port of discharging, which in turn affects the structure and duration of the time in the port of discharging (Fig. 5).

Thus, after conclusions on the basis of (19)-(21) on the time of arrival of the vessel at the port of loading, conclusions can be made regarding the vessel's time in port under loading t_{L}, as well as the probability of the vessel's arrival at the port of discharging at different time intervals (Fig. 5), which also provides information on the probability of the time under discharging t_{D}, considering the time of the vessel's passage t_{v}^{N}.

The basis of these conclusions is the reasoning and formulas similar to those presented above, regarding the time of arrival of the vessel at the port of loading. Similarly, in the structure, t_{L}, t_{v}^{N},

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t_D, random components can be distinguished and, using the information on the parameters of their distribution laws, for a given probability, the calculated values of the elements of the voyage time for the C/P in question are obtained. In particular, in [4], an approach to estimating a possible increase in time en route and time in port using the VAR method is presented and one can take into account the influence of random components in the structure t_L, t_v^N, t_D and get their total values.

So it becomes possible to estimate the duration of the voyage under the C/P in question:

$$t_{CV} = t_L + t_v^N + t_D \tag{22}$$

that in turn becomes the basis for evaluating the time-charter equivalent, as an indicator of the efficiency of a voyage.

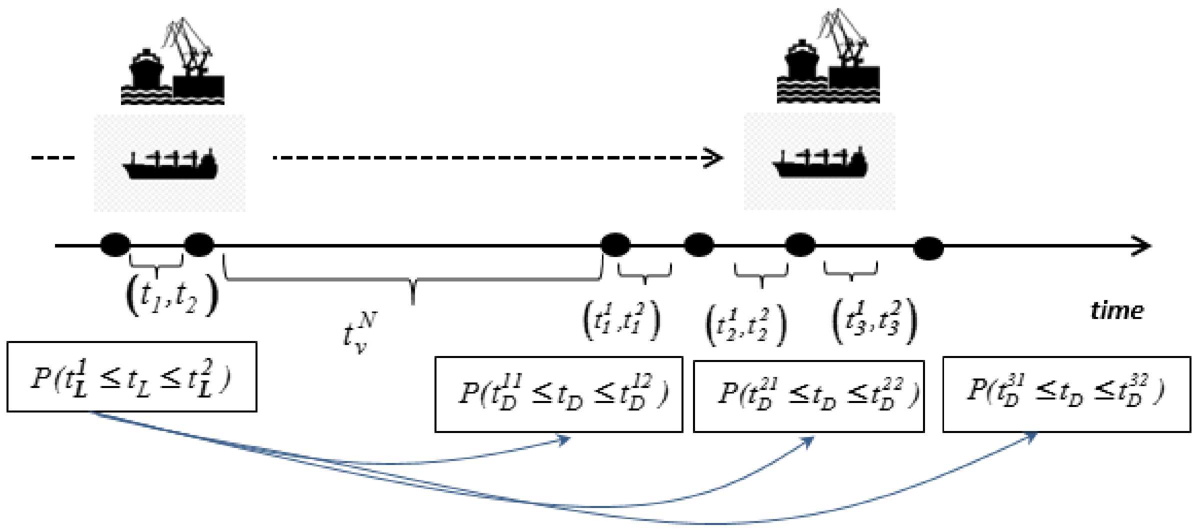

Fig. 5. The impact of the time of arrival of the vessel at the port of loading at the time of arrival at the port of discharging in terms of «probabilities»

At the same time, this assessment will largely correspond to the practice of the shipping business, since in (18) the elements of the vessel's time in port consider the specific structure and duration depending on a) the C/P terms and their wordings; b) the probability estimations of the vessel's arrival at the port of loading.

Originality and practical value

The authors have formed the structure of the vessel's time in port, based on the terms of the C/P and their possible wordings, and established their influence on the duration of the vessel's time in the ports under cargo handling. The estimation of the probability of the vessel's arrival at the ports of loading and discharging at certain time intervals has been completed considering the laytime terms stipulated in the C/P, based on the current position of the vessel. The obtained results can be used in the practice of shipping companies in order to plan the work of vessels on the carriage of goods, as well as to ensure the effectiveness of the voyage both at the negotiation on fixing and during the voyage on the already fixed C/P.

Conclusions

To ensure the effective organization and operation of the fleet for the carriage of goods, it is important to estimate the time required to carry out voyages. The results presented in this paper allow us to solve tasks related to the operation of a vessel on the terms of the voyage C/P, according to the estimation of duration of the vessels time in port under cargo handling, based on the terms and wordings in the C/P.

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ОЦІНКА ЧАСУ ПРИБУТТЯ СУДНА В ПОРТ

Мета. Стаття присвячена оцінці вірогідності прибуття судна в порт у певні часові інтервали з урахуванням різних комбінацій умов рейсової чартер-партії (Ч/П) та їх формулювань. **Методика.** Сформовано структуру стоянкового часу судна в порту за результатами аналізу умов Ч/П та їх формулювань. Часові інтервали, які повинні актуально оцінювати час прибуття судна, були визначені на підставі положень теорії транспортних процесів і систем. Для оцінки вірогідності прибуття судна в порт у певні часові інтервали використано нормальний закон розподілу. **Результати.** Вірогідність прибуття судна в порт за розглянутою Ч/П досліджена для трьох найбільш актуальних ситуацій: 1) відомою є дата «відкриття» судна; 2) відомим є час прибуття судна в порт розвантаження за попередньою Ч/П; 3) відомою є позиція судна на переході з порту розвантаження за попереднім чартером. Для цих трьох ситуацій було оцінено вірогідність тривалості елементів часу від дати «відкриття» й поточної позиції судна до порту завантаження за розглянутою Ч/П, оскільки умови Ч/П визначають початок і тривалість сталії. **Наукова новизна.** Уперше стоянковий час структуровано з урахуванням умов Ч/П та їх можливих формулювань, установлено їх вплив на стоянковий час і досліджено вірогідність прибуття судна в певні часові інтервали. **Практична значимість.** Отримані результати можна використати під час планування рейсу (під час перемовин щодо укладання Ч/П й подальшого виконання рейсу) за рахунок оцінки тривалості стоянкового часу, з урахуванням умов та формулювань Ч/П щодо початку й тривалості сталії й часу прибуття судна.

Ключові слова: рейс судна; стоянковий час; рейсова чартер-партія; планування рейсу

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ОЦЕНКА ВРЕМЕНИ ПРИБЫТИЯ СУДНА В ПОРТ

Цель. Статья посвящена оценке вероятности прибытия судна в порт в определенные временные интервалы с учетом различных комбинаций условий рейсовой чартер-партии (Ч/П) и их формулировок. **Методика.** Сформирована структура стояночного времени судна в порту по результатам анализа условий Ч/П и их формулировок. Временные интервалы, которые должны актуально оценивать время прибытия судна, были установлены на основании положений теории транспортных процессов и систем. Для оценки вероятности прибытия судна в порт в определенные временные интервалы использован нормальный закон распределения. **Результаты.** Вероятность прибытия судна в порт погрузки по рассматриваемой Ч/П изучена для трех наиболее актуальных ситуаций: 1) известна дата «открытия» судна; 2) известно время прибытия судна в порт выгрузки по предыдущему Ч/П; 3) известна позиция судна на переходе из порта выгрузки по предыдущему чартеру. Для этих трех ситуаций была оценена вероятность продолжительности элементов времени от даты «открытия» и текущей позиции до порта погрузки по рассматриваемой Ч/П, т. к. условия Ч/П определяют начало и продолжительность сталии. **Научная новизна.** Впервые стояночное время структурировано с учетом условий Ч/П и их возможных формулировок, установлено их влияние на стояночное время и исследована вероятность прибытия судна в определенные временные интервалы. **Практическая значимость.** Полученные результаты могут быть использованы в планировании рейса (в процессе переговоров по заключению Ч/П и последующего выполнения рейса) за счет оценки продолжительности стояночного времени, с учетом условий и формулировок Ч/П по началу и продолжительности сталии и времени прибытия судна.

Ключевые слова: рейс судна; стояночное время; рейсовая чартер-партия; планирование рейса

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