Introduction

1. Background

Nowadays, convergence theory plays an important role in both theorical and practical matters. In economics, convergence theory is commonly used for examining how individual subjects in the studied group can catchup with each other in terms of efficiency, effectiveness and profit. By means of production efficiency indicators, it is more clearly to decide whether or not the underdeveloped low-tech companies can keep up with the advanced ones. In addition, the productivity gap between regions ,which is the result of many factors, can be easily shown out.

In an everchanging global economy, finding an approach to the global economy is inevitable for any entities. Under such circumstances, many questions have been raised about how Vietnamese economy can exploit the global economic integration without being over whelmed by other competitors. In such urgencies, we have been researching the convergence of many industries in the economy to find the answer for the problem. Based on the understanding of the convergence theory in economics, Vietnam is believed to be in need of a key-industry-directed development scheme aiming for sustainability.As a result, ideally, every industries of the economy meets at the same point and each of them will reach their utmost potentials.

In the case of Vietnam, the economy has fairly developed throughout the recent years by means of large quantity of human and natural resources. However, in comparison with other ASEAN members, low production efficiency is still a significant problem within the country. Given that the natural resources are limited, the second-best way for a sustainable future is to boost production efficiency which is heavily relied on the firm's efficiency. Since most of Vietnamese companies are small and medium enterprises, the solution must be to help them catch up with huge state-owned enterprises in resources management structure and techonology, yet the study of this subject is still moderately insufficient.

Under such circumstances, we have decided to choose "*TFP convergence modelsof food and beverage industryin Vietnamfrom 2000 to 2010*" to be our thesis.Moreover, we strongly believe that this topic would make a competent piece to the big picture that we have been studying about the convergence of Vietnam economy.

2. Purposes

The thesis mainly focuses on studying the convergence of total factor productivity(TFP) at the level of small businesses in food and beverage industry. By conducting different experiments, an approximate equation of TFP's convergence as well as the effects of FDI transaction and technology spillover variables on it can be calculated. In addition, those information can be used to answer these questions: "*In an industry, whether or not the underinvested companiescan compete with huge corporations? How effectively*

has FDI been used in the food and beverage industry?". With the aim to help industry-leaders make appropriate decisions, we have come up with two crucial questions below:

- Does the convergence of TFP really exist in the food and beverage industry of Vietnam?
- What effect do FDI transactions and technology spilloverhave on the process of converging?

2. Subjects and scope of research

Subjects

The convergence of TFP; effects of FDI transactions, characteristics of enterprisesand technonogy spillover on the convergence.

Scope

The thesis only takes in account businesses belong to the food and beverage industry of Vietnam from 2000 to 2010 to examine their TFP's convergence. All data is cited from Vietnam GSO's database, which includes all enterprises operating throughout 13 years from 2000 to 2012.

3. Methodology

The thesis synthesizea number of researching methods such as statistical descriptions, analytical method, intergrated approach, modeling method... By using empirical models like estimation method based on cross-sectional data, panel dataand Markov chains,we are able to analyse and evaluate factors that affect productivity convergence and growth. As consequence, the convergence rate and the time to catch up in efficiency ratio of food and beverage companies.

CHAPTER 1
THEORETICAL FRAMEWORK AND LITERATURE REVIEW ON MODELS OF PRODUCTIVITY CONVERGENCE

Chapter 1 Summary

In this chapter, we have organized the principles of convergence theory and proved the basis of our empirical models.In that matter, wehave presented convergence model, its operation process and differentiated the endogenous modeland the neoclassical modelinthe empirical aspect. In specifically, our focus is two types of model: theneoclassical model having one type of capital and technological factor causing endogenous factor to alter along with the neoclassical one with many types of capital. These two models resulted in two different types of convergence whose ideas belong toMankiw, Romer and Weil(1992)and Solow-Swan**Error! Reference source not found.**. After that, we have presented regression approach resultin this research as well asorganized other methods' resultnamely cross-regression approach, panel data analysis, distribution methods, etc. Next, we

wouldpresent about theoretical model, empirical basis and domestic and foreign research summary of each method; point out the advantages and disadvantages of every single one. At the end, we have pointed out the vacancies in empirical research about productivity convergence, especially in Vietnam, and finally stated our thesis *"TFP convergence models of food and beverage industry of Vietnam from 2000 to 2010"*.

1.3. Regression approaches and research overview(Minh et al., 2015)

Table 1.1: Barro regression style of convergence

Economy	Author	No. of observed regions	Sample period	Result	Method
The U.S	(Bernard and Jones, 1996)	50	1963-1989	Convergent (labor productivity)	Barro regression
Japan	(Barro and Sala-i-Martin, 1992)	47		Convergent	Baro regression
Finland	(Pekkala, 1999)	12	1960-1994	No obvious sign of convergence	Baro regression
Japan	(Nishimura, Nakajima and Kiyota, 2005a)	12851	1994-2000	Convergent, technology spillover has positive effects on TFP development of Japan	Barro regression
Norway and Sweden	(Østbye and Westerlund, n.d.)	43 (Norway: 19; Sweden: 24)	1980 - 2000 (Norway) 1985 - 2000 (Sweden)	Norway: Convergent Sweden: Not convergent	Barro regression
13 members of OECD	(Calabrese, Campisi and Mancuso, 2002)	13	1979-1998	Only labor productivity has productivity convergence.	Barro regression
14 members of OECD	(Bernard and Jones, 1996)	14	1970-1987	The manufacture is not convergent, the others are convergent.	Barro regression
OECD	(Cornwell and Wächte, 1998)	26	1960-1994	Strong convergence between the G7, technology transfer affects the convergence.	Barro regression
OECD	(Carree, Klomp and Thurik, 2000)	26	1972-1992	Nominal convergence rate at 10% andnominal non-convergence rate at 1%.	Model β-convergence and σ-convergence
OECD	(Schjerning and Sorensen, 2003)	14	1970-1993	The manufacture is convergent.	Barro regression
European Union(EU)	(Soukiazis, n.d.)	15	1960-1997	Convergent	Convergent andBarro regression
Europe	(Rodrik, 2012)			The manufactureis convergent, the entire economy is not convergent, labor movement affects the convergence.	β-convergence and σ-convergence
Vietnam	(Minh et al., 2014)	1038 (all samples) 907 (local enterprises)	2000-2011	Samples are not convergent as a whole. Local enterprises are convergent.	Barro regression
	(Minh, Hoang and Hau, 2014)	95	2000-2011	Convergent	Barro regression
	(Bao, 2013)		1990-2006	Convergent	β-convergence and σ-convergence

Source: Research summaries

1.3.2. Empirical research using panel data:

Table 1.2: Convergence–using panel data

Economy	Author	No. of regions	Sample period	Result	Method
Italia	(Arbia, Roberto and Piras, 2005)	92	1951-2000	Convergent	Barro regressionandmodel with fixed effects
Indonesia	(Firdaus, 2012)	26	1983-2003	Convergent	Dynamic panel data approach
Europe	(Meliciani and Peracchi, 2004)	95	1980-2000	Notconvergent	Heterogeneouspanel dataapproach
Mexico and the U.S	(Ito, 2007)	18	1986-2000	Convergent	Regression panel data with fixed effects and GMM difference Arellano-Bond

Source: Research summary

Table 1.3: Convergenceusing distribution method

Economy	Author	No. of regions	Sample period	Result	Method
Japan	(Kawagoe and	47	1955-1991	Notconvergent	Markov matrix

	Masaaki, 1999)				
	(Braun and Kubota, 1998)	46	1955-1994	Two peaks (Tokyoandother regions)	Markov matrix
Finland	(Pekkala, 1999)	12	1960-1994	Convergent(1960-1980) Divergence(1980-1994)	Markov matrix
		88	1988-1994	Notconvergent	Markov matrix
Turkey	(Aldan and Gaygisiz, 2006)	67	1987-2001	Notconvergent	Barro regressionandMarkov matrix
	(Aldan, 2005)	67	1987-2001	Notconvergent	Barro regressionandMarkov matrix
Vietnam	(Minh and Khanh, 2013)	59	1991-2007	Convergent	Expanded Barro regressionandMarkov matrix

Source: Research summary

1.3.4. Other approaches

CHAPTER 2
THE CURRENT SITUATION OF TFP IN FOOD ANDBEVERAGE INDUSTRYIN VIETNAM IN THE PERIOD 2000 – 2010

In this chapter, we present the methodological basis of the method for calculating total factor productivity (TFP), the structural basis of variables that affect TFP convergence in terms of integration and tissues experimental form of the thesis.

2.1. Basis for the calculation methodology TFP

2.1.1. Semi-parametric methods

2.1.2. Multi-index method

2.2. Construction method variables potentially affecting the speed of convergence in terms of economic integration

2.2.1. The variables spread technology

2.2.2. The structure of FDI inflows variable transmission

2.3. The convergence models are used for empirical estimation

***2.3.1.* Empirircal sigma convergence model**

Empirical model

$$s_t = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(\text{tfp}_{it} - \overline{tfp_t})^2} \qquad (0.1)$$

To begin with, weassume that ε_{it} is normally distributed with mean of 0 and variance of σ_t^2 (Normal distribution N(0,σ_t^2)). Then, we have:

Suppose $TFP_{it}$is the variable of TFP at the place i and the time t (i =1, 2 ..., N, t = 1, 2, T) Set $tfp_{it} = \ln(\text{TFP}it), và\ \overline{tfp_t} = \frac{1}{N}\sum_{i=1}^{N} tfp_{it}$ respectively are logarithm manddomain averageat the moment of t. Then, the standard deviation of tfp_{it} of a nation of Nregionscan be calculated by the following formula:

$$tfp_{it} = \overline{tfp_t} + e_{it} \qquad (0.2)$$

In which e_{it} is the remainderand s_t the estimation of σ_t.

The question is whetherthe tfp_{it} variable is dependent on regional factorornot? In order to apply σ-convergence model,wehave carried out checking uponthe dependence of tfp_{it} andthe normal distribution statusof the remainder e_{it} in the equation. As consequence, the outcome has shown out in the table below.

2.3.2. Empirical absolute convergence model using cross section data approach

2.3.2.1. Model unconditional convergence approach under cross section data

Empirical model

The assigned empirical model is:

$$d\ln TFP_i = \alpha + \beta \ln TFP_{i2000} + \varepsilon_i \qquad (0.3)$$

Providing that: $\ln TFP_{it}$: the logarithm of TFP of company i year t

$d\ln TFPi$: the gap between TFP logarithm year t andthe base year, approximately equal to the quotient of logarithm difference in TFP of company atyear 2012 and atthe base year (the observed period), T=13.

In case of convergence, the rate of convergence can be calculated by the following formula:

$$\lambda = 1-(1+\beta T)^{1/T} \quad (0.4)$$

Half-lifeformula:

$$half = \frac{\ln 2}{\lambda} \quad (0.5)$$

2.3.2.2. Models with conditional convergence approach under cross section data

2.3.2.3. *Conditional convergence with technology spillover*

Assigned empirical model:

$$\begin{aligned}\Delta \ln TFP_{jT} &= \frac{1}{T}[\ln TFP_{j,2012} - \ln TFP_{j,2000}] \\ &= \alpha + \beta \ln TFP_{j,2000} + \sum_{i=2000}^{2012} \delta_i LHp_{j,i} + \mu_j\end{aligned} \quad (0.6)$$

In whichthe catch-up timeunderconvergenceis calculated by the following formula:

$$\lambda = 1-(1+\beta T)^{1/T} \quad (0.7)$$

Half-lifeformula

$$half = \frac{\ln 2}{\lambda} \quad (0.8)$$

2.3.2.4. Convergence model with variable impact of enterprise characteristics

Empirical model

In our empirical research, the assigned β-convergence conditional model is:

$$\Delta \ln TFP_i = \alpha + \beta \ln TFP_{i2000} + \sum_{t=2000}^{2012} \gamma_1 Vng_{it} + \sum_{t=2000}^{2012} \gamma_2 Lc_{it} + \sum_{t=2000}^{2012} \gamma_3 Kl_{it} + \varepsilon_i \quad (0.9)$$

2.3.3. Models unconditional convergence and convergence models under conditions of integration approaches panel data

***2.3.3.1.* Unconditional panel data model**

Empirical model (Hien, 2015)

Assigned model:

$$\text{dlnTFP} = \ln[\frac{TFP_{t+1,i}}{TFP_{t,i}}] = \alpha + \beta \text{lnTFP}_{t,i} + \varepsilon_{t,i} \quad (0.10)$$

If β<0 then we have the occurrence of unconditional convergenceor absolute convergence. In that case,the catch-up time is calculated by the following formula:

$$\lambda = -\frac{\ln(1+\beta)}{T} \quad (0.11)$$

In addition,thehalf-life formula will be:

$$half = \frac{\ln 2}{\lambda} \quad (0.12)$$

2.3.3.2. *Convergence model with technology spillovers using panel data*

Assigned model:

$$\Delta \text{lnTFPit} = \ln[\frac{TFP_{t+k,i}}{TFP_{t,i}}] = \alpha + \beta \text{lnTFP}_{t,i} + \gamma_1 LHp_{t,i} + \varepsilon_{t,i} \quad (0.13)$$

In which, the catch-up timeis calculated by the following formula:

$$\lambda = -\frac{\ln(1+\beta)}{T}$$

Half-life = $\frac{\ln 2}{\lambda}$

2.3.3.3. Conditional convergence modelwith convey the impact FDI using panel data

Empirical model

$$\Delta \text{lnTFPit} = \ln[\frac{TFP_{t+k,i}}{TFP_{t,i}}] = \alpha + \beta \text{lnTFP}_{t,i} + \gamma_1 back_{t,i} + \gamma_2 Sback_{t,i} + \gamma_3 for_{t,i} + \gamma_4 \text{hor}_{t,i} + \varepsilon_{t,i} \quad (0.14)$$

2.3.4. Distribution approachin studying convergence

Empirical model

Distribution F_t defines TFP difference in each provinces and the average TFP of Vietnam, we assume that this distribution follows the formula below:

$$F_{t+1} = P' F_t$$

In which P is the transition probability matrix (n*n). An element p_{ij} of P indicates the probability of one province in class i period t move to class j period $t+1$. Applying minimum variance criterion, distribution F optionally divided into separate parts. Then, the forward distribution s follows the formula below:

$$F_{t+s} = (P')^s F_t \quad (0.15)$$

And the maximum likelihood estimation:

$$p_{ij} = \frac{1}{T-1} \sum_{t=1}^{T-1} \frac{N_{ij}^t}{N_i^t} \quad (0.16)$$

In which N_{ij}^t isthe number of provinces moving fromclass i to j in period t; N_i^t isthe total number of provinces in class i in period t; and T is the number of periods.

CHAPTER3
EMPIRICAL RESULTS OF MODELSOF TFP OF FOOD AND BEVERAGE INDUSTRY IN THE PERIOD 2000 –2012

Before going on we present empirical calculations and the state of the industry TFP food processing and tube map. Then, we present the empirical model of productivity convergence processing industry for food and beverages. Includes models sigma convergence including the convergence models, models unconditional convergence (absolute convergence), convergence models with variable conditions is pervasive impact of technology and the FDI variable transmission follow the approach cross section data and data arrays. Finally is presented the results of the distribution approach with Markov chain model.

3.1. Perform calculations TFP food industry and beverage Vietnam period 2000-2010 according to different methods.

In this chapter, we have estimated TFP offood and beverage industry from 2000 to 2012 in three different ways. The results are significantly different between using multi-index model and semi parametric method. Despite the different results, both of them led to the same conclusion that TFP has successively raised through many years. This indicates that food and beverage industry of Vietnam has stably developed regardless ofthe recent national economic shocks.

Table 3.10: Basic statistical summaryof TFP of Vietnamese food and beverage industryfrom 2000 to 2012 by business types

Variable	Obs	Mean	Std. Dev.	Min	Max
Totalbusiness samples (100% structured)					
TFPm	6084	82.40736	153.5469	.0289926	2717.963
TFPi	6084	74.59	136.0384	.0265781	2423.838
TFPcs	5616	8.538827	15.09357	.0008531	769.4097
Small business samples (50.76% structured)					
TFPm	3088	25.11882	42.33735	.0446006	1536.061
TFPi	3088	24.73999	41.08901	.0443308	1471.49
TFPcs	2835	7.301744	17.538	.0087957	769.4097
Medium business samples (23.96% structured)					
TFPm	1458	75.42793	94.09748	.0289926	903.9598
TFPi	1458	70.13049	88.26785	.0265781	856.3485
TFPcs	1359	8.968706	11.151	.0008531	114.9333
Large business samples (25,28% structured)					
TFPm	1538	204.0478	244.6834	3.178267	2717.963
TFPi	1538	178.9065	215.7916	2.68832	2423.838
TFPcs	1422	10.59433	12.66807	.137456	125.0648
Exporters samples (6.76% structured)					
TFPm	411	224.7322	249.578	10.67299	1992.773
TFPi	411	200.7236	218.1258	10.72684	1688.756
TFPcs	411	22.12527	17.78646	1.691377	114.9333

Variable	Obs	Mean	Std. Dev.	Min	Max
Local business samples (93.24% structured)					
TFPm	5673	72.09614	138.5942	.0289926	2717.963
TFPi	5673	65.45182	123.1741	.0265781	2423.838
TFPcs	5205	7.466006	14.3232	.0008531	769.4097
Enterprises without foreign investment samples (88.73% structured)					
TFPm	5398	57.16058	103.8346	.0289926	1992.773
TFPi	5398	51.74033	89.65491	.0265781	1688.756
TFPcs	4983	7.263995	8.606492	.0008531	148.2173
Enterprises with foreign investment samples (11.27% structured)					
TFPm	686	281.0693	282.6196	2.341276	2717.963
TFPi	686	254.3896	254.014	2.239313	2423.838
TFPcs	633	18.57435	36.42036	.2872811	769.4097

Source: Original calculations of TFP estimated data of previous parts

Table 3.11: TFP development rate in year

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
TFPm	13.47	4.86	12.82	11.24	9.74	12.27	9.72	6.81	17.75	7.91	7.06	5.56
TFPi	13.51	4.76	12.82	11.08	9.90	12.42	10.15	6.88	17.61	8.42	7.28	5.64
TFPcs		27.59	25.78	27.15	23.97	33.24	24.43	28.05	42.10	28.44	14.36	21.16

Source: Original calculations

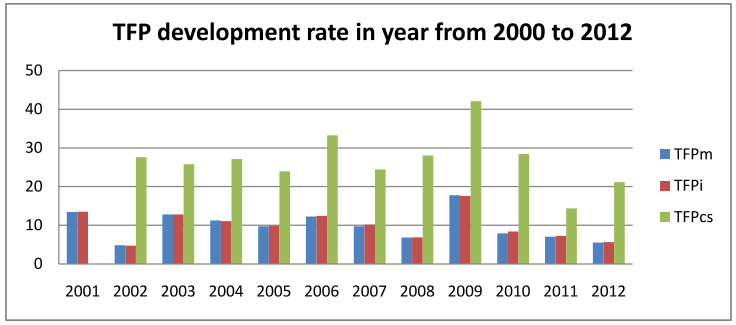

Chart 3.17: TFP development rate in year from 2000 to 2012

3.1. Empirircal sigmaconvergence model

3.1.1. Empirical statistics

Table 3.1: Basic statistics of TFP chains at the provincial level

Variable	Obs	Mean	Std. Dev.	Min	Max
TFPm_prov	650	105.3817	121.6751	3.817449	971.0629
TFPi_prov	650	93.93216	104.7425	3.735881	809.4308
TFPcs_prov	650	8.615273	9.872727	0.203425	103.6955

Source: Original calculations

Inwards: TFPm_prov, TFPi_prov and TFPcs_provrespectively are TFP at the provincial level using Levinshon-Petrin estimation method; Olley-Pakes estimation method andmulti-index model.

3.1.2. Empiricalresult

Table 3.13: Resultof accrediting the remainder with normal distribution

Sigma convergence model			
Conclusion	Tfpm (z p-value)	tfpi (z p-value)	tfpcs (z p-value)
Year 2000	7.021 0.00000	7.315 0.00000	2.669 0.00381
Year 2001	7.021 0.00000	7.315 0.00000	2.669 0.00381
Year 2002	7.021 0.00000	7.315 0.00000	2.669 0.00381
Year 2003	7.021 0.00000	10.748 0.00000	2.669 0.00381
Year 2004	7.021 0.00000	10.748 0.00000	2.669 0.00381
Year 2005	7.021 0.00000	10.748 0.00000	2.669 0.00381
Year 2006	7.021 0.00000	10.748 0.00000	2.669 0.00381
Year 2007	7.021 0.00000	10.748 0.00000	2.669 0.00381
Year 2008	7.021 0.00000	10.748 0.00000	2.669 0.00381
Year 2009	7.021 0.00000	10.748 0.00000	2.669 0.00381
Year 2010	7.021 0.00000	10.748 0.00000	2.669 0.00381
Year 2011	7.021 0.00000	10.748 0.00000	2.669 0.00381
Year 2012	7.021 0.00000	10.748 0.00000	2.669 0.00381
Total	Notconvergent	Notconvergent	Notconvergent

Source:Original calculations data

In conclusion, all 3 models corresponding with 3 methods of calculating TFP have proved the non-existence ofsigma convergence. Hence, food and beverage industryis not convergent at the provincial level.

3.2. Empirical absoluteconvergencemodelusing cross section data approach

3.2.1. Empirical statistics

Table 3.14: Variablesofconvergence model usingcross section data summary

Variable	Obs	Mean	Std. Dev.	Min	Max
lnTFPi2012	468	4.265023	.9840916	1.767899	7.946699
lnTFPm2012	468	4.994684	1.156008	2.22504	9.159879
lnTFPcs2012	468	.2829025	1.047547	-5.680681	2.352754
lnTFPi2000	468	2.862351	1.068875	-.3976324	6.433282
lnTFPm2000	468	3.506251	1.223158	.2566279	7.467757
lnTFPcs2001	468	.3765472	.7814565	-3.026174	2.993849
dlnTFPi	468	.1146433	.1050928	-.2070593	.5090653
dlnTFPm	468	.1213894	.1196629	-.2421101	.5463113
dlnTFPcs	468	-.0080364	.0983964	-.5210996	.2631356

Source: Original calculations based on TFPestimated data

3.2.2. Empiricalresult

Table 3.15: Unconditional convergenceusing cross section data

	TFPi model	TFPm model	TFPcs model
Coefficient	**Total samples**		
$\ln TFP_{2000}$	-0,0146*[1] (0,0025)	-0,0137* (0,0025)	-0,0306* (0,0043)
-cons	0,1248* (0,0081)	0,1221* (0,0080)	0,2187* (0,0031)
R-Squared	25,14	0,2415	0,2267
Thống kê F	F(1, 466)=113,45 Prob>F =0,0000	F(1, 466)=122,34 Prob>F =0,0000	F(1, 466)=137,89 Prob>F =0,0000
Convergence rate	1,60%	1,50%	3,74%
Half-life	46,07 years	46,29 years	18,52 years
No. of observations	468	468	468
T period	13 years	13 years	12 years
Local business sample			
$\ln TFP_{2000}$	-0,0753* (0,0038)	-0,0743* (0,0038)	-0,0766* (0,0052)
-cons	0,2926* (0,0127)	0,2941* (0,0129)	0,2204* (0,0039)
R-Squared	56,31	0,5648	43,81
F statistics	F(1, 332)=430,10 Prob>F =0,0000	F(1, 332)=430,92 Prob>F =0,0000	F(1, 332)=260,62 Prob>F =0,0000
Convergence rate	17,62%	21,11%	34,35%
Half-life	3,9 years	3,2 years	2 years
No. of Observations	334	334	334

Source:Original calculationsaccording to GSO data

Every model has its own estimated coefficient, which is very useful for statistical analyses.

In comparison with all samples, local sample has a moderate gap in TFP between small and medium businesses and, as a result, the time for them to catch up is rarely short. This also meansthat most of food and beverage companies of Vietnam are underdeveloped companies because the newcomers can easily catch up with their technology and productivity in a short time. On the other hand, this may also resulted from the management and the policy to attract talents from pre-existing companies of the newcomers.

Nevertheless, wehave omitted affects of other economics factor upon convergence. Due to the assumption of regional independenceand the overlooked enterprise characteristics, the result of unconditional cross section data model might

[1] Các Coefficient có ý nghĩa thống kê ở mức 0,01, 0,05, 0,10 được kí hiệu tương ứng bởi *, **, ***

be slightly imprecise. Therefore, we have proceeded with conditional cross section data modelin the later parts.

3.3. Unconditional panel data model

3.3.1. Empirical statistics

Table 3.16:Summary of lnTFP value chain

Total samples					
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
lnTFPm	6084	3.602998	1.190969	-3.540715	7.907638
lnTFPi	6084	3.542148	1.159589	-3.627668	7.793108
lnTFPcs	6084	1.555722	1.100119	-7.066674	6.645624

Source: Original calculations based on estimated TFP value chain

3.3.3 Empirical result(Hien, 2015)

Table 3.17: Unconditional panel datamodel result

	TFPi model			**TFPm model**			**TFPcs model**		
Method	**OLS**	**FE**	**HAC(FE)**	**OLS**	**FE**	**HAC(FE)**	**OLS**	**FE**	**HAC(FE)**
Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
$lnTFP_{t,i}$	-,0879* (0,0055)	-,4243* (0,0112)	-0,5223* (0,0130)	-,0831* (0,0055)	-,4281* (0,0112)	-0,523* (0,0126)	-,1292* (0,0067)	-,1886* (0,0081)	-0,3460* (0,0107)
R-sq	0,0415	0,2187	0,2671	0,0393	0,2202	0,2676	0,0666	10,29	0,1916
Sigma_u		0,4474	0,5427		0,4636	0,5626		0,1412	0,2279
Sigma_e		0,4487	0,4533		0,4537	0,4516		0,5228	0,5286
Rho		0,4986	0,589		0,5107	0,608		0,0682	0,1567
Hausman test	Chi2(1)= 1204,96 Prob>chi2 = 0.0000			Chi2(1) =1239,57 Prob>chi2 = 0.0000			Chi2(1) =169,66 Prob>chi2 = 0.0000		
The catch-up time(%)	0,70	4,25	5,68	0,67	4,29	5,69	1,06	1,61	3,26
Half-life (years)	97,94	16,32	12,20	103,86	16,12	12,17	65,13	43,12	21,22

Source: Original calculations based on GSO data

By means of fixed effects (FE) method, beta coefficient is proved to be negative (-0, 5223 using OP estimator, -0,523 usingLP estimatorand -0,346 using measuring indicators), which is very useful for statistical calculations. Given that, there has been the existence of absolute convergence. All three models have come up with the catch-up times respectively are 5,68%, 5,69% and 3,26%. In addition, the corresponding half-lifesare 12,2 years, 12,17 yearsand 21,22 years.

In comparison withcross section data, panel data approach has a higher rate of convergence. This indicates that panel data method has had advantage overcross section data approach in providing optimal result. Although cross section data directly extracted from neoclassical model, it is only suitable for linear production

functions, while, our observed production functions are mainly nonlinear. To conclude, approachpanel data has over come difficulties in endogenous factorin this model. This conclusion also completely matches to verdicts of (Bernard and Durlauf, 1996), (Romer, 1986)and(Fagerberg and Verspagen, 1996).

In comparison with other industries, the convergence food and beverage industry processes quite slow[2]. Thus, we can see the signify cant difference of convergence rateand the catch-up time when using two sequence of TFP in semi parametric OL and LP method and multi-index model. In fact,food and beverage companies in Vietnam do not have abundant capital, highly skilled labor and good materials. Besides, the lack of training program for worker and technology for production are also the reasons for the low efficiency, for which its convergence is lower than other industries. Next, wehave analyzed beta (β) model - convergenceof TFP under affects oftechnology spilloverand FDI transaction variables.

3.4. Conditional convergencewithtechnology spillover

3.4.1. Technology spillovervariables(Hien, 2015)

Table 3.18: High technology variables summary

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
LHpm	6084	.0014661	.0074742	-6.63e-06	.1324454
LHpi	6084	.0014328	.0074412	-6.63e-06	.1324454
LHpcs	6084	.0005872	.0051413	-6.63e-06	.1324454

Source: Original calculations based on GSO data

3.4.2. Convergence modelwithtechnology spillover incross section data

3.4.3. Empirical resultconvergence modelwithtechnology spillover incross section data

Table 3.19: Resultof convergence with technology spillover in cross section data

Model	**Estimated TFP using Olley-Pakes method (Investment - Control variable)**
Equation (1)	Denta_pi= 0,1360* - 0.0219*$lnTFPi_0$ -4,7642***$LHpi_0$ (0,0087) (0,0049) (2,2012) +4,6536***$LHpi_5$+ 3, 8776***$LHpm_6$ – 2,4585***$LHpm_9$ (2,1324) (1,8453) (1,3728) R^2=0,1228 Convergence rate: 2,54% Half-life: 27,24 Year
	Estimated TFPusing Levinshon-Petrin method (Intermediate inputs– Control variable)
Equation (2)	Denta_pm= 0.1340* - 0.0216*$lnTFPm_0$ -2,1368***$LHpm_0$ (0,0087) (0,0028) (1,1012) + 4,1699***$LHpm_6$+4,7096***$LHpm_8$-3,2561***$LHpm_9$ (2,1224) (2,1453) (1,6728) R^2=0,1216 Convergence rate: 2,50% Half-life: 27,68 Year

[2] Calculations are made based on textiles industry survey data: 7,4%-9%, processing industry 4,2%-6,3%

	Estimated TFPusing multi-index model
Equation (3)	Denta_pcs= 0.2169* - 0.0428*lnTFPtfpcs$_1$ -8,6254**LHpcs$_3$ (0,0030) (0,0044) (4,0538) + 3,5191**Lhtfpcs$_4$+6,1846** Lhtfpcs$_5$ + 4,7523***Lhtfpcs$_8$ (1,8907) (2,9134) (2,7133) R^2=0,2764 Convergence rate: 6,06% Half-life:11,44 Year

Source: Original estimations based on GSO data

All three conditional convergence models have come up with the same estimated result: Model (1), model (2) and model (3) showed the existence of TFP convergence in Vietnamese food and beverage industry from 2000 to 2012. Every estimated coefficientis statistically valuable.

As consequence of the estimated result, we have come up with the conclusion: Coefficients of technology spillover variable in 2000 and 2009 of model (1) as well as model (2) and in 2003 of model (3) have negative values. The explanation for this is that, in those years, there has been a movement of highly skilled workers from low-efficient companies to high-efficient companies and the technology imitation of low-efficient companies has not been successful. However, the coefficients of technology spillover variablein 2005, 2006 of model (1), in 2006, 2008 of model (2) andin 2004, 2005 and 2008 of model (3) have positive values. In addition, the total effect of the variable in all three models during the period has a positive value. When we compare the resultoftable 3.4 (Unconditional convergence) and table 3.8 (convergence with high technology variable), there has been real proof about the signify cant influence technology spillover has on TFP convergence in food and beverage industry. For instance, the beta coefficient of conditional convergence models under the effects of technology spillover variablein three models are -0, 0219; -0,0216 and -0,0428.Whereas, the beta coefficient of unconditional convergence models respectively are -0,0146; -0,0137 and -0, 0306. By means of empirical result, we can recognize technology spillover to have noticeable effects upon TFP convergence.

3.4.4. Convergence modelwith technology spillovers usingpanel data

3.4.5. Result of convergence model withte chnology spillover using panel data (look at table 3.20)

Empirical result of conditional convergence model with technology spillover has positive coefficientand high statistical meaning. This indicates that the existence of

high-tech companies has a powerfuleffect on TFP convergence of food and beverage industry.

Moreover, this phenomenon has repeatedly happened throughout the researching period. As it can be explained, generally, the technology transfer between the low-tech and the high-tech has been successful.

Table 3.20: Resultof convergence model withtechnology spillover usingpanel data approach

	TFPi model			TFPm model			TFPcs model		
	RE	FE	HAC(FE)	RE	FE	HAC(FE)	RE	FE	HAC(FE)
Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
$lnTFP_{it}$	-0,111* (0,061)	-0,429* (0,0112)	-0,543* (0,0125)	-0, 106* (0,060)	-0434 1* (0,0112)	-0,554* (0,0125)	-0,137* (0,0067)	-0,1917* (0,0081)	-0,351* (0,0108)
LHp_{it}	8,1864* (0,9415)	18,198* (2,975)	23,478* (3,322)	8,1373* (0,9429)	18,878* (2,9879)	23,478* (3,322)	5,497* (1,075)	9,4112* (2,4868)	11,771* (2,854)
-cons	0,4623 (0,0220)	1,562* (0,0395)	1,692* (0,0427)	0,4491* (0,0218)	1,6014* (0,0403)	1,692* (0,0427)	0,417* (0,012)	0,4930* (0,0139)	0,5338* (0,0164)
R-sq	0,2206	0,2237	0,2695	0,2231	0,2265	0,2695	0,1094	0,1095	0,2015
Kiểm định	Wald chi2(2)=332,61 Prob>chi2=0,0000		F test that all u_i=0: F(467,4678) = 3,02 Prob > F = 0.0000	Wald chi2(2)=307,51 Prob>chi2=0,0000		F test that all u_i=0: F(467,4678) = 3,02 Prob > F = 0.0000	chi2(2)=413,0 Prob>chi2=0,0000		F test that all u_i=0: F(467,4210) =0,94 Prob > F = 0.0000
Sigma_u	0	0,4029	0	0	0,4208	0	0	0,1378	0,1882
Sigma_e	0,4534	0,4534	0,4100	0,4519	0,4519	0,4100	0,5182	0,5182	0,2222
Rho	0	0,4411	0	0	0,4644	0	0	0,0661	0,5285
Hausman test	chi2(2)= 1178,41 Prob>chi2 = 0,0000			chi2(2) = 1218,24 Prob>chi2 = 0,0000			chi2(2) = 162,73 Prob>chi2 = 0,0000		
Convergence rate (%)	0,91	4,31	6,02	0,86	4,37	6,21	1,13	1,68	3,32
Half-life (years)	76,58	16,12	11,50	80,41	15,83	11,16	61,15	41,07	20,84

Source: Original calculations based on GSO data

3.4.6. Performance of domestic companies

Table 3.21: High-tech companies and FDI companies

Year	N_j	N_{Fj}	Rate	Year	N_j	N_{Fj}	Rate
2000	45	29	64,44	2007	42	21	50,00
2001	46	27	58,70	2008	47	22	46,81
2002	45	28	62,22	2009	46	23	50,00
2003	46	27	58,70	2010	41	17	41,46
2004	46	27	58,70	2011	39	18	46,15
2005	45	24	53,33	2012	47	22	46,81
2006	42	23	54,76				

Note: N_j: the number of businesses having TFP as twice asaverage; N_{Fj}: the number of FDI businesses in N_j; rate $=N_{Fj}/N_j$; the industry code of FDI companies are 9 and 10.

Source: Original calculations and extract from GSO data

3.5. Conditional convergence modelwith FDI

3.5.1. Structure ofFDI inflows variable

3.5.2. Empirical statistics

3.5.3. Effectsof FDI on TFP development

Table 3.23: Resultof estimated production functionto calculate TFP usingsemi parametric method

	Estimated TFPusing Olley-Pakes (Investment as control variable)				Estimated TFPusing Levinshon-Petrin (Intermediateinput ascontrol variable)			
	Model 1		*Model 2*		*Model 3*		*Model 4*	
	Total samples	*Domestic*	*Domestic*	*Total samples*	*Total samples*	*Domestic*	*Domestic*	*Total samples*
Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Lnl	0,3754* (0,0251)	0,3832* (0,0246)	0,5185* (0,0247)	0,5152* (0,0243)	0,3336* (0,0236)	0,3421* (0,0200)	0,4950* (0,0264)	0,4919* (0,0207)
Lnk	0,2888* (0,0347)	0,3004* (0,0355)	0,2079* (0,0304)	0,1898* (0,0349)	0,3019* (0,0304)	0,3173* (0,0269)	0,2108* (0,0302)	0,1986* (0,0329)
Back			12,7507* (2,4984)	16,4735* (2,5440)			16,2983* (2,4270)	18,8343* (2,6369)
Sback			-8,4339* (6,0482)	-8,8039* (6,0261)			- 36,1699* (5,4246)	- 43,5878* (5,8808)
Forwd			-5,5190* (1,9766)	-,9600** (2,4083)			-9,6992* (2,0158)	-9,3064* (1,7747)
Hori			-12,7238 (9,8481)	-4,0926 (8,9224)			-10,1551 (9,4575)	-3,3733 (8,0500)

Lc			0,0189* (0,0018)	0,0145* (0,0017)			0,0190* (0,0019)	0,0148* (0,0019)
Kl			0,0009 (0,0006)	0,0001** (0,00007)			0,00001 (0,00005)	0,0001 (0,00005)
Vng			-0,0058 (0,0306)	-0,0075 (0,0249)			-0,0165 (0,0276)	-0,0198 (0,00255)
TotalNo. of Observations	6084	5762	5762	6084	6084	5762	5762	6084
No. of group	468	468	468	468	468	468	468	468

Source: Original calculations based on GSO data

3.5.4. Conditional convergence model using cross section data

3.5.4.1. Empirical result

Table 3.24: Result of conditional convergencemodel usingcross section data

Regression model	**TFPi (Investment as control variable)**
Total samples	Denta_TFPi = 0,1419* - 0,0364lnTFP$_i$*+ 0,0336Vng$_0$**+ 0,0001Kl$_1$**+ (0,0087) (0,0033) (0,0146) (0,00003) 0,0380Vng$_2$*+0,0010Lc$_4$**+ 0,0005Lc$_8$**+0,001Lc$_{12}$*-0,0331Vng$_{12}$* (0,0115) (0,0004) (0,0002) (0,0001) (0,0115) R^2=43,14; the catch-up time: 4,81%; Half-life: 14.4 years
Local samples	Denta_TFPi = 0,1958* - 0,0707lnTFP$_i$*+ 0,0012Lc$_1$*- 0,0017Lc$_2$*– (0,0158) (0,0045) (0,0006) (0,0008) 0,0043Vng$_3$***- 0,0012Lc$_5$***- 0,041Vng$_8$**+ 0,0020Lc$_{12}$* (0,0026) (0,0006) (0,0189) (0,0001) R^2=0,7790; the catch-up time: 17,58%; Half-life: 3,94 years
	TFPm (Intermediate input as control variable)
Total samples	Denta_TFPm = 0,1389* - 0,0350lnTFP$_m$*+0,0339Vng$_0$**+0,039Vng$_2$* (0,0078) (0,0032) (0,0146) (0,0116) -0,0020Lc$_3$*+0,0018Lc$_4$**+0,0005Lc$_8$***+ 0,0010Lc$_{12}$*-0,0345Vng$_{12}$* (0,0006) (0,0005) (0,0002) (0,0001) (0,0117) R^2=0,4233; the catch-up time: 4,56%; Half-life: 15,19 years
Local samples	Denta_TFPm = 0,1966* - 0,0710lnTFP$_m$*+ 0,0013Lc$_1$**- 0,0018Lc$_2$** - (0,0160) (0,0044) (0,0007) (0,0008) 0,0046Vng$_3$***- 0,0019Lc$_5$***- 0,043Vng$_8$**+ 0,0022Lc$_{12}$* (0,0026) (0,0007) (0,0194) (0,0001) R^2=0,7480; the catch-up time: 17,89%; Half-life: 3,87 years
	Estimated TFPusingMulti-index model
Total samples	Denta_TFPcs = 0,1794* - 0,0501lnTFPcs$_0$*+0,0001Kl$_1$**+ 0,0013Lc$_2$** (0,0119) (0,0045) (0,00003) (0,0007)

	-0,0020Lc$_3$*+0,014Lc$_4$**+0,0006Lc$_8$***-0,0311Vng$_9$**- 0,0004Lc$_{11}$** (0,0007) (0,0005) (0,0003) (0,0151) (0,0001) -0,0425Vng$_{11}$*+0,0008Lc$_{12}$* - 0,0319Vng$_{12}$** (0,0163) (0,0001) (0,0123) R^2=0,4979; the catch-up time: 7,78%; Half-life: 8,90 years
Local samples	Denta_TFPcs = 0,1794* - 0,0648lnTFPcs*- 0,0013Lc$_2$**- 0,0430Vng$_8$** (0,0119) (0,0045) (0,0006) (0,0190) +0,0020Lc$_{12}$ (0,0001) R^2=0,5771; the catch-up time: 13,24%; Half-life: 5,23 years

Source: Original calculations

By combining unconditional model with conditional model under the effects of Lc, Kl and Vng variables, we have come up with the conclusion that Lc, Kl and Vng variables have positive effects on TFP convergence. For example,the estimated TFP convergence ratecalculated using semi parametric method has risen from 1,5% to 4,56% and from 3,74% to 7,78% for that using multi-index model. As a result, both productivity growth and industry development have experienced a dramatic increase.

3.5.5. Conditional convergence modelusing panel data

3.5.5.1.Empiricalresult

Table 3.25: Convergencewith FDI transaction variable using panel data

Variabledepended on Δ lnY$_{it}$	**Estimated TFPusing Olley-Pakes (Investment as control variable)**			**Estimated TFPusing Levinshon-Petrin (Intermediate input as control variable)**			**Estimated TFPusingMulti-index model**		
Phương pháp hồi quy	**RE**	**FE**	**HAC(FE)**	**RE**	**FE**	**HAC(FE)**	**RE**	**FE**	**HAC(FE)**
Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
lnY$_{it}$	0,0907* (0,0054)	-,6659* (0,0127)	-,7408* (0,0139)	-,0917* (0,0057)	-,6669* (0,0127)	-,7482* (0,0139)	-,2324* (0,0089)	-0,5189* (0,0123)	-,6099* (0,0131)
Back	7,4336* (1,9675)	31,3365* (1,8985)	33,7584* (2,0212)	6,9162* (1,9661)	30,9308* (1,8937)	33,5334* (2,0196)	24,7763* (2,2954)	57,3766* (2,5277)	82,1438* (3,0138)
Sback	-12,1631 * (3,6103)	-70,7784 * (3,7585)	-76,9864 * (4,1302)	-10,9136 * (3,6062)	-69,8458 * (3,7484)	-76,5054 * (4,1328)	-52,9229 * (4,5096)	-132,5913 * (5,2956)	-200,730 * (7,1287)
For	-5,7451* (1,3834)	-24,6279 * (1,2514)	-26,2274 * (1,2815)	-5,4415* (1,3823)	-24,2643 * (1,2471)	-25,9727 * (1,2778)	-19,7156 * (1,6160)	-44,2256* (1,7077)	-55,2785 * (1,8019)
Hor	6,4420* (3,5327)	7,1754** (3,3217)	5,5642* (5,1913)	6,2879** (2,8544)	6,7280*** (3,3799)	5,2000 (5,2136)	1,4631 (3,7318)	24,7157* (5,5369)	28,6321 (6,1211)
-cons	0,4963* (0,0286)	2,8437* (0,0542)	3,1490* (0,0554)	0,4724* (0,0283)	2,8824* (0,0549)	3,2175* (0,0560)	0,8714* (0,0308)	1,6832* (0,0386)	1,9530* (0,0444)
R-sq	0,3150	0,3479	0,3778	0,3118	0,3484	0,3809	0,2717	0,2757	0,3401
Test	Wald		F test that	chi2(5)=2		F test that	chi2(5)=6		F test that

Variabledepended on $\Delta \ln Y_{it}$	Estimated TFPusing Olley-Pakes (Investment as control variable)			Estimated TFPusing Levinshon-Petrin (Intermediate input as control variable)			Estimated TFPusingMulti-index model		
	chi2(5)=281,08 Prob>chi2 =0,0000		all u_i=0: F(467,4670) = 5.34 Prob > F = 0.0000	81,08 Prob>chi2 =0,0000		all u_i=0: F(467,4670) = 5.47 Prob > F = 0.0000	80,08 Prob>chi2 =0,0000		all u_i=0: F(467,4207) = 3.09 Prob > F = 0.0000
Sigma_u	0	0,6814	0	0	0,7071	0,7920	0	0,3190	0,3803
Sigma_e	0,4100	0,4100	0,4100	0,4092	0,4092	0,4127	0,4693	0,4693	0,4483
Rho	0	0,7341	0	0	0,7491	0,7864	0	0,3160	0,4184
Hausman test	chi2(5)= 2535.47 Prob>chi2 = 0.0000			chi2(5) = 2555.77 Prob>chi2 = 0.0000			chi2(5) = 1144,18 Prob>chi2 = 0.0000		
Convergence rate (%)	0,79	8,43	10,38	0,74	8,46	10,61	2,03	5,63	7,24
Half-life (years)	87,36	8,22	6,67	93,68	8,19	6,53	34,06	12,31	9,57

Source: Original calculations based on GSO data

Based onthe resultof Hausman test, the assigned method to regress convergence model is fixed-effects method. In both cross section data and panel data, the results have proved the existence of TFP convergence. To sum up, technology spillover, enterprise characteristics and FDI transactions variables all have positive effects on the convergence rate.

3.6. Distribution approachin studying convergence

3.6.1. Data and variables:

Table 3.26: Segments of $F_t$chain and statistics summary

Variable	F_{it}	F_{mt}	F_{cst}	Variable	F_{it}	F_{mt}	F_{cst}
Min	0,036	0,035	0,09	**C2**	(0,28; 0,56]	(0,3; 0,6]	(0,38; 0,76]
Max	6,39	6,87	4,32	**C3**	(0,56; 0,84]	(0,6; 0,9]	(0,76; 1,14]
Mean	0,681	0,692	0,935	**C4**	(0,84; 1,12]	(0,9; 1,2]	(1,14; 1,52]
C1	(0;0,28]	(0; 0,3]	(0; 0,38]	**C5**	(1,12; 6,4]	(1,2; 7)	(1,52; 4,5)

Source:Original calculations based on GSO data

3.6.3. Empirical result

Table 3.29: Matrix switch modules for 12 periods

	F_{it} chain					F_{mt}chain					F_{cst}chain				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
1	0.83	0.158	0.01	0.001	0.001	0.86	0.11	0.01	0.01	0.01	0.57	0.3	0.08	0.02	0.03
2	0.1	0.82	0.06	0.01	0.01	0.1	0.79	0.08	0.01	0.02	0.05	0.74	0.18	0.02	0.01
3	0.01	0.1	0.67	0.19	0.03	0.01	0.13	0.69	0.16	0.01	0.01	0.19	0.62	0.17	0.01
4	0.005	0.04	0.2	0.555	0.2	0.01	0.03	0.18	0.51	0.27	0.01	0.05	0.24	0.58	0.12
5	0.001	0.01	0.01	0.079	0.9	0.01	0.02	0.01	0.07	0.89	0.01	0.03	0.06	0.18	0.72

Source:Original calculations based on GSO data

Table 3.20: Matrix switch after 3 iterations

	F_{it}chain					F_{mt}chain					F_{cst}chain				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
1	0.612	0.332	0.041	0.009	0.006	0.731	0.217	0.038	0.007	0.006	0.226	0.432	0.211	0.077	0.054
2	0.208	0.605	0.113	0.041	0.034	0.216	0.542	0.142	0.044	0.055	0.072	0.514	0.287	0.094	0.032
3	0.040	0.178	0.406	0.235	0.141	0.048	0.221	0.409	0.200	0.122	0.034	0.306	0.391	0.210	0.059
4	0.015	0.104	0.266	0.272	0.343	0.015	0.110	0.220	0.228	0.427	0.023	0.180	0.325	0.307	0.166
5	0.004	0.036	0.076	0.140	0.745	0.006	0.055	0.054	0.129	0.756	0.010	0.119	0.190	0.260	0.421

Source:Original calculations based onGSO data

Table 3.30: Matrix switch after 19 iterations

	F_{it}chain					F_{mt}chain					F_{cst}chain				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
1	0.245	0.348	0.142	0.093	0.171	0.337	0.280	0.131	0.076	0.177	0.053	0.341	0.312	0.186	0.108
2	0.217	0.322	0.147	0.104	0.210	0.272	0.257	0.137	0.091	0.243	0.053	0.341	0.312	0.186	0.108
3	0.150	0.253	0.158	0.129	0.310	0.204	0.229	0.140	0.107	0.321	0.052	0.339	0.312	0.187	0.109
4	0.128	0.229	0.160	0.137	0.346	0.163	0.207	0.139	0.116	0.376	0.052	0.338	0.312	0.188	0.110
5	0.101	0.198	0.162	0.146	0.393	0.134	0.191	0.137	0.122	0.415	0.051	0.336	0.312	0.189	0.112

Source: Original calculations based on GSO data

Table 3.34: ForecastedTFP status at provincial level after 19 years

	F_{it}chain					F_{mt}chain					F_{cst}chain				
	ST1	ST2	ST3	ST4	ST5	ST1	ST2	ST3	ST4	ST5	ST1	ST2	ST3	ST4	ST5
No.of provinces	8.116	13.188	7.726	6.195	14.775	10.950	11.565	6.843	5.150	15.492	2.613	16.955	15.605	9.367	5.460
Rate	0.162	0.264	0.155	0.124	0.295	0.219	0.231	0.137	0.103	0.310	0.052	0.339	0.312	0.187	0.109

Source: Original calculations based on GSO data

Table 3.35: Matrixswitch after 25 iterations

	Fit chain					Fmt chain					Fcstchain				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	0.222	0.325	0.146	0.102	0.205	0.303	0.267	0.133	0.084	0.213	0.052	0.340	0.312	0.187	0.109
2	0.203	0.306	0.149	0.109	0.233	0.259	0.249	0.136	0.094	0.262	0.052	0.340	0.312	0.187	0.109
3	0.155	0.257	0.156	0.127	0.305	0.211	0.229	0.138	0.105	0.318	0.052	0.339	0.312	0.187	0.109
4	0.140	0.240	0.158	0.132	0.330	0.181	0.214	0.138	0.112	0.356	0.052	0.339	0.312	0.187	0.109
5	0.120	0.219	0.160	0.139	0.362	0.160	0.204	0.138	0.116	0.382	0.052	0.338	0.312	0.188	0.110

Sourceoriginal calculations data dựa vào bộ số liệu điều tra danh nghiệp GSO

Table 3.36: Resultforecast TFP at the provincial level after 25 years

	F_{it}chain					F_{mt}chain					F_{cst}chain				
	TT1	TT2	TT3	TT4	TT5	TT1	TT2	TT3	TT4	TT5	TT1	TT2	TT3	TT4	TT5
No.of provinces	8.186	13.257	7.713	6.169	14.675	11.035	11.583	6.827	5.129	15.426	2.613	16.959	15.606	9.365	5.457
Rate	0.164	0.265	0.154	0.123	0.293	0.221	0.232	0.137	0.103	0.309	0.052	0.339	0.312	0.187	0.109

Source: Original calculations based on GSO data

Approximately, after 19-25 years,the forecast becomes highly stable. This indicates that thereis a steady state, which defines the development level of that process, in TFP at provincial levelinfood and beverage industry. Although local convergencedid not occur, convergence still appearsin groups. Therefore,concerning poor and lack of condition provinces, if their food and beverage industry receives properly investment, there is a high chance that they can catch up with the developed ones.

COCLUSION, RECOMMENDATIONSAND FURTHER RESEARCH SUGGESTION

Conclusion:

The thesis "Convergence modelsof TFP in food and beverage in dustry Vietnam from 2000 to 2010" has given out answers for the questions of the topic's objectives, there has been some conclusion made through empirical research:

- *Theory*

The thesis proposes empirical models for conditional convergence in food and beverage industry in Vietnam. Moreover, the thesis have taken in account of new variablessuch as backspread, spread and techonology spillover. In addition, the industry TFP has been calculated in 3 different ways under certain conditional convergence models.

- *Recommendations*

There is no sign of sigma convergence (σ) in the whole economyof Vietnam. On the other hand, unconditional convergent, absolute convergence and conditional convergence do

exist at the enterprise level. Besides, at the provincial level exist the steady state of TFP. In specifically:

Estimated resultof convergence using cross section data with Barro regression: There have been the occurence of unconditional convergence, absolute convergence and conditional convergence. The unconditional convergence rate, orabsolute convergence, fluctuates from 1,6% to 3,74% in a year. This in dicates that the low-efficient companies can narrow the gap with high-efficient companies from 1,6% to 3,74% in average a year. The techonology spillover and FDI interdisciplinary transaction have been major factors in theresult of TFP convergence. Under the effects of these variables, the convergence rateof TFP chains using cross section data has increased from 2,54% to 6,06% (with technology spillover), and from 4,81% to 7,78% (with FDI spread). By means of these variables, every year the underdeveloped companies can get closer to developed ones in terms of efficiency from 2,56% to 6,06% and from 4,81% to 7,78%. The result has also pointed out that *Back* and *Hor* transmssion variables (representing spread variables) has positive effects onthe convergence rate, while, *Sback* and *Forwad* variables (representing backspread variables) constraints the TFP convergence of businesses.

Regression resultusingpanel data: There have been the existence of unconditional convergenceand conditional convergence with technology spillover FDI transactions. The rateof unconditional convergence is between 3,26% - 5,68%, 3,32% - 6,21% for conditional convergence (technology spillover) and 7,24% - 10,61% for conditional convergence (FDI transactions). *Back* and *Hor* variables (representing spread variables) has positive effects on the convergence rate, whereas, *Sback* and *Forwad* variables (representing backspread variables) has negative effects on the convergence rate.

Resultusing Markov chains method: Companies are divided into 5 different groups. In group 1, the underdeveloped companies accounts for 16,4%; in group 2, slightly underdeveloped companies account for 26,5%; in group 3, average companies account for 15,4%; in group 4, fairly developed companies accout for 12,3% andin group 5, developed companies account for 29,3%. The time for companies to get to the steady state falls between 24 and 25 years.

State owned enterprises group has increasingly taken good advantages in technology. As a result, these enterprises have made significant contribution to the industry TFP development. In fact, the number of new high-tech companiesre cognized in this group has increased from 35,56% in 2000 to 53,19% in 2012.

Policy proposals

Based on the empirical resultof chapter 2 andchapter 3, wehave come up with these proposals:

First, allocate more investmentson food and beverage industry, especially focus on improving technology and attracting capital from foreign andlocal companies.

Second, research the natural advantages of each region and match them with the right industry. According to the result of sigma convergence, the regional factor plays an important role in TFP convergence.

Third, back variables have positive effects on the development andconvergence of TFP. Therefore, the collaboration of many industries is very essential in the developing process. In specifically, there should be a mutual network for sharing products information between different industries to enhance the cooperating chances.

Fourth, Sback and *For* variables both have a negative valueand high statistical value, which means that the collaboration between local companies and FDI companies is not really effective. Because these variables are very crucial to the development of TFP, there must be some measurements taken by policy makers to improve the cooperative quality.

Fifth, enterprise characteristics variable has the same level of effects on TFP in comparison with the convergence ratethrough the whole period. Hence, in order to boost the convergence rate,we shoul dincrease the capital to labor ratios, workers incomeand equity ratio.

Sixth, high-technological factor has great impact on TFP convergence, therefore, weneed to have tools and methods to spread out the technical information, support experiment exchangeandfurther invest in technology for the industry.

Seventh, from the resultof Markov chains model and TFP chains at the provincial level,we has found out the existence of a long-term steady state. Although there is no sign ofthe convergenceof TFP chains at the provincial level of all samples,there has been proof ofgroup convergence. Based on that information, the policy makers can have a clue of future TFP convergence at the provincial level and decide the best region to invest.

Further research direction

In this research, wejust have examinedabsolute convergenceandthe effect so fenterprise characteristics variables such astechnology spilloverand FDI transactionson TFP convergence. Nonetheless, wehave not taken regional factor in account. This is important because given that there is no sigma convergence (σ) in the food and beverageindustry, the TFP convergence, theoretically, must depend on the differences between regions. Hence, weproposefurther research of TFP convergence in food and beverage industry following spacing approach. Moreover, cross section dataandpanel datamodels are only staticmodels; wesuggest using dynamicpanel datamodel to have a closer look at this topic.