Assessing the Market Impacts of the Common Agricultural Policy: Does Farmers' Risk Attitude Matter?

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Abstract

Recent models assessing the market impacts of Common Agricultural Policy (CAP) reforms are mostly static, non-stochastic and do not account for risks. This paper is a first attempt to fill this gap. We develop a stochastic version of GTAP-AGR model in which we introduce productivity risk and farmers' attitude towards risks. In addition to the price expectation, the expectation on price volatility becomes a key factor for the farmers' decisions. We show that under the endogenous modeling of the CAP instruments, risk aversion leads to larger production and price effects. The impacts are even larger if wealth effect is considered.

Keywords: Agricultural policy, Risk aversion, Dynamic, Stochastic, Computable general equilibrium

1 Introduction

The Common Agricultural Policy (CAP) of the European Union (EU) is a complex public policy pursuing different objectives with many instruments. This policy has a long history and has been reformed several times in the last two decades. These reforms gradually reduce the initial market price support system and introduce payments intended to deal directly with potential market failures (public goods and bads, missing contingent markets and unfair competition) and to directly support farm income.

Many ex-ante assessments of the economic and physical impacts of these reforms (or proposals) have been performed either at the farm and/or market levels. This paper focuses on the modeling frameworks that have been recently developed to assess the market impacts of the CAP. In a general way, all these assessments conclude that the market impacts of the price instruments are, in absolute terms, more important than those induced by the direct payments of the first pillar, when the latter are linked to the land factor. On the other hand, there is less confidence on the relative impacts of the more recent second pillar instruments.

All aforementioned studies recognize the challenges to model accurately the way CAP instruments really operate. These market CGE/PE models are well designed to capture the working of the price instruments. On the other hand, they rely on more disputed assumptions for the other CAP instruments. In particular, the important direct payments of the first pillar are often modeled through so called coupling factors. These factors intend to measure the impacts of payments which occur through economic mechanisms that are not explicitly considered in these market models. Most cited is the wealth effect provided by direct payments to risk-averse farmers (Hennessy 1998). In fact these models are generally static and non-stochastic, preventing the explicit modeling of such economic mechanisms. This leads for instance Moro and Sckokai (2013) to call for the revision of these market models routinely run for policy analysis because the impact of direct payments is analyzed by means of arbitrary coupling factors. In the same vein, Heckelei (2014) argues that these models are weak on the dynamic and stochastic dimensions and that they need to be improved to remain policy relevant.

To our knowledge, there have been limited efforts to improve the market models devoted to analyze agricultural policy issues in these two dimensions. In that context, our main objective in this paper is to investigate to what extent the simultaneous introduction of exogenous risks and farmers' attitude toward risk matters when assessing the market impacts of the CAP.

We start our investigation using the standard static approach without any risk considerations. We choose as the benchmark the CGE approach, essentially because it potentially encompasses more economic mechanisms than a PE model. We retain the GTAP-Agr specification using the latest GTAP database calibrated on the 2011 economic flows. Because a risky event is a future event, not a present or past one, the explicit introduction of exogenous risks and risk attitude requires first a dynamic dimension. Accordingly, our investigation then continues with the development of a dynamic version of the GTAP-AGR model. Here we follow the approach of Femenia and Gohin (2011), where exogenous production risks and farmers' attitude towards risks are excluded. As these authors show the importance of price expectation schemes, we will consider different expectation schemes. In the third step of our investigation, we introduce exogenous production risks and farmers' attitude towards risks. The development of these different versions will allow us to reveal if the introduction of exogenous risks and farmers' attitude towards risks really matters when assessing the market impacts of some CAP instruments.

2 Modeling Frameworks

2.1 The Static GTAP-Agr CGE Model

The GTAP-Agr model is a static CGE model derived from the GTAP model and designed to better capture certain structural features of world agricultural markets and policies (essentially through better calibration of elasticities). The GTAP model is a relatively standard multi-region CGE model where consumers are assumed to maximize their utility, factor owners their revenue. This model employs the simplistic assumptions of perfect competition in all commodity and factor markets, that flexible prices ensure market equilibrium and that investment are saving-driven. Commodities are differentiated by origin, allowing the modeling of bilateral international trade flows. This GTAP framework is implemented using data organized in Social Accounting Matrices (SAM) per region capturing economic flows during a given year and exogenous substitution/price/income elasticities.

At the farm supply side, it should be underlined that the modeled agent is not one farmer who may own different primary factors (capital and land in addition to his own human capital and labor force) and decide production variables. Rather the approach is activity-based with a distinction made according the different primary factor owners. Our main point is that this static activity-based supply modeling does not allow for the explicit modeling of farmers' attitude towards risk. Farmers, and other producers as well, are not explicitly identified. They are indeed aggregated with other households, and eventually only the aggregated attitude toward risks can be contemplated. Moreover, this static approach assumes that the regional households (more precisely primary factor owners) know the true market prices of commodities and the true primary factor returns when they decide their factor allocation. The lag between production decisions and commodity selling on market is not recognized, preventing the real modeling of the dynamic and stochastic dimensions. In order to authorize the later analysis of farmers' attitude towards risk on

CAP assessments, we need to model farmers even in the static approach. The simplest way to do this is to assume that the physical capital initially allocated to each activity is specific to that activity and is owned by a representative producer who maximizes his primary factor return.

2.2 The Development of a Dynamic Version

In most productive activities, inputs and/or primary factors of production are engaged before the production is realized. This is particularly true in farming where arable crop producers for instance first decide their land use and seed application, then apply variable inputs over the plant growing period such as fertilizers and pesticides and finally harvest the crop and market it (possibly directly selling on the market or storing before selling). This time lag between production decisions and production marketing implies that the farmers must base their decisions on expected prices, which can be different from the true ones. By nature, this issue is neglected in static analysis while dynamic analyses generally conclude that the price expectations are critical.

The modeling of dynamic behavior is a tricky issue involving unobservable expectations and used information by economic agents. In this paper, we adopt backward price expectation schemes. That is, we assume that farmers form their price expectations using past observations, with different weights attached to recent versus old observations.

In addition to the expectation assumptions, we also need for the implementation of the dynamic version to decide the number of periods we consider during a given year (such as the planting period, the application period of fertilizers, pesticides, the harvesting period,...) and the predetermined versus endogenous variables in each period. We adopt again the simplest assumption by dividing a year in two periods. In the first period that can be labeled the production period, farmers equipped with their physical capital decide their production, input and primary factor levels given their commodity price expectations and also the labor price expectations (labor is used all along the production campaign, such as during harvesting). On the other hand, the land use is negotiated at the beginning of the production campaign with the land owner. This economic agent needs to form land return expectations for other potential activities when deciding to allocate some land to one farming activity. Hence, in the first period of a given year, we determine the output level, input use, primary factor use (land and labor) by the farmers, parts of the land allocation by the land owner and the equilibrium land return for these dynamic activities. In the second period of the given year that can be labeled the marketing period, these variables become predetermined in the static CGE model, market price will be determined, residual capital return as well. They may differ from expected values by farmers.

It remains us to determine the dynamic over the years. The exogenous variables in the first period PE model are the capital stocks and the net price expectations. We need to determine the dynamics of these exogenous variables. We again make simplified assumptions by assuming that the capital stock in each farm activity is always the same.

2.3 The Development of a Stochastic Version

The agricultural activity is confronted to many sources of risks, the most obvious one being the yield risk linked to climate events for crop activities. These production risks may lead to price risks, depending on the functioning of agricultural markets. Some European farmers have long been protected from these price risks with the market price instruments of the CAP. If the presence of production/price risks is not disputed, the exact attitude of farmers towards these risks is more debated. Many efforts have been pursued in recent years with different methods to reveal their risk attitude (Roe 2015). This is challenging for instance because one must also identify their expectations. It is still rather accepted that farmers in general, EU farmers as well, can be risk averse. This means that they prefer to plant a safe crop rather than a risky crop giving the same expected return. Our development of a stochastic version intends to capture these features.

We again do that in a simplified manner starting from the above dynamic version. We assume that EU farmers consider only their output price as a stochastic variable, that they maximize the expected utility of their profit, and that their utility function exhibits Constant Absolute Risk Aversion (CARA).

Compared to the previous farmer program, this new program involves the expected variance of output price. That is, we now need to define the average output price expected by farmers as well as its variance.

3 Simulations

3.1 Empirical Assumption

We implement the different versions of GTAP-Agr model described above using the latest GTAP database, version 9 GTAP, of which the data is calibrated from 2011 economic flows. We aggregate the data to 26 commodities including 17 agricultural products, 5 regions including EU28, China, US, Argentina-Brazil-Uruguay(ABU) and Rest of the World (RoW). In both the dynamic and stochastic versions, we have the opportunity to choose the number of dynamic activities. We start by focusing on one crop (wheat), and later extend to other activities. In these two versions, the expectation schemes need to be determined.

The price expectations of the producers are formed based on past observed prices and past price expectations by the historical weighting parameter α, similarly, the volatility expectations are based on past volatilities and past volatility expectations. We start with the naïve expectation scheme by assuming $\alpha = 1$, that is, the price expectations of the producers are equal to the observed prices of last year, and the volatility expectation equals the average price volatility of last year. In the sensitivity analysis, the weighting parameter α is extended to other values.

When implementing the stochastic version, we also need to make assumptions on the risk premium and the productivity shocks. On the calibration of the risk premium, we fix the baseline risk premium at 2% of the production value.We assume that the productivity shocks follow a stochastic Gaussian process with mean zero and a standard deviation of 0.1.

3.2 Policy Scenarios

We are now ready to analyze the market impacts of the CAP using our different versions of GTAP-Agr model. First, we explain the modeling of CAP instruments. In most CGE applications, the price instruments which act through ad valorem export subsidies and import tariffs are usually assumed to be exogenous. In reality, the levels of these price instruments can be adapted to protect the domestic price from dropping below a price floor (the so-called intervention price) when the world price is low. Accordingly, we will consider below two alternative modeling of the price instruments: either an exogenous representation where the unitary levels are fixed, either an endogenous representation where they adjust to ensure minimum intervention/entry prices.

The modeling of direct payments is also challenging with the decoupling of farm payments introduced in 2003. These direct payments are perceived by farmers provided that they have a corresponding land use. Accordingly, they are often modeled as an ad valorem subsidy to the land factor, while remaining coupled subsidies are linked to the production. Below we adopt the allocation of subsidies provided in the GTAP9 database and again consider two modeling. The standard exogenous one assumes that the unitary land payment is ad valorem (and thus change with the land return) while the endogenous one assumes that the unitary land payment are fixed per hectare. These two alternative modeling of CAP instruments are indeed worth differentiating with our stochastic framework.

We successively simulate two radical policy scenarios: first the EU removes the price instruments on wheat, second the EU removes the direct payments on wheat. In both scenarios, the policy instruments in other regions and on other farm products stay at their initial level. Very importantly, the impacts are assessed compared to a baseline. It should be understood that the baseline may change depending on the representation of the CAP. More specifically, in the static version and the dynamic version, we assume that the economy is initially at the steady state, and the initial point is used as the baseline. In the stochastic version, the introduction of productivity shocks makes the economy moves from the initial steady state to a new stochastic steady state, and this new stochastic steady state is used as the baseline in the stochastic model.

3.3 Simulation Results

Results from the Static GTAP-Agr Model

We concentrate our analysis on price, production in EU and RoW. Table 1 shows the impacts of the policy scenarios in the static GTAP-Agr model. We find that the EU wheat production declines by 1.98% in response to the removal of price instruments. This is because removing the trade barriers puts a downward pressure on domestic EU wheat prices, which induces a 1.69% reduction in EU wheat price. On the contrary, the wheat

Table 1: Impacts of the Removal of Price Instruments and the Removal of Direct Payment on EU Wheat (in percent with respect to the initial baseline)

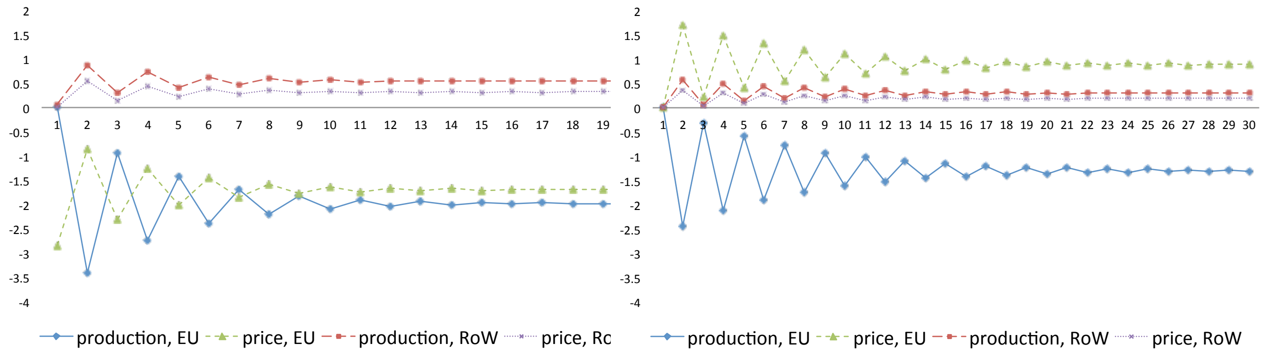
	European Union		Rest of the World	
Removal of Price Instruments	Production	Price	Production	Price
Static Model	-1.98	-1.69	0.54	0.32
Dynamic Model (Steady State)	-1.98	-1.69	0.54	0.32
Removal of Direct Payments	Production	Price	Production	Price
Static Model	-1.29	0.90	0.30	0.19
Dynamic Model (Steady State)	-1.31	0.91	0.31	0.19

production and price in rest of the world increase by 0.54% and 0.32% respectively since they benefit from less supply coming from Europe.

We also find that removing the direct payments induces a 1.29% decline in EU wheat production. As the direct payments are linked to the factor land, more acreages are thus allocated to other activities with higher land returns and less acreages are used for wheat production. Accordingly the EU wheat production declines and the EU wheat price increases. Again the rest of the world faces less competition from Europe, as witnessed by the expanding of wheat production by 0.30% and the increase of wheat price by 0.19% in RoW. All these results are quite standard and constitute our benchmark results before dealing with the dynamic and stochastic dimensions.

Results from the Dynamic Version

Figure 1 depicts the evolution of EU wheat production and price after implementing the policy scenarios in 2011. After 20 and 30 years' evolution respectively, the EU wheat production and price converge to a steady state, and the converged market impacts in the dynamic model are almost the same with the impacts in the static model (Table 1).



(a) Removal of Price Instruments **(b) Removal of Direct Payments**

Figure 1: Evolution of the EU Wheat Production and Price under the Naïve Expectation Assumption in Dynamic Version (in percent compared to the initial baseline)

Table 2: Impacts of the Removal of CAP Instruments under Exogenous Policy Representation (production and price in percent with respect to the baseline)

	European Union				Rest of the World		
	Production	Price	Volatility(σ)	β	Production	Price	Volatility(σ)
New Baseline with Productivity Shocks							
Risk Neutral	1.09	0.92	0.15	-	1.45	1.64	0.17
Risk Aversion	1.16	0.87	0.15	2%	1.43	1.62	0.17
Impacts of the Policy Shocks							
Removal of Price Instruments							
Risk Neutral	-1.87	-1.62	0.15	-	0.52	0.31	0.17
Risk Aversion	-2.03	-1.52	0.16	2.03%	0.56	0.34	0.17
Removal of Direct Payments							
Risk Neutral	-1.34	0.93	0.16	-	0.28	0.19	0.17
Risk Aversion	-1.46	1.02	0.16	2.04%	0.31	0.21	0.17

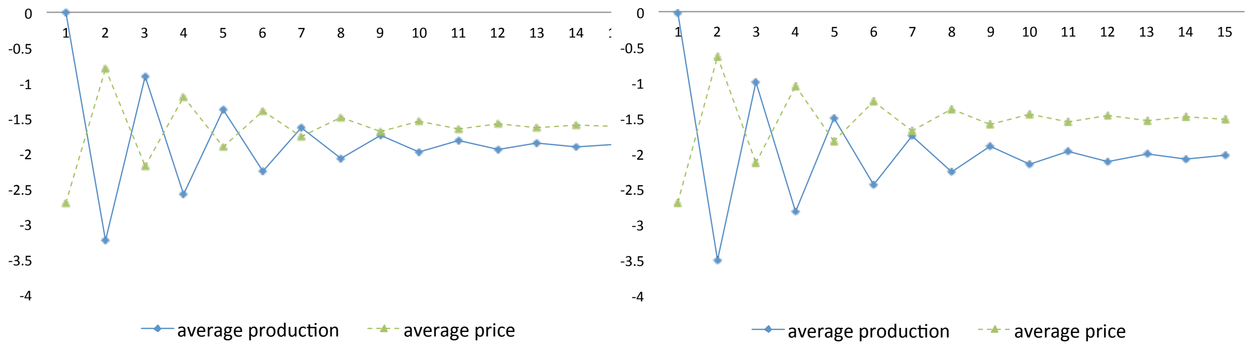
Results from the Stochastic Version with Exogenous Policy

We now use our stochastic version with the exogenous policy representation. Before assessing the policy impacts, it is important to obtain a new baseline because the economy has moved from the initial steady state (the baseline used in the static and dynamic version) to a new stochastic steady state due to the introduction of the stochastic productivity shocks. We perform thus a first stage simulation by including only the productivity shocks. We reach the new stochastic steady state after 30 years in the stochastic model without risk aversion and after 50 years in the stochastic model with risk aversion, as it takes longer time for the expected volatility (σ) converge to the steady state with risk aversion. Having obtained the new baseline, we implement the policy shocks at the 31^{st} year for risk neutral case and at the 51^{st} year for risk aversion case. Table 2 presents the converged values, and Figure 2 and Figure 3 show the evolution of European production and price for both policy scenarios.

With the removal of price instruments, the economy converges to a new stochastic steady state in around 15 years. We observe similar evolution paths and modest differences between the impacts with or without risk aversion. The price volatility in Europe increases slightly to 0.16 with risk aversion, while it remains the same at 0.15 for the risk neutral case. As a result, the risk premium of the EU farmers increases by a small amount from 2% to 2.03%.

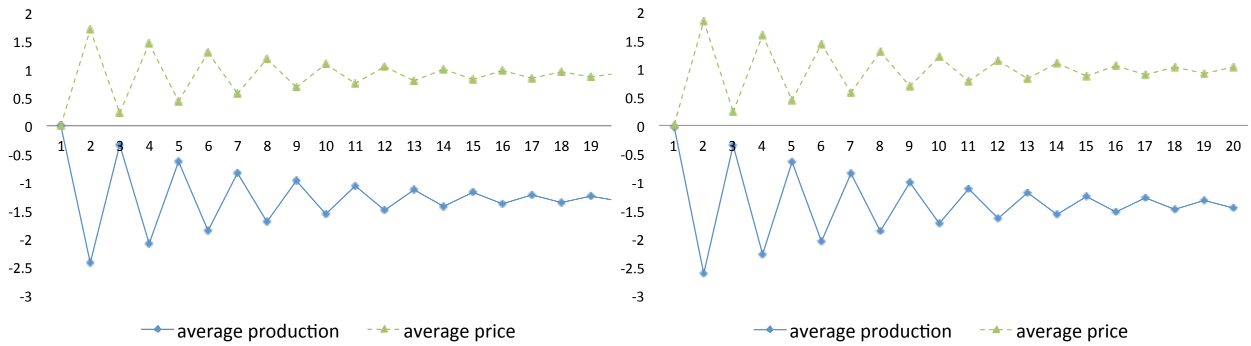
Although the price volatility does not change much from the baseline, we find that the risk-averse wheat producers in Europe reduce their production slightly more (by 2.03%) compared to risk-neutral producers (by 1.87%). As discussed before in Table **??**, the risk-averse producers have higher price elasticities than risk-neutral farmers. The trade liberalization puts a downward pressure on the EU domestic price, the risk-averse farmers produce less than the risk-neutral farmers. With regard to the impacts on price, we find that at the converged steady state, the EU wheat price decreases by 1.52% with risk aversion and by 1.62% without risk aversion.

With the removal of direct payments, the economy reaches the steady state after 20 years. Again, there is no obvious difference between the evolution paths with and without risk aversion (Figure 3a and Figure 3b). The results in Table 2 suggest first that the policy



(a) Risk Neutral **(b) Risk Aversion**

Figure 2: Exogenous Policy: Evolution of the EU Wheat Production and Price following the Removal of Price Instruments (in percent compared to the baseline)



(a) Risk Neutral **(b) Risk Aversion**

Figure 3: Exogenous Policy: Evolution of the EU Wheat Production and Price following the Removal of Direct Payments (in percent compared to the baseline)

shock has a limited impact on the price volatility, which increases slightly from 0.15 to 0.16 in EU for both risk attitudes. The reason for this small impact is that the price volatility is mainly induced by the productivity shocks in other regions, on which the European policy reform has very limited influence. Second, we find as expected that the risk-averse producers in Europe reduce their wheat supply a little more (by 1.46%) compared to the risk-neutral producers in Europe (by 1.34%). Accordingly, the wheat price in Europe increases more under risk aversion (by 1.02%) than under risk neutrality (by 0.93%). The intuitions behind these results are the same as mentioned before with the static version.

Results from the Stochastic Version with Endogenous Policy

Although the exogenous policy assumption is widely adopted, in reality, especially for agricultural producers in Europe who have been protected from price risks, we are more likely to have the endogenous policy which prevents the domestic price from fluctuating

Table 3: Impacts of the Removal of CAP Instruments under Endogenous Policy Representation (production and price in percent with respect to the baseline)

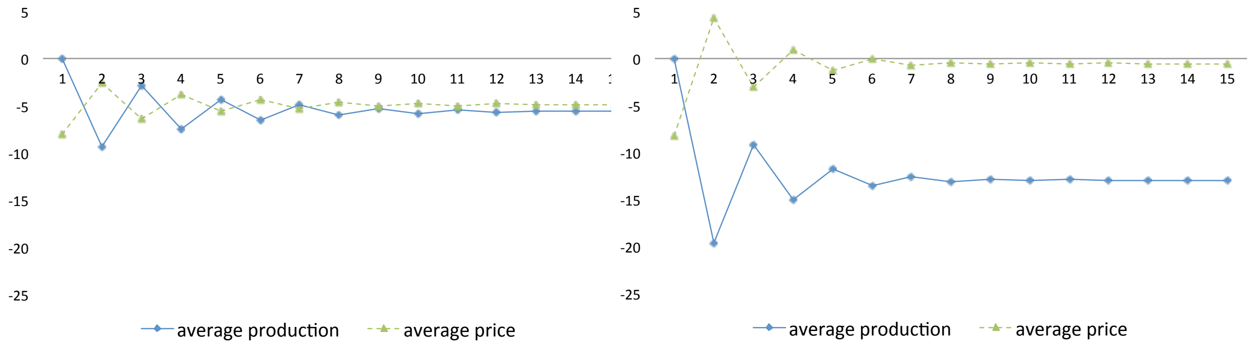
	European Union				Rest of the World		
	Production	Price	Volatility(σ)	β	Production	Price	Volatility(σ)
New Baseline with Productivity Shocks							
Risk Neutral	5.07	4.39	0.09	-	-0.10	0.77	0.17
Risk Aversion	5.51	4.32	0.09	2%	-0.22	0.69	0.17
Impacts of the Policy Shocks							
Removal of Price Instruments							
Risk Neutral	-5.56	-4.91	0.15	-	2.07	1.17	0.17
Risk Aversion	-12.92	-0.52	0.16	7.14%	3.91	2.46	0.18
Removal of Direct Payments							
Risk Neutral	-1.84	0.30	0.09	-	0.52	0.34	0.17
Risk Aversion	-2.83	0.45	0.09	2.40%	0.80	0.52	0.17

severely with the world price. Under this consideration, we now turn to the stochastic version with endogenous policy.

As usual, we first simulate the new baseline brought by the productivity shocks (Table 3). Different from the stochastic version with exogenous policy, the economy converges to the new steady state much faster (around 5 years) both with and without risk aversion. On the one hand, the price volatility in the EU is much lower, which is at the value of 0.09, compared to a volatility of 0.15 with exogenous policy, and it remains at 0.17 in the RoW for both policy representations. This is much more consistent with historical volatilities on both EU and world market prices (European Commission 2010). On the other hand, the average EU wheat price raises as much as 4.39% under risk neutrality and 4.32% under risk aversion. Accordingly, the EU wheat production raises by 5.07% and by 5.51% respectively. The low price volatility and the high price increase are due to the endogenous policy representation: when the positive productivity shocks induce an expansion of wheat production outside Europe and a decline in wheat world price, the endogenous import tariffs and export subsidies in Europe increase to protect the EU price from dropping below a price floor. It erases the negative fluctuation below the price floor and leads to a price stabilization effect. As a result, the EU wheat price is less volatile and converges faster to a higher steady state price. With regards to the rest of the world, the EU price stabilization policy has limited effect on the world price volatility, since the EU market is not large enough to significantly influence the world price fluctuation (according to the GTAP database). Nevertheless, the increase of EU wheat production leads to a decrease in RoW wheat production and a different baseline for the RoW.

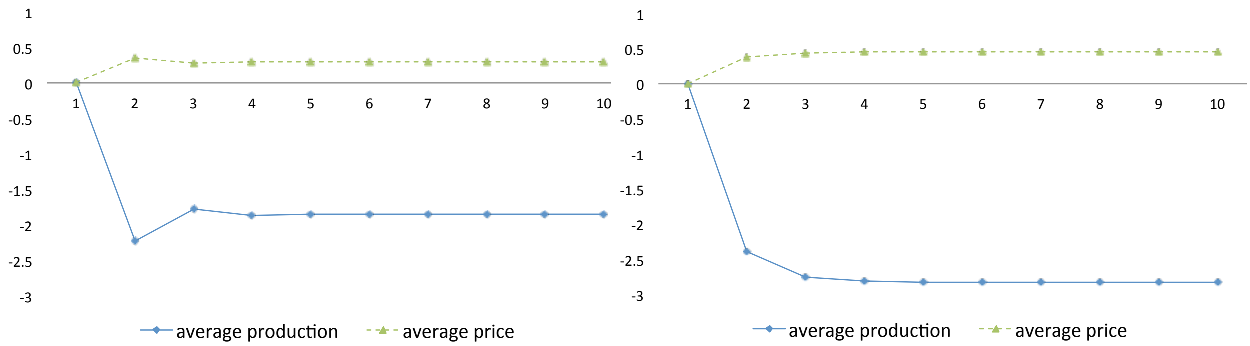
Next, we perform the policy shocks in 2021 (10 years after the initial year). The second part of Table 3 presents the converged results, Figure 4 and Figure 5 show the evolution of production and price in both policy scenarios.

After the removal of price instruments, the economy moves to the stochastic steady state in 15 years in the risk neutrality case and in 10 years in the risk aversion case. The difference between the impacts with and without risk aversion is no longer negligible: the risk-averse wheat producers in Europe reduce their production much more (by 12.92%) than the risk-neutral ones (by 5.56%), and the EU wheat price decreases much less (by 0.52%) in the risk-averse case than that of the risk-neutral case (by 4.91%). To explain this important



(a) **Risk Neutral** (b) **Risk Aversion**

Figure 4: Endogenous Policy: Evolution of the EU Wheat Production and Price following the Removal of Price Instruments (in percent compared to the baseline)



(a) **Risk Neutral** (b) **Risk Aversion**

Figure 5: Endogenous Policy: Evolution of the EU Wheat Production and Price following the Removal of Direct Payments (in percent compared to the baseline)

difference, we know first that the removal of price instruments put a downward pressure on the EU wheat price. Since the risk-averse EU farmers have higher price elasticities than the risk-neutral ones, they reduce their production more when they expect the wheat price to decrease. We've discussed this mechanism in the exogenous policy part, this effect exists but not big enough if the farmers' risk premium stays around the baseline of 2%. Then additionally, removing price instruments eliminates the endogenous policy and its price stabilization effects. As a result, the price volatility in Europe rises to a considerable large level (0.16) compared to the baseline (0.09). Under the assumption of $CARA$, the risk premium parameter β depends on the price volatility, and it increases from 2% to 7.14%. With this great increase in risk premium, the price elasticities of the risk averse producer rises to a much higher level than that at the baseline. With the combined effects of the decrease in expected price and the increase in expected volatility, the risk averse EU farmers reduce their production much more sharply than the risk-neutral farmers.

We also find that risk aversion leads to different impacts after the removal of direct payments. Under the endogenous policy, it takes only around 5 years to converge to the steady state for both cases. Figures 5a and 5b show the evolution paths with and without risk aversion: the discrepancy lies especially between the second year and the third year after the policy shock. In the risk aversion case, the production continues to fall despite the increase in the output price expectation, while in the risk-neutral case, production rebounds a little with the increase in output price expectation. We also find in Table 3 that the final converged wheat production in Europe declines more (by 2.83%) in the risk aversion case compared to the risk neutrality case (by 1.84%), and the EU wheat price increases more (by 0.45%) with risk aversion than without risk aversion (by 0.30%). This is because under the endogenous policy representation, removing direct payments leads to an increase in price volatility in Europe from 0.086 to 0.094, so that the risk premium of the risk averse producers rises from 2% to 2.40%. As a result, the risk-averse producer becomes more sensitive to the increase in land price expectations, and they reduce their supply more following the removal of land subsidies.

Moreover, risk aversion has a smoothing effect following the removal of price instruments. The production and price converge to the steady state faster under risk aversion (10 years) than under risk neutrality (15 years). This effect could also be seen in Figures 4a and 4b, where the dynamics is smoother in the risk-averse case. This is because the removal of endogenous price instruments induces volatility change. While the change of volatility has no effect on the supply in the risk neutrality case, it affects the slope of supply curve in the risk aversion case and lead to a converging effect. This effect is even more obvious in the coarse grain case.

4 Conclusion

The Common Agricultural Policy (CAP) has been reformed several times with shifts from initial market price support to decoupled payments. Many models have been developed to assess the market impacts of these reforms, but without explicitly introducing the stochastic dimension. In this paper, based on the standard static GTAP-Agr model and a dynamic version of GTAP-Agr model, we propose a stochastic PE/CGE modeling framework in which we introduce exogenous productivity shocks and farmers' attitude towards risks. We investigate to what extent the farmers' risk attitude matters in assessing the market impacts of CAP instruments.

We show that under the endogenous policy representation, compared to risk neutrality, risk aversion leads to larger market impacts at the stochastic steady state after the removal of CAP instruments. In particular, risk aversion does alter the farmers' production decisions in the way that risk-averse farmers have higher price elasticities of supply. With the introduction of risk aversion, price volatility becomes important to the producers' decisions through its influence on the risk premium. As the CAP reforms under the endogenous policy increase considerably the market fluctuations, the farmers' risk premium increases with the price volatility and leads to larger market impacts. Moreover, if the farmers exhibit decreasing absolute risk aversion, the additional wealth effects will bring even larger market impacts. With regard to the evolution of dynamics, risk aversion also leads to a converging effect after the removal of the endogenous price instruments. Under the exogenous policy representation, our findings are similar to previous ones: including farmers' risk attitude brings limited difference in assessing market impacts of the CAP instruments. This is because with exogenous policy, the CAP reforms bring limited influences on price volatility, consequently, the risk premium which remains at the initial level is not large enough to make a difference. In sum, our findings imply that risk aversion matters in assessing the CAP instruments particularly when the policy initially prevent price drops.

As usual, our modeling framework is subject to some limiting assumptions. For example, we assume that capital is fixed, so that the investment equals the capital depreciation for each period. In fact, risks and risk aversion exist not only in production decisions, but also in inter temporal saving and investment decisions. It is thus worthwhile to extend the recent model to a stochastic model with investment, while risk aversion is implemented in production, investment and saving decisions. We can also enlarge the current analysis with hedging issues on contingent markets or by considering a portfolio of products by farmers instead of focusing on only one product.

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