Welfare analysis of price stabilization a case study of small chili in west nusa tenggara province indonesia

by Muhamad Siddik

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Welfare analysis of price stabilization: a case study of small chili in West Nusa Tenggara Province, Indonesia

Welfare analysis of price stabilization: a case study of small chili in West Nusa Tenggara Province, Indonesia

A Zaini[1], M Siddik[1] and D Rukmana[2]

[1]Agribusiness Study Program, Faculty of Agriculture, Mataram University
[2]Agribusiness Study Program, Department of Social Economic of Agriculture, Faculty of Agriculture, Hasanuddin University

Email: anzaekopol@gmail.com

Abstract. As one among others strategic commodity in which its price often fluctuate seasonally, price stabilization of chili commodity is conducted through import regulation. This research aims at analyzing the welfare impacts of this price stabilization policy by utilizing monthly time series data of 2012-2016. Data were then analyzed using Eviews 6.0 software package. The simultaneous equation model and two-stage least square (TSLS) estimation technique were undertaken. Results conclude that the source of chili price instability comes from a supply shock. Moreover, price stabilization policy has benefitted producers/farmers, consumers, and society as a whole indicated by the positive sign of their welfare gains.

1. Introduction

In the early 1950s, around 83% of Indonesia's 80 million population was estimated to live in poverty. This condition did not improve significantly over the next two decades. Therefore, one of the priorities of the Indonesian government's development program is poverty alleviation [1]. Poverty alleviation can be done if the government could create the ultimate high yield for the poor' resources (especially land and labor). Therefore, with a small size of land ownership (0.26 hectares for each farmer), it is challenging for farmers to be able to increase their prosperity if they are still dependent on food crops (especially rice). As a staple food among the community, rice price is controlled by the government through maximum retail price policy [2]

One of the agricultural commodities which have the potential to give a high yield is small chili [3]. However, this commodity's price has always been fluctuating at a certain season. Consequently, it should be developed through a comprehensive approach, noted the price's fluctuation could be very sharp when the price is "plummet," as well as when the price is "bounced" [4]. The problem is that the price stabilization effort and revenue of small chili farmers, like other horticultural products, can't be treated like food grain products, which can be stored for a long time. A vegetable product like chili can get easily rotten, so the effort that can be made by the government is to regulating an import. On and off imports faucet has been done through Horticultural Products Import Recommendation to recommend such as import quota and listed importers' allocation. The regulation aims to control horticultural products that allowed to be imported when the import will occur and the import's quota. This article aims to analyze the Welfare Impact of Price Stabilisation of Chilli Pepper in West Nusa Tenggara.

2. Methods

2.1. The Massel Model to Measure Social Welfare Impacts

This model can allow for the shift in the demand and supply curves of small chili. However, unlike the other agricultural products which can be stored a little longer where stabilization has doney by using buffer stock instrument, the price stabilization in this study is practically controlling the price's stabilization through export and import:

$$S = \alpha P + x \qquad \alpha \geq 0$$
$$D = -\beta P + y \qquad \beta \geq 0$$

Where S is the total production of chili, P is the small chili's price, α and β are constant parameters, while x and y are the shifter variables for supply and demand, which normally distribute with an expected value that not equal to zero. The price is stabilized at its average value, which discovers from the x and y distributed value and doesn't have a correlation or cov (x,y) = 0. The average price on a competitive structural market can be stated as follow:

$$\mu P = E(P) = (\mu y - \mu x)/(\alpha + \beta)$$

where,

$$\mu x = E(x) \text{ dan } \mu y = E(y)$$

The result from this Massel model implies that the producer can obtain more enormous advantages from stabilization regulation with increasing supply relative's variance (σxx) towards its demand variance (σyy). The producer's tendency to get more prominent stabilization advantages is with the steeper supply relative's curve (decrease in α) toward its demand curve. A limited case such as a vertical supply curve or demand variance is valued with zero; producers will not losing anything because of the stabilization. On the other hand, consumers will benefit more by increasing the variance in demand relative to supply, and with a steeper demand curve relative to supply curves. In a limited case, such as a vertical demand curve or a zero-value supply variance, the consumer has nothing to lose with a stabilization policy.

Using the Massel model, Schmitz et al. (2002) [5] show that people, in general, tend to like a stabilize price rather than fluctuating one, as illustrated in Figure 1. Consumer demand is symbolized with D, and stochastic supplies are S1 and S2 with each probability to happen is 0,5, and the equilibrium of possible events are symbolized with P1 and P2. For example, if the price is stabilized at Pμ with the government buying the surplus Qs1-Qμ (buffer stock) if the S1 is the production happened and selling Qμ-Qs2 if the production happened in S2. With this regulation, if S1 occurs, the consumer will eventually lose the c + d shade area, and the producer will benefit in the c + d + e shade area. Therefore, net income will be in the e area; However, if the S2 is happening, then the producers will lose their profit at the shaded area of a and consumer will gain benefit from the shaded area of a+b. Therefore the benefit of the price stabilization regulation as a whole is at the shaded area of b+e.

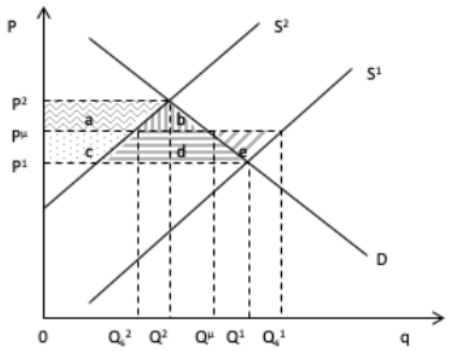

Figure 1. Market's equilibrium of demand and supply.

2.2. Model Specification and Technique Estimation

The first step in identifying the supply and demand model of small chili is to finding a basic economy argument. Generally, each consumer who consumes a specific commodity hopes to achieve its utility from what they have consumed directly. When choosing and buying the commodity, he/she will attempt to reach the maximum utility value on a certain level of yield. Moreover, the consumer does put their concern to their favorite commodity price and facing many alternatives to get maximum satisfaction. If the price hikes, they will search for its substitute goods. One of the demand property function is the total demanded product is inversely proportional to its price. That means, if the price of demanded goods climbs up, then the total goods sold are diminished, and *vice versa*, with other factors, remain unchanged.

On the other hand, the demanding commodity function can be different, along with changing time, priority needs, revenue, tastes, and others. Hence, if there's any change in variables of intangible goods, then it will cause the whole demand curve to shift. Market structural can also get impacted, both from the condition side on production or supply. If a farmer operated on a competitive market, then the supply curve would be identic with its marginal cost curve at climbed or higher level than the average costs. So, if there's any change in its marginal cost at the production process, then the supply curve would be shifted. In addition to small chili that is still land-based, the harvested area significantly affects production or supply. The more extensive the harvested area, the more production increases, while other factors consider remains.

Model parameter evaluation, especially been done to its economic criteria, expected to fit the prediction (*theoretically meaningful)* through its symbols and the amount of estimator. Like Koutsoyiannis (1978) [6] said, if the parameter does not have a fit symbol and estimator's amount, it could not predict the economic theory, and so the result should be denied, except there are some solid reasons to prove and it should be stated explicitly.

The following criteria are statistic criteria, which then led to the statistical parameter satisfaction, have a high determine coefficient (R^2), and small standard error. The high R^2 can show the explanatory variables that were used to explain the majority variance of the endogenous variable value, and the smaller standard error parameter could point to the model's reliability. The econometric criteria are the last criteria, which could identify whether the required assumption for each of the models and methods (especially the most critical parameter) has been fulfilling or not. If the assumption is not fulfilled, then the estimating parameter can be biased or not valid to be used in the prediction.

Based on the economic theory, the specific model of supply and demand on small chili commodity could be stated as follow:

$$Q_{ti}^{S} = \alpha_0 + \sum_{i=1}^{11} \rho D_{ti} + \alpha_P PCRR_{ti} + \alpha_L LPCR_{ti} + \alpha_U UPAH\_R_{ti} + \omega_{ti}$$

$$Q_{ti}^{D} = \beta_0 + \sum_{i=1}^{11} \delta_i D_{ti} + \alpha_P PCRR_{ti} + \alpha_B PCBR_{ti} + \omega_{ti}$$
$$Q_{ti}^{S} = Q_{ti}^{D}$$

Where:

Q = Small chilli production (quintal=100kg)	PCRR = real price of small chilli (rp/kg)
LPCR = harvesting areal (ha)	UPAH_R = real wage (Rp/day)
PCBR = real price of chilli (Rp/kg)	Di = *dummy* for month

This study used the Two-Stage Least Square (2SLS) method with help from software, known as Eviews 6.0. to estimate the parameter.

2.3. Data

This study used secondary data from Dinas Perindustrian dan Perdagangan Propinsi Nusa Tenggara Barat (Dinas Perindag NTB), Badan Pusat Statistik (BPS NTB), and Dinas Pertanian dan Perkebunan NTB. Data of small chili's price taken from Dinas Perindang in the form of monthly time-series, while monthly production data came from BPS NTB, so the harvested area data is obtained from Dinas Pertanian dan Perkebunan.

3. Results and discussion

3.1. Supply Estimated Function

The specific model of small chili supply function has stated below:

$$Q_{ti}^{S} = \alpha_0 + \sum_{i=1}^{11} d_i D_{ti} + \alpha_P PCRR_{ti} + \alpha_L LPCR_{ti} + \alpha_U UPAH\_R_{ti} + \omega_{ti}$$

The supply estimated function with Two-Stage Least Square (2SLS) method produces a parameter which similar to its economic theory prediction, α_P, α_L, > 0, i.e., the main variables which are small chili's price and harvesting areal can positively impact the supply of small chili in West Nusa Tenggara. The unexpected result is the parameter αU> 0, which, according to economic theory, must be negative. The most likely explanation for this is that the real wage data used in the agricultural sector cannot represent the production costs of small chili farming. Therefore, the real wage variable in this model cannot be used in further prosperity analysis so that the supply function shifter variable used is the variable area of cayenne pepper (LPCR). The supply or production of small chili varies each year greatly, wherein January-June, the supply of cayenne pepper decreases as indicated by the dummy variable coefficient D1-D6, which is negative and significant at α = 5%. Conversely, in October-November, production increased as indicated by the sign of the coefficient of dummy variable D10-D11, which was positive but not significant. The complete parameter estimation results are presented in Table 1.

Table 1. The estimated results of the small chili supply function using the 2SLS method.

Variable	Parameter	Coefficient	Std. Error	t-Statistic	Prob.
C	α_0	-58124.46	48452.22	-1.199624	0.2366
D1	d_1	-65217.33	27077.40	-2.408552	0.0202
D2	d_1	-77806.01	28352.08	-2.744278	0.0087
D3	d_1	-88014.52	36668.04	-2.400306	0.0206
D4	d_1	-92227.70	40331.58	-2.286737	0.0270
D5	d_1	-74739.06	29309.21	-2.550019	0.0142
D6	d_1	-72933.56	28113.01	-2.594299	0.0127

D7	d_1	-50170.74	27520.04	-1.823062	0.0749
D8	d_1	-30800.62	26440.43	-1.164906	0.2502
D9	d_1	-11252.18	26422.70	-0.425853	0.6722
D10	d_1	31176.79	27640.06	1.127957	0.2653
D11	d_1	12397.61	26916.44	0.460596	0.6473
PCRR	α_P	0.627396	0.990208	0.633600	0.5295
LPCR	α_L	11.32687	24.09280	0.470135	0.6405
UPAH_R	α_U	3853.412	1082.632	3.559298	0.0009
R-squared		0.535667	Mean dependent var		48862.35
Adjusted R-squared		0.391208	S.D. dependent var		53262.80
S.E. of regression		41558.37	Sum squared resid		7.77E+10
F-statistic		3.719480	Durbin-Watson stat		0.785341
Prob(F-statistic)		0.000392	Second-Stage SSR		7.74E+10

3.2. Demand Estimated Function

The specific model of small chili demand function has stated below:

$$Q_{ti}^{D} = \beta_0 + \sum_{i=1}^{11} \gamma_i D_{ti} + \beta_P PCRR_{ti} + \beta_B PCBR_{ti} + \omega_{ti}$$

The estimated function of demand has fulfilled the expectation and economic theory on its parameter sign, which is $\beta P < 0$ and $\beta B > 0$, proving that small chili is a normal good and able to be substitute with chili although it is not perfect to be the substitutional goods. Thus, if seen from the time variance (month), then Table 2 shows that the demand for small chili is relatively stable throughout the year, except in February and June, which is significantly decreasing. This indicates that the price volatility of small chili is commonly caused by ultimate shock at its supply side. The complete estimation result is served at Table 2.

Table 2. The estimated results of the small chili demand function using the 2SLS method.

Variable	Parameter	Coefficient	Std. Error	t-Statistic	Prob.
C	β_0	62300.18	37218.47	1.673905	0.1009
D1	γ_1	-59435.76	30708.74	-1.935467	0.0591
D2	γ_2	-64684.75	31623.28	-2.045479	0.0466
D3	γ_3	-48971.86	46888.44	-1.044433	0.3017
D4	γ_4	-39362.26	59354.85	-0.663168	0.5105
D5	γ_5	-61382.12	31076.93	-1.975167	0.0543
D6	γ_6	-68866.19	30755.66	-2.239139	0.0300
D7	γ_7	-32865.56	34967.00	-0.939902	0.3522
D8	γ_8	-15249.79	35337.35	-0.431549	0.6681
D9	γ_9	-1845.153	32713.63	-0.056403	0.9553
D10	γ_{10}	24098.19	32742.04	0.736002	0.4655
D11	γ_{11}	7797.792	31488.84	0.247637	0.8055
PCRR	β_P	-1.489915	2.567838	-0.580222	0.5646
PCBR	β_B	2.575261	3.188712	0.807618	0.4235
R-squared		0.359192	Mean dependent var		48862.35
Adjusted R-squared		0.178094	S.D. dependent var		53262.80
S.E. of regression		48287.53	Sum squared resid		1.07E+11
F-statistic		2.292162	Durbin-Watson stat		0.651009
Prob(F-statistic)		0.019586	Second-Stage SSR		9.79E+10

3.3. Impacted welfare of the stabilization policy

Using a concept of consumer and producer surplus to quantify prosperity from the Massel model of price stabilization [5,7]. Matthew et al. (2004) [8] shows that for certain years, the expected value of the producer's surplus due to price stabilization is represented by:

$$E(Gp) = \frac{(\alpha + 2\beta)\sigma xx - \alpha\sigma yy}{2(\alpha + \beta)^2}$$

while the consumer's surplus expectation value is:

$$E(Gc) = \frac{(2\alpha + \beta)\sigma yy - \beta\alpha xx}{2(\alpha + \beta)^2}$$

So, the net impact of the price stabilization is:

$$E(G) = \frac{\sigma xx + \sigma yy}{2(\alpha + \beta)}$$

$$\sigma pp = \frac{\sigma xx + \sigma yy}{(\alpha + \beta)^2}$$

where, σ_{xx} = Var (x)
σ_{yy} = Var (y)
σ_{xy} = Cov (x,y) = 0

Therefore, the surplus calculation that received by the parties is:

$$E(Gp) = \frac{(\alpha+2\beta)\sigma xx-\alpha\sigma yy}{2(\alpha+\beta)^2}$$

$$E(Gp) = \frac{\left((0{,}63+2*(1{,}49))*8{,}7777E+07\right)-(0{,}63*2{,}3605E+08)}{2(0{,}63+1{,}49)^2}$$

$$= 1{,}87079\text{E+07}$$

$$E(Gc) = \frac{(2\alpha+\beta)\sigma yy-\beta\sigma xx}{2(\alpha+\beta)^2}$$

$$E(Gc) = \frac{(2*0{,}63+1{,}49)*2{,}3605E+08-(1{,}49*8{,}7777E+07)}{2(0{,}63+1{,}49)^2}$$

$$= 5{,}76674\text{E+07}$$

$$E(G) = \frac{\sigma xx+\sigma yy}{2(\alpha+\beta)}$$

$$E(G) = \frac{(8{,}7777E+07)+(2{,}3605E+08)}{2(0{,}63+1{,}49)} = 7{,}63753\text{E} + 07$$

At such, the stabilization policy of small chili is profitable to involved parties like producers, consumers, and the public, as seen on the positive sign of the expected value of producers' gain E(GP), consumers E(GC), and net E(G) surpluses. Yet, the price stabilization policy affected welfare distribution through the import limitation, so it is mostly enjoyed by the consumer. It is not that surprising, because the government will open the import of small chili when the price is high due to domestic deficiency supply, while demand is relatively elastic compared to its supply side.

4. Conclusion and recommendation

First, the fluctuating price of small chili is commonly caused by a volatility event on its supply side, especially from January to June. *Second*, inbound with the welfare's impact, the price stabilizer regulation of small chili can boost up the prosperity of producers, consumers, and the community as a whole. *Third*, the demand for small chili is relatively elastic compared to its supply. Therefore, the

regulation that aims to stabilize small chili's price has positively impacted the welfare of the community; then, the regulation instrument should be broadened, including the plantation pattern model, so the farmers' welfare can also be leveled up.

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