Y O. Susilo and M. Dijst:
Behavioural decisions of travel-time ratios for work, maintenance and leisure activities in the Netherlands
Transportation Planning and Technology, 33:1, 19-34, 2010.

M2 大山雄己

TTR（Travel Time Ratio）

■ Dijst and Vidakovic (2000)

$$\tau = \frac{T_t}{T_t + T_a} \qquad (0 < \tau < 1)$$

τ ：TTR

T_t ：Travel time（活動場所までの旅行時間）

T_a ：Activity duration（活動時間）

・TTRが大きい＝活動時間に比して旅行時間が大きい
・TTRが小さい＝活動時間に比して旅行時間が小さい

Journey type

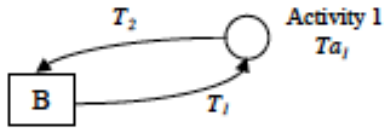
・B(Base location)
　：Home or Work

・活動場所が2つ以上存在する場合は、活動時間に応じて旅行時間を配分する（type 2）

・H-Wの間に活動場所が存在する場合は、総旅行時間から純粋な通勤（or帰宅）時間を除いた分を旅行時間（Travel-time）とする（type4）

I. Journey has only one base location B (either home or work)

Journey type 1: Only one visit journey

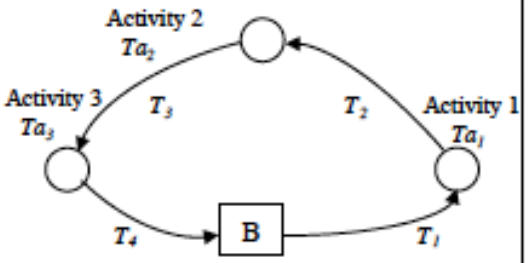


$T_t = T_1 + T_2$

$T_a = T_{a1}$

$\tau = \frac{T_t}{T_t + T_a}$

Journey type 2: More than one visit journey



For a pattern with more than one visit, the travel time is allocated proportional to the stay times in activity places (for arguments of the assumption, please see Dijst, 1995). For example:

If $T_{a1} = 1$, $T_{a2} = 12$ and $T_{a3} = 1$

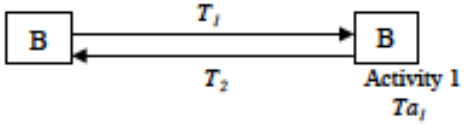
and $T_1 + T_2 + T_3 + T_4 = 24$

then $T_1' = 2$, $T_2' = 20$ and $T_3' = 2$

$\tau = \frac{T'}{T' + T_a}$

II. Journey has two bases locations B (home and work)

Journey type 3: No additional activity location (simple commute pattern)

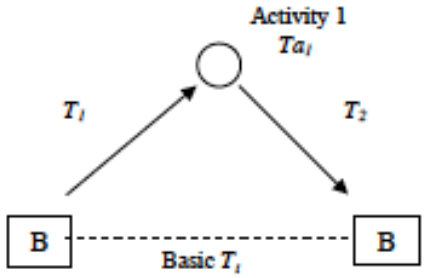


$T_t = T_1 + T_2$

$T_a = T_{a1}$

$\tau = \frac{T_t}{T_t + T_a}$

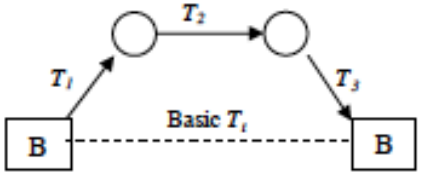
Journey type 4: With one additional activity location



For a pattern with two bases, the travel time spent on the visited activity places is computed by subtracting 'the travel time needed for a direct trip between bases' from 'the actual total travel time'. The steps are:

1. determine basic travel time (basic T_t) between base locations (using BasNet 2000 database);
2. travel time spent to visit additional activity, T' = actual total travel time ($T_1 + T_2$) - basic T_t; and
3. the TTR index, $\tau = \frac{T'}{T' + T_a}$

Journey type 5: With more than 1 additional activity location

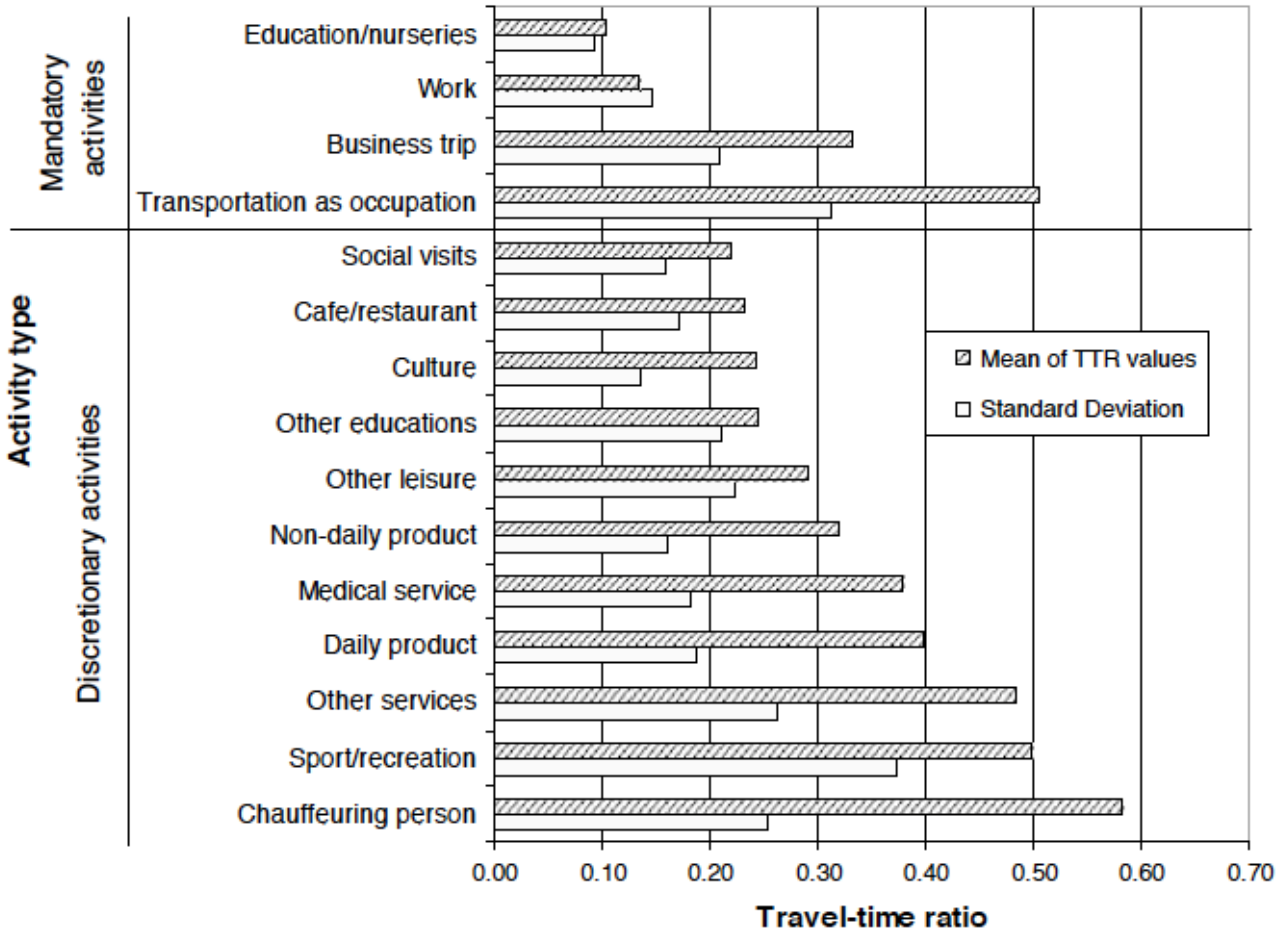


Similar to the journey Type 4 approach, combined with journey Type 2 approach

1. Calculate T_t' (time spent to visit additional activity as journey type 4); and
2. Distribute T_t' for each activity, weighted by the amount of Ta, as journey Type 2

Note: Journeys without any additional activity (e.g. jogging) and which did not return to either home or work are excluded. The respondents who have such journeys in their daily-activity pattern on the given day were excluded from the analysis.

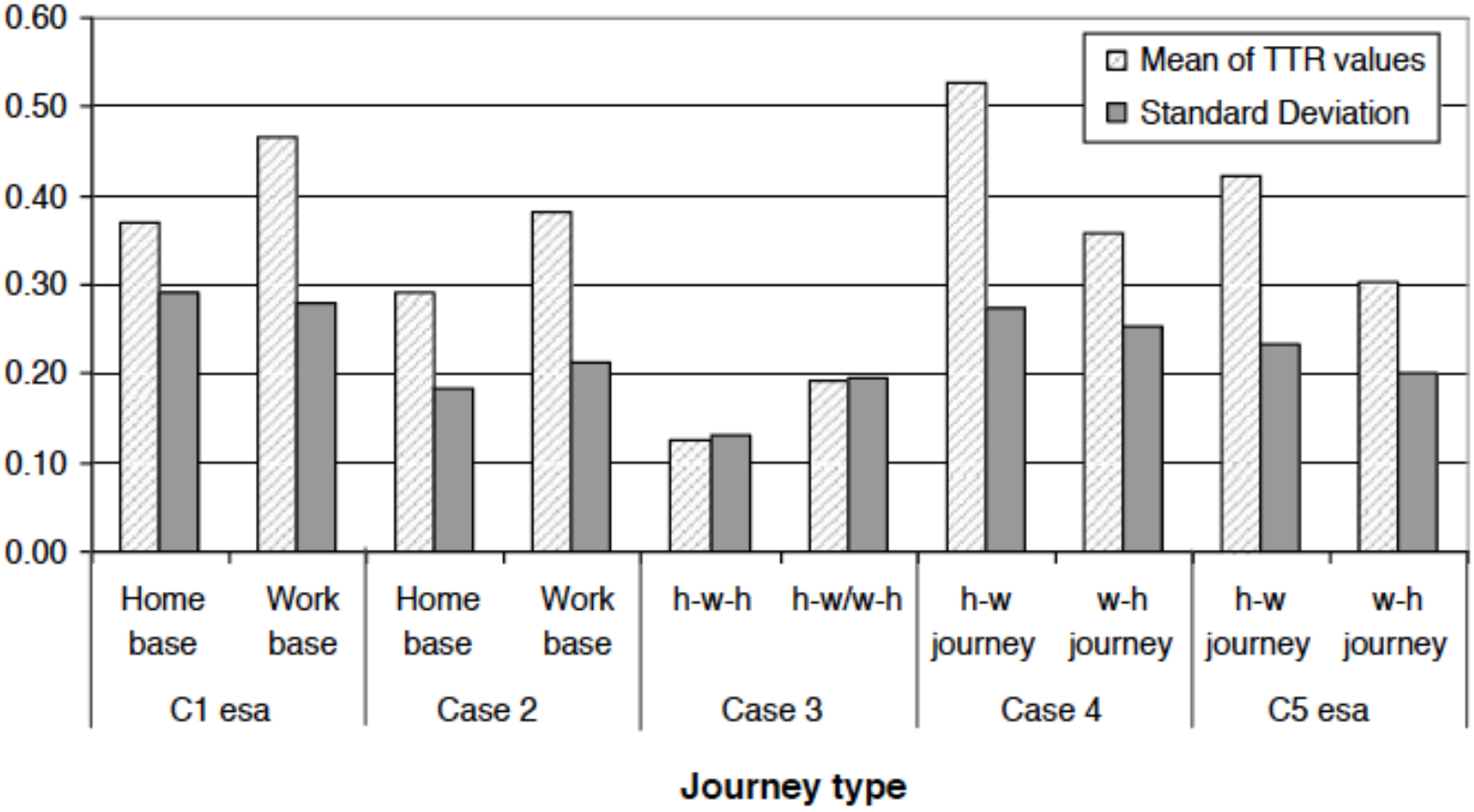
Activity type and TTR



・基本的に義務的活動の方がTTRが小さい

・work/educationは標準偏差が大きく、時間や距離以外にも場所を選択するための要因が多数存在する。

Journey type and TTR



・Case1,2のWorkベース（昼休み等）、Case4,5のh-wタイプ（朝の通勤時間）は活動時間に余裕がなくTTRが大きい。

→標準偏差も小さく、個人間で似たような行動が取られている。

要因分析（重回帰分析）

$$y_{ijkl} = \beta_0 + \beta' X_{ijkl} + (f_{0l} + v_{0kl} + u_{0jkl} + e_{0ijkl}) \quad i = 1, 2, ..., N,$$
$$j = 1, 2, ..., M, \quad k = 1, 2, ..., H, \quad l = 1, 2, ..., R,$$
$$f_{0l} \sim N(0, \sigma^2_{f0}), \quad v_{0kl} \sim N(0, \sigma^2_{v0}), \quad u_{0jkl} \sim N(0, \sigma^2_{u0}), \quad e_{0ijkl} \sim N(0, \sigma^2_e)$$

y_{ijkl} ：TTR　　$e_{0ijkl}, u_{0jkl}, v_{0kl}, f_{0l}$ ：確率項

i （Journey episode)
：活動時間帯、平日/休日、ベース（Home/Work）、トリップチェインの長さ、交通機関…

j （Individual)
：性別、年齢、学年、就業年数、収入、一日の活動場所数…

k （Household)
：家族構成、世帯収入、子供の有無、車の利用可能性、一日の活動場所/活動数…

l （Spatial context)
：土地利用特性、都市化レベル、地域のアクセス指数…

Results

Table 1. Multilevel regression analyses of TTRs for work, maintenance and leisure activities.

	Random-intercept model							
	Work activity		Daily product		Non-daily product		Sport and recreation	
	Coefficient	*t*-stats	Coefficient	*t*-stats	Coefficient	*t*-stats	Coefficient	*t*-stats
Constant	0.206	12.03	0.354	21.15	0.364	14.11	0.356	9.93
Journey characteristics								
The journey departed between 06 and 12 h	−0.057	−13.14	−0.018	−2.37	−0.040	−3.78		
The journey departed between 12 and 18 h	−0.058	−11.03			−0.021	−2.03	0.036	6.06
The journey is done on weekend	−0.022	−4.60	−0.013	−2.64	−0.017	−2.78	0.073	8.37
The journey only has one-base (home/office)			0.085	7.06			0.219	7.08
Number of activities on this particular journey	0.105	12.64	−0.038	−15.88	−0.014	−3.88	−0.029	−6.42
The journey started from office location			0.077	6.61			0.164	6.17
Travel with private car	0.032	12.28	−0.032	−9.51	−0.034	−7.75	−0.300	−51.52
Travel with public transport	0.079	16.01					−0.162	−4.78
Individual characteristics								
Male travellers	0.034	14.27	0.040	13.09	0.022	6.32	−0.013	−2.63
Younger than 25 years old travellers			−0.024	−3.01	−0.043	−4.48	−0.153	−10.40

Results

Table 1 (*Continued*)

	Random-intercept model							
	Work activity		Daily product		Non-daily product		Sport and recreation	
	Coefficient	*t*-stats	Coefficient	*t*-stats	Coefficient	*t*-stats	Coefficient	*t*-stats
Between 25 and 40 years old travellers			−0.021	−3.12	−0.039	−4.61	−0.059	−4.52
Between 40 and 64 years old travellers					−0.024	−3.59		
High education level travellers							−0.029	−2.73
Medium education level travellers	−0.018	−4.18					−0.020	−2.34
High income group travellers	0.011	2.06						
Medium income group travellers								
Total amount of time spent on obligation commitments	−0.00038	−45.72	−3.68E-05	−2.88			−0.00016	−9.35
Number of journey on the given day	0.016	11.21	0.020	10.77	0.016	6.55	0.042	15.45
Household characteristics								
Number of household member			0.007	2.95			−0.029	−6.50
Presence of dependent children (less than 15-year-old)	−0.008	−2.48	−0.018	−2.89			0.021	1.99
Number of private car within household					0.011	2.63	0.037	6.18
Travellers come from single earner household			−0.011	−2.02				

Results

Table 1 (*Continued*)

	Random-intercept model							
	Work activity		Daily product		Non-daily product		Sport and recreation	
	Coefficient	*t*-stats	Coefficient	*t*-stats	Coefficient	*t*-stats	Coefficient	*t*-stats
Two or more earner household								
Total number of journey within household	−0.013	−15.42	−0.006	−4.05				
Total number of activity within household	0.014	21.18	0.004	3.24				
Land use characteristics								
Number of retail per km^2					0.000001	2.43	0.0000016	2.50
Number of jobs can be reached within 30 minutes travel	−2.22E-08	−2.29						
Number of population can be reached within 30 minutes travel	4.11E-08	2.20						
Home municipality has ≥2500 addresses per km^2			−0.025	−2.74	−0.036	−3.21	−0.052	−3.08
Home municipality has 1500 to <2500 addresses per km^2	−0.009	−2.27	−0.030	−4.66	−0.023	−2.81		
Home municipality has 1000 to <1500 addresses per km^2	−0.010	−2.62	−0.030	−4.77				
Home municipality has 500 to <1000 addresses per km^2	−0.013	−3.49	−0.024	−3.97				

Results

Table 1 (*Continued*)

	Random-intercept model							
	Work activity		Daily product		Non-daily product		Sport and recreation	
	Coefficient	*t*-stats	Coefficient	*t*-stats	Coefficient	*t*-stats	Coefficient	*t*-stats
The residents of Randstad area (the main built area in the NL)	0.010	2.95						
The respondent reside next to Randstad area							−0.035	−3.75
Random part								
Variance at level land use (level 4)								
Variance at level household (level 3)	0.0018	5.33	0.016232	22.38	0.0157	19.05	0.0055	10.05
Variance at level individual (level 2)								
Variance at level journey (level 1)	0.0139	48.72	0.015843	52.66	0.0085	33.62	0.0006	55.41
−2*loglikelihood	−18,026.55	−10,206.646	−6950.257	2299.673				

Note: Only variables significant at $p \leq 0.05$ ($\alpha = 5\%$) are shown in the table.