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Yan Jin,[†] Dušan Drabik,[†] Nico Heerink,[‡] and Justus Wesseler[†1]

[†] Agricultural Economics and Rural Policy Group, Wageningen University, The Netherlands

[‡] Development Economics Group, Wageningen University, The Netherlands

Abstract [49 words]

What is the procedure and trend of getting imported GM crops approved in China? And how do approval dates and length of approval in China compare to other countries? The answers are crucial for the current food security in China and the future of crops derived by gene editing.

Keywords: GM crops, approval, regulation, China

Main text [1554 words]

With only six percent of fresh water and seven percent of arable land in the world, China has to nurture nearly 20 percent of the world population [1]. Imports of food commodities, often produced with new technologies, are an important component of China's food security strategy. Yet, it is demanding to get imported genetically modified (GM) crops approved in China [2]. In this article, we describe the approval process for GM crops in China, and compare the approval dates and length of approval for imported GM crops in China with the United States, Canada, and the European Union. The length of the approval process and differences in length has implications for current but also for future food security in China as this also affects the future of New Plant Breeding Techniques which might face a similar approval process for commercialization [3].

How the approval process works

[1] Correspondence: justus.wesseler@wur.nl (J. Wesseler)

The approval process for GM crops in China is complex and almost exclusively overseen by the Ministry of Agriculture and Rural Affairs (MARA). The process starts with a biotech seed developer applying for the biosafety certificate. The application in China is not allowed until the variety has been approved in its country of origin for the same use, as China does not allow for simultaneous submission. The GM product is then examined for food safety, gene flow, non-target organisms effects, and other potential risk factors. Then starts a three-phase process: field trials (equivalent to small contained trials in the United States), environmental release trials (known as farmer field trials in the United States), and pre-production trials [2]. In pre-production trials (on fields larger than two hectares and smaller than 66.7 hectares), farmers receive seeds, and scientists do not influence the cultivation [2]. The pre-production trials are only required when the developer applies for cultivation. Imported GM crops to be used as processing material do not need to go through this last phase (http://www.moa.gov.cn/ztzl/zjyqwgz/zcfg/201007/t20100717_1601304.htm).

In parallel with the three-phase process, research institutions or universities assigned by MARA conduct food safety tests. Foreign applicants for GM biosafety certificates need to document prior research and testing conducted in their domestic countries. They also need to document that the exporting country or other countries have allowed commercialization of the GM product for the same intended use as applied for in China.

After MARA has issued the biosafety certificates, imported GM crops are allowed for commercialization as processing material. If they are used for cultivation in China, another three documents are needed: a seed variety certificate showing successful new crop variety registration, a production license for a new crop variety to be produced, and a marketing license for a new crop variety to be commercialized (see Text Box).

Is the approval for imported GM crops in China getting shorter?

Since 2002, GMOs have been approved for import. We analyse the approval length of all GM crops submitted successfully for import as processing material between 2002 and 2017 as reported by MARA (50 varieties). We exclude domestic GM crops because the data are not publically available. We measure the approval length as the number of months between the filing of the application and the issuance of the biosafety certificate.

For the 50 imported GM varieties (corresponding to five crops: canola, cotton, maize, soybean, and sugar beet) which passed the approval process in China, the average approval length is 34 months, with a maximum of 71 months for MIR162 maize and a minimum of 18 months for MIR604 maize (Table S1). Figure 1A shows that the approval length has increased considerably since 2010. We suggest two important causes, similar to the reasons suggested by [4] for the increase in approval length in the United States: First, there have been increasing public concerns since MARA issued biosafety certificates for Bt rice in 2009 [5]. Second, the Minister of Agriculture with a background in plant breeding and supportive towards GMO crops was replaced by a minister with a background in law in December 2009 and less supportive.

After 2010, it took on average 15 to 16 months longer to approve an imported GM crop in China. For the 50 imported GM varieties, we find that the approval length varies according to different trait types, number of traits, companies, and crop type (Table S1). In addition, the approval length of maize is considerably longer (10 to 11 months as compared to cotton) (Table S2). The reason might be that China is largely self-sufficient in maize production and has a sizable stock of the commodity.

China compared to other countries

The biotech seed developers are allowed to apply for the biosafety certificate in China only when a GM crop variety has been approved in the country of origin for the same use (http://www.agritrade.org/Publications/documents/LLPChina.pdf). Of the 50 imported GM crop varieties approved in China, 46 were previously approved in the United States, and 47 in Canada. There exists asynchronicity in China, meaning that the approval of a new GM variety does not happen simultaneously in all target markets of the developer (e.g., a US developer can apply for approval of a GM product in the United States and Canada at the same time, but not in China). The asynchronicity creates an invisible delay and can have significant trade impacts [6].

Figure 1B shows that in China the same GM variety is approved on average 1544 days (4.2 years) after it has been approved in the United States, and 1783 days (4.9 years) compared to Canada. Comparing 32 crops that have been approved in both China and the European Union learns that the same GM crop is approved on average one year earlier in China.

Although the previous comparisons indicate that China was not the first mover in the area of GM technology (at least relative to the United States and Canada), it can be that once the approval process starts, it is shorter in China than elsewhere. We compare 19 GM crop varieties which have been approved in China, the United States as well as the European Union (we do not have relevant data for Canada). We find that the average approval length is 2.9 years in China, 4.8 years in the European Union, and 5.9 years in the United States. These results suggest that once the approval process for imported GM products starts, it tends to be the shortest in China. Direct comparison is complicated by the fact that a large share of the needed information is generated in the country of first submission, such as the United States. The shorter length in approval in comparison to the United States indicates that China benefits from the safety assessments conducted in the United States. The situation is different for comparisons with the European Union. Here it seems that indeed the approval process for import can be considered to be less time consuming in China. A major underlying cause is the fact that the European Union has a so called ‘risk management’ phase which is highly politicised [7] and which contributes substantially to the approval length [4].

Conclusion

Slow approval processes can hamper commercialization of new GM crops, and the largest potential constraint to commercialization is regulatory delay [8]. China, like many other countries in the world, experiences it, especially around 2010 after the biosafety certificates for GM rice are issued by MARA. Since increasing national food security and improving agricultural productivity are major agricultural policy goals, the Chinese government restarted to take action in policy support since 2016. The ‘13th Five-Year Plan for Science and Technology Innovation’ aims to push forward the commercialization of new domestic GM crops by 2020 (http://www.gov.cn/zhengce/content/2016-08/08/content_5098072.htm). In the same year, the MARA revealed a roadmap for commercializing GM crops, starting with cash crops ‘not for food use’ (like cotton), followed by crops used as input for feed and industrial use (like maize), and finally by staple food crops (like rice) (http://politics.people.com.cn/n/2014/1206/c1001-26158566.html).

Although each year over 10 million tons of GM soybean oil are sold with compulsory GM labeling in China since the early 2000s [9], most Chinese agri-business managers still oppose GM foods adoption because they expect lower profits [10]. In July 2018, MARA released a report on how to increase the public knowledge of GMOs to push forward their commercialization. The strategy includes closer cooperation between local governments and mainstream media (http://www.moa.gov.cn/govpublic/KJJYS/201807/t20180713_6154028.htm).

The consequences of the policy strategy on promoting commercialization and increasing public knowledge for the approval process are not known yet. A direct positive impact on approval length at first sight might not exist, as the same main governmental agencies are involved in the approval process. At second sight, the overall policy climate towards GMOs might be positively affected with an overall positive effect on the approval process [4,11]. The potential change in the trend will be of great interest for those working with genome-editing technologies in plant breeding to get a better idea about what to expect [12, 13]. Expectations are genome-editing may be accepted by the public more easily [14].

A shortened approval process promotes food security and international trade. Possibilities for reducing the approval process exist including immediate approval for import and processing of GMOs that have received approval in the country of origin. Although the issue is controversial, this can substantially reduce trade disruptions caused by asynchronous approval and increase the comparative advantage of food production in China.

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Text Box

Three main governmental departments and committees are involved in the approval process

1. Ministry of Agriculture and Rural Affairs (MARA)

The MARA is the primary department in charge of the approval process for domestic and imported GM crops. During the approval process, apart from the technical assessments and field trials, socio-economic and political factors are also taken into consideration by MARA but it is not clear to what extent. The MARA makes final decision on issuing biosafety certificates and registering seed varieties

2. National Agricultural GMO Biosafety Committee (NABC)

Established by the MARA, the NABC nominates scientists from various disciplines as NABC members to perform technical assessments and evaluate applications for biosafety certificates. The NABC gives recommendations to MARA on issuing biosafety certificates based on the analysis results.

3. National Crop Variety Registration Committee (CVRC)

Established by the MARA, the CVRC nominates experts in research, production, marketing, and management to conduct field trials and evaluate applications for seed variety registration. The CVRC gives recommendations to MARA on seed variety registration based on the analysis results.

Figure captions

Note 1: Data source - China Ministry of Agriculture and Rural Affairs (http://www.moa.gov.cn/ztzl/zjyqwgz/spxx/201307/t20130702_3509313.htm)

Note 2: fitted using a polynomial function of fourth order due to a better fit with R^2=0.4632.

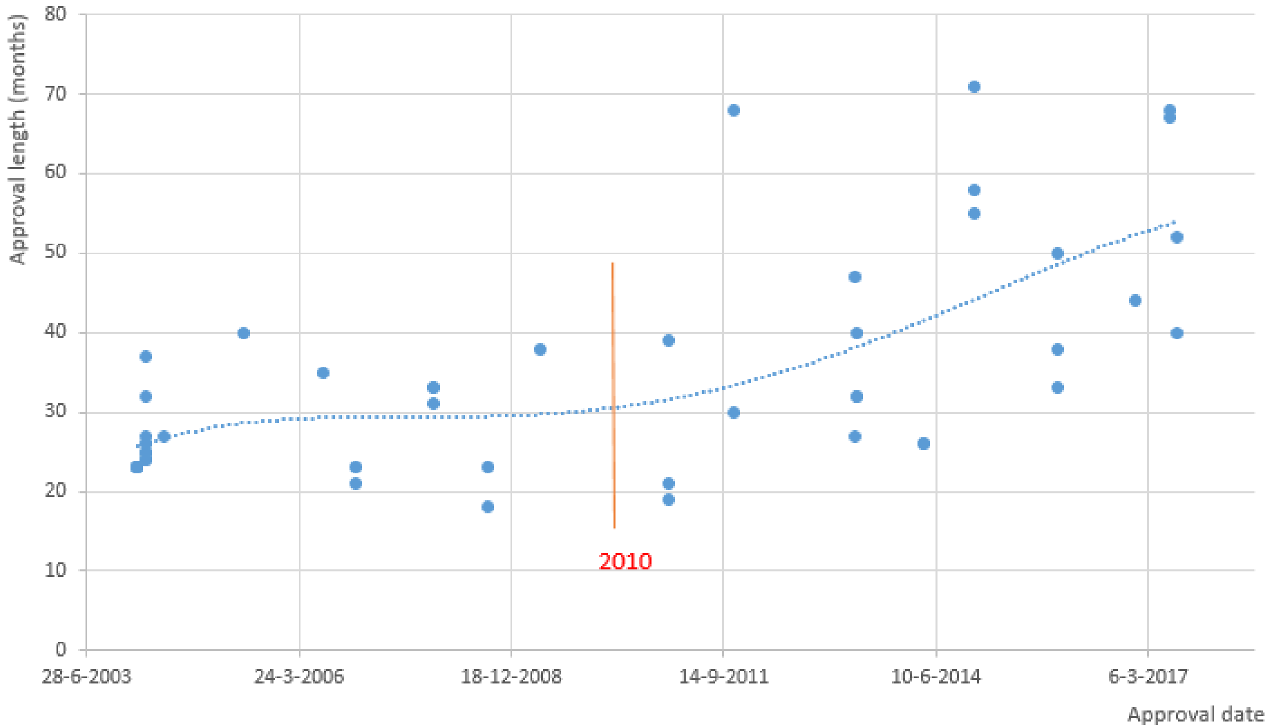
Figure 1A. Time trend for the approval length of the imported GM crops in China between 2002 and 2017 (N = 50).

Note 1: A positive (negative) time lag indicates how many days later (earlier) China approved a GM variety compared to the other country. The number of GM crop varieties is in parentheses. Total numbers of varieties are different because 46 varieties passed the approval process both in China and the USA, 47 both in China and Canada, and 32 both in China and the European Union.

Note 2: The data is from China Ministry of Agriculture and Rural Affairs (http://www.moa.gov.cn/ztzl/zjyqwgz/spxx/201307/t20130702_3509313.htm), United States Department of Agriculture (https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/permits-notifications-petitions/petitions/petition-status), Government of Canada (https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/approved-products.html), and [4].

Note 3: The suspension of sugar beet H7-1 in the United States occurred after its original approval in need of an environmental impact statement from biotech developers [4]. The approval process of sugar beet H7-1 can be considered as skewed by the lawsuit.

Figure 1B. Comparison of GM crop approval dates in China versus the United States, Canada, and the European Union.



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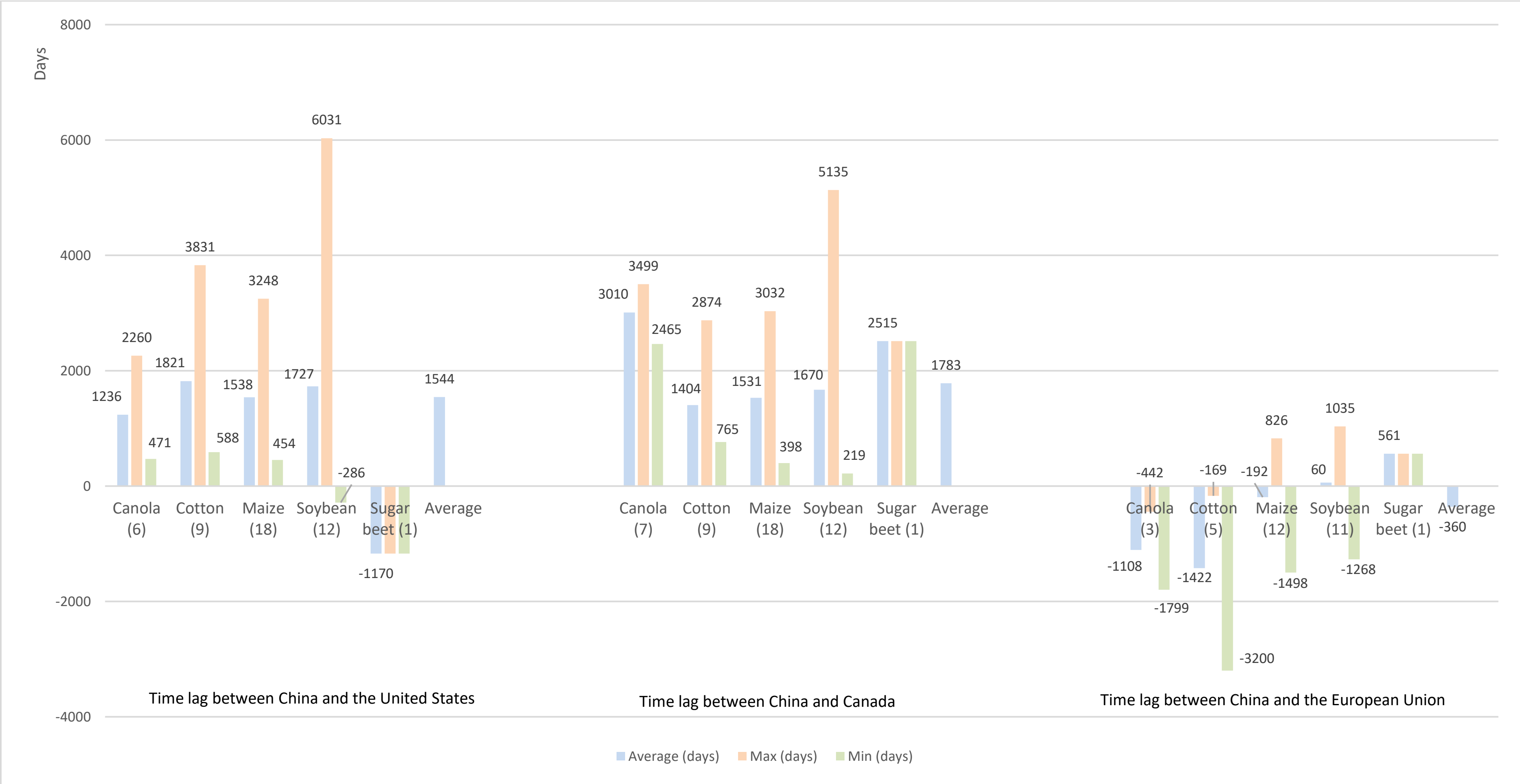

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Supplement 1. Data and methodology

Figure S1 highlights the timeline of the approval process for imported GM crops in China. To apply for the biosafety certificate, the biotech seed developer has to hand in an application form to MARA. After MARA allows imports of the GM crops for further testing, the GM crops have to go through the environmental release trial and food safety tests. MARA appoints an independent scientific institute or university to perform the tests. The choice of the institution is based on specialization, location, and availability. The periods of environmental release trial and food safety tests differ a lot among different GM crops and their varieties. The biotech seed developer has to hand in a report including the results of both environmental release trial and the food safety tests to MARA for the final decision. The approval process ends when the biosafety certificate is issued.

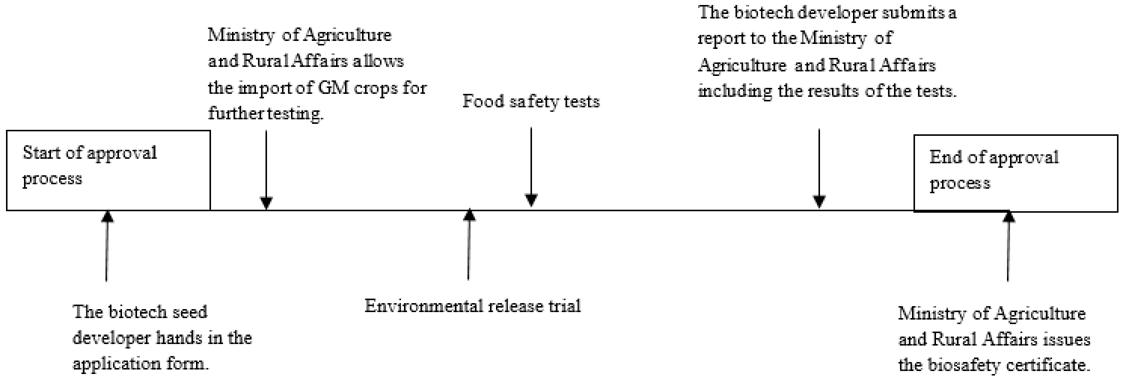

Figure S1. Timeline of the approval process for imported GM crops in China

The data we use come from the official website of MARA, United States Department of Agriculture, Government of Canada, data published in [4], and personal communication with two biotech seed developing companies. Based on data, we use an ordinary least squares regression to show to what extent crop characteristics and other factors affect the approval length and to investigate the trend of approval length between 2002 and 2017. For all the imported GM crop varieties, we obtained the exact date of issuing the biosafety certificate from official documents published by MARA. For half of the imported GM crop varieties (25 varieties), we obtained the exact date of application either by personal communication with the companies (21 varieties) or from official documents published by MARA (4 varieties). The exact dates of application for the remaining half of the varieties are not available, only the years in which the application was made.[1] In those cases, we assume that July is the starting month. We also perform a sensitivity analysis[2] by randomly choosing a month for these observations. We assume that the biotech seed developers are well-informed and rational in choosing the date of application. This is because the members of Biosafety Committee meet twice a year (in April and November) to decide whether to issue the biosafety certificate, and therefore unnecessary waiting time could occur when the biotech seed developer hands in the application form right after the meeting.

Table S1 presents summary statistics for 50 imported GM crop varieties (five crops: canola, cotton, maize, soybean, and sugar beet) which passed the approval process in China. The average approval length for an imported GM crop variety is 34.3 months. Since 2002, the maximum time for the approval process has been 71 months (MIR162 maize), and the minimum time has been 18 months (MIR604 maize).

[1] We tried contacting the remaining companies but unfortunately they were not willing to share the information.
[2] Sensitivity analysis in our paper is conducted by letting EXCEL to randomly choose a number from 1 to 12 (denoting from January to December) for those half of the GM varieties that we only know the year of the application instead of the detailed month. We use Microsoft Excel's functionality RANDBETWEEN (1,12) to do the random selection. Sensitivity analysis is used to show whether the result is robust due to those uncertain variables.

Table S1. Approval length of imported GM crops in China[3]

Category	Sub-category	No. of variety	No. of month		
			Average	Min	Max
Total		50	34.3	18	71
Year	Before 2010	27	27	18	40
	After 2010	23	43	19	71
Trait type	Insect resistance only	10	34	18	71
	Herbicide tolerance only	23	35	19	68
	Combination or other traits	17	34	23	68
Crop	Canola	7	26	24	32
	Cotton	9	27	21	35
	Maize	19	38	18	71
	Soybean	14	39	19	68
	Sugar beet	1	38	38	38
Company	Company 1	21	34	23	68
	Company 2	14	29	21	58
	Company 3	8	42	18	71
	Other companies[4]	7	37	19	67
No. of traits	Single	37	35	18	71
	Multiple[5]	13	33	23	68

Following [4], we use an ordinary least squares regression to show to what extent crop characteristics and other factors affect the approval length. We specify the model as follows

$$AT = c_0 + c_1 BA + \sum_{i=1}^{2} c_{2i} TT_i + \sum_{j=1}^{4} c_{3j} CT_j + \sum_{m=1}^{3} c_{4m} COM_m + c_5 NR + \varepsilon , \qquad (1)$$

where AT is the approval length in months. BA denotes the period in which a GM crop obtained the biosafety certificate (BA = 1 after 2010, and 0 before 2010). TT_i denotes trait type, and the reference is insecticide resistance only. CT_j denotes crop type with cotton as the reference. COM_m denotes company, and the reference is Company 1. NR denotes the number of trait combinations, and the reference is the crop with a single trait. Finally, c_0, c_1, c_{2i}, c_{3j}, c_{4m}, and c_5 are unknown parameters, and ε is the error term with standard properties. All explanatory variables are dummy variables that equal one if a variable has a given property

[3] Authors' calculations based on the reports from MARA.
[4] We anonymize the company names due to request, and use number to distinguish different large companies. 'Company 1' represents the company with the largest market share. 'Company 2' represents the company with the second largest market share. 'Company 3' represents the company with the third largest market share. 'Other companies' represents other small companies all together (each company might only have one variety, and therefore we group them together).
[5] It is interesting to see that the approval length for single-trait GM crops is on average two months longer than the approval length for multiple-trait GM crops. The potential reason might be in our dataset, the approval length for several single-trait GM crops is extremely long, such as DAS-40278-9 maize (67 months), MON 87705 soybean (68 months), and MIR 162 maize (71 months).

and zero otherwise. We estimate six models to see if and how the inclusion of additional dummy variables (one by one) influences the approval length for imported GM crops in China. The results are robust across all model specifications (as is interpreted in the main text). Table S2 presents the estimated results. Table S3 presents the results with the hard data (25 varieties). Table S4 presents the results of sensitivity analysis.

Table S2. Factors related to the approval length (dependent variable) for imported GM crops in China, 2002-2017

Category		1	2	3	4	5	6
Year	Before 2010	reference	reference	reference	reference	reference	reference
	After 2010	15.63***	15.96***	15.58***	14.79***	16.18***	16.66***
		(3.28)	(3.36)	(3.33)	(3.41)	(3.70)	(3.97)
Trait type	Insect resistance		reference				reference
	Herbicide tolerance		2.19				6.50
			(4.46)				(5.18)
	Combination or other traits		-0.51				1.28
			(4.68)				(5.05)
Crop	Canola					6.13	7.40
						(5.88)	(6.40)
	Cotton					reference	reference
	Maize					11.13**	9.54*
						(4.54)	(5.16)
	Soybean					6.49	5.48
						(4.95)	(5.51)
	Sugar beet					18.41	14.33
						(11.93)	(12.54)
Company	Company 1				reference		reference
	Company 2				-4.17		-3.65
					(3.98)		(4.93)
	Company 3				5.10		5.80
					(4.86)		(5.53)
	Other companies				-1.31		-2.53
					(5.16)		(5.41)
No. of traits	Single			reference			
	Multiple			-0.59			
				(3.78)			
	Constant	27.11***	26.12***	27.28***	28.03***	19.59***	17.18***
		(2.23)	(4.08)	(2.51)	(2.83)	(4.08)	(5.38)
	Observations	50	50	50	50	50	50
	R-squared	0.32	0.33	0.32	0.37	0.42	0.46

Note: Standard errors in parentheses. ***, **, * indicate statistical significance at 1, 5, and 10 percent levels, respectively. Reference categories are marked. For example, in Model 6, reference category refers to the insect-resistant cotton produced by Company 1 before 2010.

Table S3. Factors related to the approval time (dependent variable) for imported GM crops in China, 2002-2017 (complete original data)

Category		1	2	3	4	5	6
Year	Before 2010	reference	reference	reference	reference	reference	reference
	After 2010	12.31**	15.09***	13.50***	11.01**	11.80**	14.32**
		(4.46)	(4.47)	(4.34)	(4.40)	(5.32)	(6.69)
Trait type	Insect resistance		reference				reference
	Herbicide tolerance		6.92 (5.20)				5.26 (6.38)
	Combination or other traits		-4.30 (6.03)				0.05 (7.83)
Crop	Canola					1.27	2.71
						(9.59)	(9.85)
	Cotton					reference	reference
	Maize					6.72	2.27
						(6.24)	(7.09)
	Soybean					5.67	-1.04
						(6.61)	(7.96)
	sugar beet					14.27	8.64
						(12.59)	(12.82)
Company	Company 1				reference		reference
	Company2				-10.57		-8.93
					(6.38)		(10.96)
	Other companies				13.60		9.20
					(7.99)		(10.14)
No. of traits	Single			reference			
	Multiple			-9.15			
				(5.39)			
	Constant	28.14***	24.80***	29.45***	28.90***	23.73***	24.10***
		(2.96)	(4.50)	(2.95)	(2.73)	(5.03)	(6.50)
	Observations	25	25	25	25	25	25
	R-squared	0.25	0.39	0.34	0.43	0.33	0.49

Note: Standard errors in parentheses. ***, **, * indicate statistical significance at 1, 5, and 10% levels, respectively. Reference categories are marked. For example, in Model 6, reference category refers to the insect-resistant cotton produced by Company 1 before 2010. In this scenario, there is no GM crops from Company 3.

Table S4. Factors related to the approval length (dependent variable) for imported GM crops in China, 2002-2017 (Sensitivity analysis-Excel random generation)

Category		1	2	3	4	5	6
Year	Before 2010	reference	reference	reference	reference	reference	reference
	After 2010	16.77***	17.11***	16.67***	16.03***	17.25***	17.61***
		(3.37)	(3.45)	(3.42)	(3.51)	(3.79)	(4.08)
Trait type	Insect resistance		reference				reference
	Herbicide tolerance		1.77 (4.59)				5.50 (5.32)
	Combination or other traits		-1.20 (4.81)				0.21 (5.19)
Crop	Canola					7.16	8.46
						(6.04)	(6.57)
	Cotton					reference	reference
	Maize					11.60**	10.29*
						(4.66)	(5.31)
	Soybean					7.61	7.26
						(5.09)	(5.66)
	sugar beet					19.44	16.02
						(12.25)	(12.89)
Company	Company 1				reference		reference
	Company 2				-3.81		-2.87
					(4.10)		(5.07)
	Company 3				5.34		6.27
					(5.01)		(5.68)
	Other companies				-1.82		-2.96
					(5.52)		(5.56)
No. of traits	Single			reference			
	Multiple			-1.36			
				(3.89)			
	Constant	26.70***	26.14***	27.11***	27.51***	18.56***	16.48***
		(2.29)	(4.19)	(2.58)	(2.92)	(4.19)	(5.53)
	Observations	50	50	50	50	50	50
	R-squared	0.34	0.35	0.34	0.38	0.43	0.48

Note: Standard errors in parentheses. ***, **, * indicate statistical significance at 1, 5, and 10% levels, respectively. Reference categories are marked. For example, in Model 6, reference category refers to the insect-resistant cotton produced by Company 1 before 2010.

Tomato	f	Calgene	s	x	d	FLAVR SAVR
Cotton	n	Calgene	s	h	d	BXN
Squash	f	Upjohn	s	x	d	ZW-20
Soybean	f	AgrEvo	s	h	f	W62, W98, A2704-12, A2704-21, A5547-35
Maize	f	DeKalb	s	h	d	B 16
Cotton	n	Monsanto	s	i	d	531, 757, 1076
Potato	f	Monsanto	s	i	d	BT6, BT10, BT12, BT16, BT17, BT18, BT23
Soybean	f	Monsanto	s	h	d	40-3-2
Cotton	n	Du Pont	s	h	d	19-51a
Tomato	f	Zeneca & Petoseed	s	x	df	B, Da, F
Oilseed rape	f	Calgene	s	x	d	pCGN3828-212/86-18 & 23
Cotton	n	Monsanto	s	h	d	1445.1698
Potato	f	Monsanto	s	i	d	SBT02-5 & -7, ABBT04-6 & -27, -30, -31, -36
Maize	f	AgrEvo	s	h	f	T14, T25
Maize	f	Nothrup King	s	i	d	Bt11
Tomato	f	DNA Plant Tech	s	x	d	1345-4
Maize	f	Ciba Seeds	s	i	d	176
Tomato	f	Monsanto	s	x	d	8338
Maize	f	Plant Genetic Systems	s	x	d	MS3
Tomato	f	Agritope	s	x	d	35 1 N
Maize	f	Monsanto	s	i	d	MON 80100
Maize	f	Monsanto	m	hi	d	MON802
Maize	f	DeKalb	s	i	d	DBT418
Potato	f	Monsanto	m	ix	d	RBMT15-101, SEMT15-02, SEMT15-15
Potato	f	Monsanto	m	ix	d	RBMT21-129 & RBMT21-350
Cotton	n	Calgene	m	hi	d	31807 & 31808
Sugar Beet	f	AgrEvo	s	h	f	T-120-7
Maize	f	Monsanto	s	h	d	GA21
Maize	f	AgrEvo	m	hi	f	CBH-351
Sqash	f	Asgrow	s	x	d	CZW-3
Soybean	f	Du Pont	s	x	d	G94-1, G94-19, G168
Papaya	f	Cornell University	s	x	d	55-1, 63-1
Tomato	f	Monsanto	s	i	d	5345
Chicory	f	Bejo	s	x	d	RM3-3, RM3-4, RM3-6
Maize	f	Pioneer	m	hx	d	676, 678, 680
Oilseed rape	f	Monsanto	s	h	d	RT73
Sugar Beet	f	Novartis Seeds & Monsan	s	h	f	GTSB77
Oilseed rape	f	AgrEvo	s	h	f	T45
Oilseed rape	f	AgrEvo	m	hx	f	MS8 & RF3
Maize	f	Mycogen c/oDow&Pioneer	m	hi	d	Line 1507
Rice	f	AgrEvo	s	h	f	LLRICE06, LLRICE62

56	Oilseed rap	GT73	Monsanto
8	Maize	1507	Dow AgroSciences/Pioneer Hi-Bred
9	Maize	NK603	Monsanto
45	Maize	NK603 X MON810	Monsanto
10	Maize	MON863	Monsanto
44	Maize	MON863 X MON810	Monsanto
49	Maize	NK603 X MON811	Monsanto
42	Maize	Bt11	Syngenta Seeds
46	Rice	LLRICE62	Bayer CropScience
32	Cotton	281-24-236X3006-210-23	Dow AgroSciences
48	Maize	NK603 X MON810	Monsanto
11	Maize	NK603 x MON810	Monsanto
12	Maize	MON863 x MON810	Monsanto
6	Flowers	carnation Moonlite 123.2.38	Florigene Ltd.
13	Maize	1507 x NK603	Dow AgroSciences/Pioneer Hi-Bred
14	Maize	MON863 x NK603	Monsanto
15	Maize	MON863 x MON810 x NK603	Monsanto
31	Sugarbeet	H7-1	KWS SAAT AG/Monsanto
16	Maize	MIR604	Syngenta Seeds
17	Maize	59122	Dow AgroSciences/Pioneer Hi-Bred
28	Potato	EH92-527-1	BASF Plant Science
5	Cotton	LL Cotton 25	Bayer CropScience
18	Maize	1507 x 59122	Dow AgroSciences/Pioneer Hi-Bred
29	Soybean	A2704-12	Bayer CropScience
53	Soybean	A2704-12	Bayer CropScience AG
19	Maize	GA21	Syngenta
41	Maize	NK603	Monsanto
20	Maize	59122 x 1507 x NK603	Pioneer Hi-Bred
21	Maize	59122 x NK603	Pioneer Hi-Bred
22	Maize	MON88017	Monsanto
4	Oilseed rap	T45	Bayer CropScience
23	Maize	MON88017 x MON810	Monsanto
40	Maize	MON89034 X MON88017	Monsanto
34	Flowers	Carnation Moonaqua	Florigene Ltd
30	Soybean	MON89788	Monsanto
55	Soybean	MON 89788	Monsanto
24	Maize	MON89034	Monsanto
25	Maize	MON89034 x NK603	Monsanto
50	Soybean	356043	Pioneer
66	Cotton	MON89913	Monsanto
33	Cotton	GHB614	Bayer CropScience
59	Soybean	305423	Pioneer
37	Maize	Bt11 X MIR604	Syngenta
38	Maize	MIR604 X GA21	Syngenta
27	Maize	Bt11 x GA21	Syngenta
35	Maize	MON89034 X 1507 X MON880	Dow AgroSciences/Monsanto
39	Maize	Bt11 X MIR604 X GA21	Syngenta Seeds
36	Maize	MON89034 X 1507 X NK603	Monsanto
54	Soybean	A5547-12	Bayer CropScience AG
62	Soybean	BPS-CV127-9	BASF Plant Science GmbH
52	Soybean	MON 87701 × MON 89788	Monsanto
63	Soybean	MON87769	Monsanto
65	Cotton	GHB614xLLCotton25	Bayer CropScience
60	Soybean	MON87705	Monsanto
51	Soybean	MON 87701	Monsanto
47	Maize	MIR162	Syngenta
61	Soybean	MON87708	Monsanto
64	Oilseed rap	MON88302	Monsanto

name	developer	trait	China approval date	Canada approval date	China approval length (months)
Canola: 7 Events					
GT73/RT73 canola	Monsanto Company	Herbicide Tolerance	2004.04.06	1994.11.21	25
Topas19/2(HCN92) canola	Bayer CropScience	Herbicide Tolerance	2004.04.06	1995.02.16	32
Ms1Rf1 canola	Bayer CropScience	Herbicide Tolerance + Pollination control	2004.04.06	1994.09.08	24
Ms1Rf2 canola	Bayer CropScience	Herbicide Tolerance + Pollination control	2004.04.06	1995.08.17	24
Ms8Rf3 canola	Bayer CropScience	Pollination control	2004.04.06	1997.03.12	25
Oxy-235 canola	Bayer CropScience	Herbicide Tolerance	2004.04.06	1997.07.08	26
T45 canola	Bayer CropScience	Herbicide Tolerance	2004.04.06	1997.02.17	24
Cotton : 9 Events					
1445 cotton	Monsanto Company	Herbicide Tolerance	2004.02.20	1996.12.19	23
MON 531 cotton	Monsanto Company	Insect Resistance	2004.02.20	1996.04.09	23
GHB614 cotton	Bayer CropScience	Herbicide Tolerance	2010.12.30	2008.03.13	21
LLCOTTON25 cotton	Bayer CropScience	Herbicide Tolerance	2006.12.20	2004.09.03	21
GHB119 cotton	Bayer CropScience	Herbicide Tolerance + Insect Resistance	2014.04.10	2011.12.29	26
T304-40 cotton	Bayer CropScience	Herbicide Tolerance + Insect Resistance	2014.04.10	2011.12.29	26
MON88913 cotton	Monsanto Company	Herbicide Tolerance	2007.12.20	2005.11.16	33
MON15985(BollgardII) cotton	Monsanto Company	Insect Resistance	2006.07.20	2003.06.27	35
COT102 cotton	Syngenta	Insect Resistance	2015.12.31	2011.04.13	33
Maize : 19 Events					
NK603 maize	Monsanto Company	Herbicide Tolerance	2005.07.08	2001.02.19	40
MON87460 maise	Monsanto Company	Abiotic Stress Tolerance	2013.05.21	2011.01.20	27
MON810 maize	Monsanto Company	Insect Resistance	2004.02.20	1997.02.17	23
MON863 maize	Monsanto Company	Insect Resistance	2004.06.25	2003.03.03	27
MON88017 maize	Monsanto Company	Herbicide Tolerance + Insect Resistance	2007.12.20	2006.02.17	33
MON89034 maize	Monsanto Company	Insect Resistance	2010.12.30	2008.05.18	39
T25 maize	Bayer CropScience	Herbicide Tolerance	2004.04.06	1997.04.03	26
TC1507 maize	Dow AgroSciences LLC and DuPont	Herbicide Tolerance + Insect Resistance	2004.04.06	2002.10.11	27
59122 maize	Dow AgroSciences LLC and DuPont	Herbicide Tolerance + Insect Resistance	2006.12.20	2005.11.18	23

Bt11 maize	Syngenta	Insect Resistance	2004.04.06	1996.08.15	37
Bt176 maize	Syngenta	Herbicide Tolerance + Insect Resistance	2004.04.06	1995.12.19	25
Bt11×GA21 maize	Syngenta	Insect Resistance	2011.11.03	N.A.	68
MIR604 maize	Syngenta	Insect Resistance	2008.08.28	2007.07.04	18
GA21 maize	Syngenta	Herbicide Tolerance	2004.02.20	1999.05.13	23
3272 maize	Syngenta	Modified Product Quality	2013.05.21	2008.03.13	47
MIR162 maize	Syngenta	Insect Resistance	2014.12.11	2010.03.24	71
DAS-40278-9 maize	DowAgroScience	Herbicide Tolerance	2017.06.12	2012.05.16	67
MON87427 maize	Monsanto Company	Herbicide Tolerance	2017.07.16	2012.06.12	52
5307 maize	Syngenta	Insect Resistance	2017.07.16	2013.02.22	40
Soybean : 14 Events					
MON87701 soybean	Monsanto Company	Insect Resistance	2013.06.06	2010.10.21	32
MON87701xMON89788 soybe	Monsanto Company	Herbicide Tolerance + Insect Resistance	2013.06.06	N.A.	32
CV127 soybean	BASF Agrochemical Pro	Herbicide Tolerance	2013.06.06	2012.10.31	40
GTS40-3-2 soybean	Monsanto Company	Herbicide Tolerance	2004.02.20	1996.04.09	23
MON89788 soybean	Monsanto Company	Herbicide Tolerance	2008.08.28	2007.06.27	23
A2704-12 soybean	Bayer CropScience	Herbicide Tolerance	2007.12.20	2000.11.20	31
356043 soybean	DuPont	Herbicide Tolerance	2010.12.30	2009.09.23	19
305423 soymean	DuPont	Modified Product Quality	2011.11.03	2009.05.06	30
A5547-127 soybean	Bayer CropScience	Herbicide Tolerance	2014.12.11	2000.11.20	58
305423×40-3-2 soybean	DuPont	Herbicide Tolerance + Modified Product	2014.12.11	N.A.	55
MON87708 soybean	Monsanto Company	Herbicide Tolerance	2015.12.31	2012.10.12	38
MON87769 soybean	Monsanto Company	Modified Product Quality	2015.12.31	2011.10.15	50
FG72 soybean	Bayer CropScience	Herbicide Tolerance	2016.12.31	2012.06.20	44
MON 87705 soybean	Monsanto Company	Herbicide Tolerance	2017.06.12	2011.09.29	68
sugarbeet : 1 Event					

H7-1 sugarbeet	Monsanto Company	Herbicide Tolerance	2009.05.07	2005.08.31	38