AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Journal of Agricultural and Resource Economics Preprint
ISSN: 1068-5502 (Print); 2327-8285 (Online)
Copyright 2025 the authors
doi: 10.22004/ag.econ.364790

Impacts of Deportation of Undocumented Workers on the Broiler Supply Chain

Stephen Devadoss and Jeff Luckstead

This study explores the impacts of deportation of the undocumented workers on various segments of the poultry supply chain using a model comprising domestic workers and undocumented workers. The results show that the deportation of 20% of undocumented workers in the poultry supply chain increases the wage rates by 7.82% which raises the cost of production and chicken product prices. Lack of labor availability due to this deportation policy causes production to decline in every segment of the poultry supply chain. Poultry producers' welfare declines by $63.85 million. Price inflation for chicken products occurs, ranging from 1.41% for feet to 2.94% for ready-to-eat products. Domestic consumption of chicken products falls, ranging from 0.73% for whole chickens to 2.11% for ready-to-eat products. US consumers' surplus declines by $1.94 billion.

Key words: Broiler Supply Chain, Deportation, Undocumented Workers

JARE Preprint

Introduction

The Trump Administration is deporting undocumented workers from the United States. Labor-intensive sectors of the economy, such as agriculture and meat processing, employ unauthorized workers (Krogstad, Lopez, and Passel, 2020; Volker, 2022). Specifically, immigrant workers comprise between 42% and 58% of roughly 470,000 workers in the meat processing sector (Groves and Tareen, 2020). This sector has historically relied on foreign-born workers to carry out dangerous and physically demanding jobs.[1] Among meat processing, poultry processing is the largest industry and employs a significant number of undocumented workers. How the removal of undocumented works impact the production in the poultry supply chain is important for policy makers, producers, and consumers, which is the focus of this study.

Workers in the poultry supply chain are US citizens, foreign-born workers legally eligible to work in the United States, and undocumented workers. These undocumented workers, with expired visas or entered the United States illegally, largely come from the Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Mexico, the Philippines, and other Central and South American countries (Groves and Tareen, 2020). Because many jobs in poultry processing require limited education, experience, or language skills, these occupations are entry points for many of the low-skilled new immigrants (GAO).

Despite work in poultry processing being 3-D (dirty, demanding, and dangerous) and backbreaking jobs (Quandt et al., 2013), wages are generally low at about $12.50. The hazardous

Stephen Devadoss is the Emabeth Thompson Endowed Professor in the Department of Agricultural and Applied Economics at Texas Tech University. Jeff Luckstead is a professor in the School of Economic Sciences at Washington State University.
This work is supported by the USDA National Institute of Food and Agriculture, Agricultural and Food Research Initiative Competitive Program, Agriculture Economics and Rural Communities, grant # 2022-67023-36382. The authors acknowledge helpful comments of a reviewer and the efficient editorial coordination of the managing editor Vardges Hovhannisyan.
This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.
Review coordinated by Vardges Hovhannisyan.

[1] GAO reports that the percentage of foreign-born workers of the total labor force in the meat processing sector is about three times greater than that in the manufacturing sector.

nature of this work is evident from 100 workers dying and 300,000 workers getting injured annually (Southern Poverty Law).[2] Most of the poultry processing jobs are in rural areas and lack access to lawyers and union laws. Since unauthorized workers are employed illegally, they do not report workplace abuse to law enforcement due to the fear of deportation (Groves and Tareen, 2020). Given the importance of unauthorized workers in the poultry supply chain, deportation of a large number of these workers will disrupt the daily operations of firms at the various segments of the poultry supply chain.

Furthermore, because of the 3-D nature of the jobs, US domestic workers are unwilling to work in these jobs (Mukherjee and Krogstad, 2024). Therefore, this policy could cause labor shortfalls, which could lead to firm closures, increased cost of operations, and higher prices of chicken products, which ultimately hurt US consumers. Thus, quantifying the effects of deportation of unauthorized workers on prices, supply, demand, and welfare on each segment of the poultry supply chain will benefit policymakers, chicken-growing and chicken-processing firms, and consumers.

A few studies have examined the impacts of domestic enforcement to remove undocumented workers from the United States on the US economy and various sectors (Aguiar, 2009; Devadoss and Luckstead, 2011; Luckstead, Devadoss, and Rodriguez, 2012; Devadoss and Luckstead, 2018; Devadoss, Zhao, and Luckstead, 2020). These studies have found that the removal of these workers cripples the production in the labor-intensive sectors of the United States. Other studies analyzed the importance of migrant workers in several regions of the world, which include North America (Aguiar and Walmsley, 2014), Europe (Angioloni et al., 2022), and East and Southeast Asia (Corong and Aguiar, 2019). These studies have shown that immigrant workers boost the host country's economy. The current study builds on this literature to specifically analyze the Trump Administration's policy of deportation of undocumented workers on the poultry supply chain which relies heavily on these workers.

The rest of the paper is organized as follows. The next section presents an overview of the structure of the poultry supply chain model using a flow chart, and Appendix A describes the detailed mathematical equations of the model. Section 3 discusses the simulation results of the effects of deportation of undocumented workers under the Trump policy. The final section concludes the paper and provides policy implications.

Model

The broiler industry is one of the most vertically integrated in the agri-food sector, with centralized decision makers coordinating the production process starting with feed mills to breeder flocks, hatcheries, grow-out farms, and processing plants (MacDonald, 2014). This study modifies the poultry supply chain model detailed in Unveren and Luckstead (2020) and Luckstead and Devadoss (2020) by incorporating undocumented workers to suit the analyses of the Trump administration's labor policy. Specifically, we decompose labor into domestic and undocumented workers in the processing sectors of the poultry supply chain to aptly analyze the impacts of deportation of unauthorized workers. In Appendix A, we describe the complete poultry supply-chain model capturing the vertical and horizontal links. Here, we provide a descriptive overview of the model using Figure 1 where dashed rectangles represent firms contracted with the integrator (ovals) which is the company that owns the birds and contracts with farmers to raise them, and the hexagons indicates markets.

In this model, the representative integrated broiler firm controls the feed mill, hatchery, and processing and contracts with grain producers, hatcheries, and grow-out farms.[3] The poultry supply

[2] As per US Occupational Health and Safety Administration, the non-fatal injury rate in this sector is 5.8 injuries and illnesses per 100 workers, which is 1.5 times more that the average for all US employment (BLS). According to Musolin et al. (2013), about 42% of poultry processing workers endure carpal tunnel syndrome.

[3] This vertical integration has evolved over time and his shifted market risk from hatcheries and broiler farms to the integrator.

JARE Preprint

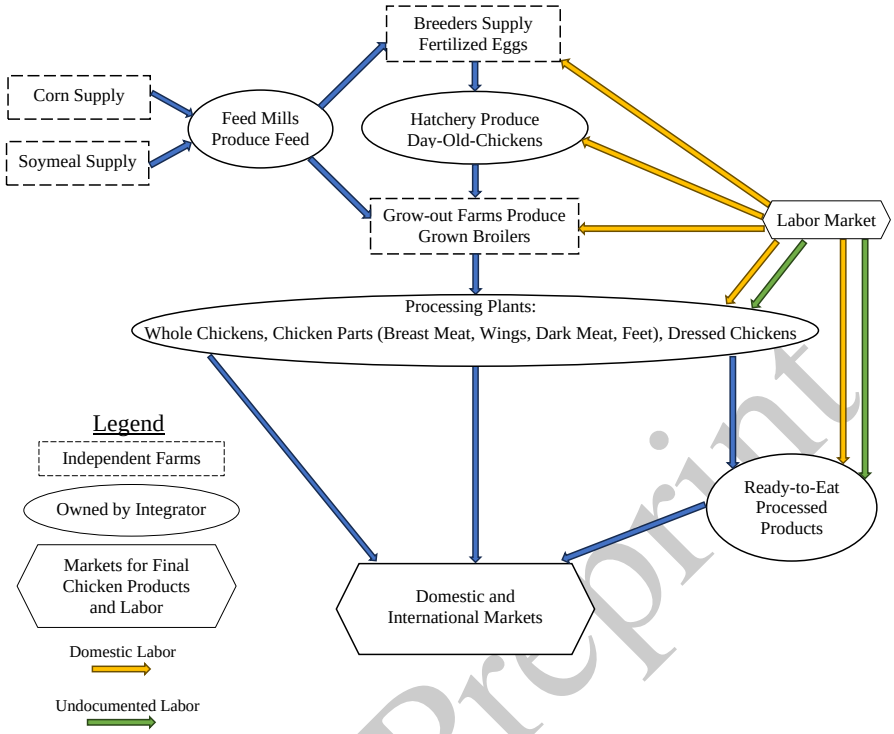

Figure 1. The Structure of the Poultry Supply Chain

chain has several stages of production starting with feed use in the upstream segment and end with final chicken products in the downstream segment. Corn and soymeal are major ingredients supplied to the Feed Mills, which combine these two inputs to produce chicken feed that is transferred to the Breeder Farms and Grow Out farms. The integrator contracts with Breeder Farms and pays (which increases for above average management and performances) these farms based on the number of eggs produced, and these contracts last for around 45 weeks (the amount of time that birds produce hatching eggs) (Cunningham, 2013). Breeder Farms utilize land, housing, equipment, utilities, and hired domestic workers to feed and raise the integrator-owned hens to produce fertilized eggs that are transferred to the integrator-owned Hatcheries (MacDonald, 2014; Cunningham, 2013).[4] The Hatcheries employ domestic workers and incubate fertilized eggs for three weeks to produce day-old chicks that are moved to Grow Out Farms. The integrator has production contracts with the Grow Out Farms, who receive fees—which may be adjusted based on performance or changes in input prices and market prices of broilers—to raise the integrator-owned broilers (MacDonald, 2008, 2014).[5] The Grow Out farms use domestic workers to raise the day-old chicks to produce grown broilers, which are transferred to the Processing Plants. The integrator-owned Processing Plants employ domestic and undocumented workers to process the grown chickens into three major products: whole chickens, chicken parts, and dressed chickens. The chicken parts are further separated into breast meat, wings, dark meat, and feet. The dressed chickens are further processed using domestic and undocumented workers to produce ready-to-eat chicken products. Because whole chicken, breast meat, wings, and dark meat are largely sold in the domestic market and exports of these products are

[4] We assume undocumented are used minimally in these segments. However, if these segment use a significant number of undocumented workers, then the removal of these workers will have more pronounced effects throughout the poultry supply chain.

[5] While the length of a production contract can be 7 or more years, the most common is 5-10 weeks (flock-to-flock) (MacDonald, 2008).

JARE Preprint

limited, we model exports of only dark meat, wings, and ready-to-eat processed products to Canada, Mexico, and the ROW, and feet to China.

As explained in the introduction, both domestic workers and undocumented workers are employed in the poultry processing segment. Though both types of workers perform similar tasks and are part of the same labor market, undocumented workers are paid only about 88.8% of the wage rate of domestic workers because of their illegal employment status. This wage cut of 88.8% is determined based on the National Agricultural Workers Survey by the US Department of Labor which collects visa/citizenship status and wage rates for farm and non-farm work. We compared the wage rates of domestic workers and undocumented workers in the non-farm jobs over the period 2019 - 2020 (most recently available data) and determined that the undocumented workers are paid on average about 88.8% of domestic workers' non-farm wage rate.

Results of Deportation

Since no official statistics exist on the composition of domestic, foreign-born legally eligible, and undocumented workers in poultry processing, we rely on reports by the popular press. For example, Driver (2024) report an estimated 30% to 50% of the workers in meatpacking are undocumented. Based on this report, we consider the percent of undocumented workers in poultry processing to be 40% and conduct sensitivity analyses for 30% and 50%. Furthermore, US government may not be able to deport all undocumented workers in the country, including those employed in poultry processing, because employers, churches, and relatives of undocumented workers may provide protection for these laborers. Also, the US public may be averse to deporting all undocumented workers because of their importance in laborious and physical work at the poultry processing plants, which US citizen do not want to do. Consequently, we conduct simulation analyses for three scenarios corresponding to deportation rates of 10%, 20%, and 30%. Thus, for the main analysis, we consider 40% of workers in the poultry sector are undocumented and run three scenarios corresponding to each deportation rate. Table 1 reports the simulation results of the effect of the three deportation rates on prices and quantity supplied, consumed, and exported. We first discuss the results for a 20% deportation rate in detail, and we then compare these results to those for 10% and 30% deportation rates. Tables A1 and A3 in Appendix B presents the results of undocumented workers comprising 30% and 50%, respectively, of the workforce in the poultry sector with the three deportation rates. At the end of this appendix, we plot the results of four key variables (wage rate, price of Ready-To-Eat products, quantity produced of Ready-To-Eat products, and quantity consumed of Ready-To-Eat products) for different deportation rates and share of undocumented workers in the poultry processing labor force. The results generally increase linearly with higher deportation rates and higher share of undocumented workforce.

With 40% of the workforce being unauthorized, a 20% deportation rate of undocumented workers shifts these workers' supply curve to the left, contracting the availability of labor in the poultry supply chain. Employers may try to hire domestic workers to replace the deported unauthorized workers. However, because of the hazardous and backbreaking nature of the jobs, domestic workers are less inclined to fill these jobs (Mukherjee and Krogstad, 2024). Consequently, as noted in the supply-chain model in Appendix A, domestic workers' labor supply is more inelastic than that for undocumented workers. As a result of the deportations, the model predicts that wage rates increase by 7.82% for both types of workers,[6] which increases production costs and lowers production capacity throughout the supply chain. The deportation of unauthorized workers hampers the operation of poultry processing plants as these workers are largely employed in this segment of the supply chain, which produces final chicken products (whole chickens, breast meat, wings, dark meat, feet, and ready-to-eat products). The effects of the deportation also reverberate to the

[6] The wage rate increases by the same percent by both domestic and undocumented workers because the undocumented wage rate is $\omega = 0.88$ fracion of the domestic wage rate.

JARE Preprint

Table 1. Impacts of Deportation of Undocumented Workers (40% Undocumented Workforce)

		Reduction in Undocumented Workers		
		10%	20%	30%
	Baseline*	Percent Change		
Price				
Domestic Wage Rate ($/hr)	13.86	3.71	7.82	12.41
Undocumented Wage Rate ($/hr)	12.19	3.71	7.82	12.41
Corn ($/tonne)	165.08	-0.22	-0.47	-0.74
Soymeal ($/tonne)	420.28	-0.01	-0.03	-0.04
Feed ($/tonne)	265.25	-0.13	-0.27	-0.42
Fertilized Egg ($/dozen eggs)	3.35	0.49	1.02	1.61
Day-Old Chicks ($/dozen heads)	4.3	0.48	1.01	1.6
Grown Chicken ($/lbs)	0.55	-0.04	-0.08	-0.13
Whole Chicken ($/lbs)	1.48	0.8	1.68	2.64
Breast Meat ($/lbs)	3.35	0.72	1.5	2.35
Wing ($/lbs)	1.73	0.89	1.86	2.92
Dark Meat ($/lbs)	1.56	0.83	1.72	2.7
Feet (Paws) ($/lbs)	0.35	0.68	1.41	2.21
Processed Chicken ($/lbs)	2.15	0.9	1.88	2.95
Ready-to-Eat Product ($/lbs)	2.8	1.41	2.94	4.62
Weighted Average Retail ($/lbs)	2.42	0.72	1.5	2.34
Quantity				
Corn (1000 tonne)	0.04	0	-0.01	-0.01
Soymeal (1000 tonne)	0.01	-0.02	-0.05	-0.08
Feed (1000 tonne)	0.09	-0.01	-0.01	-0.02
Fertilized Egg (mil dozens)	1.09	-0.01	-0.03	-0.05
Day-Old Chicks (mil dozens)	0.77	-0.02	-0.04	-0.06
Grown Chicken (mil lbs)	52.48	-0.02	-0.04	-0.06
Whole Chicken (mil lbs)	4.1	-0.35	-0.73	-1.15
Breast Meat (mil lbs)	5.55	-0.66	-1.36	-2.11
Wings (mil lbs)	1.63	-0.66	-1.36	-2.11
Dark Meat (mil lbs)	6.45	-0.66	-1.36	-2.11
Feet (Paws) (mil lbs)	1.23	-0.66	-1.36	-2.11
Processed Chicken Products (mil lbs)	18.29	-0.57	-1.17	-1.82
Ready-to-Eat (mil lbs)	18.53	-1.02	-2.11	-3.27
US Consumption of				
Whole Chicken (mil lbs)	4.1	-0.35	-0.73	-1.15
Breast Meat (mil lbs)	5.55	-0.66	-1.36	-2.11
Wings (mil lbs)	1.45	-0.66	-1.36	-2.12
Dark Meat (mil lbs)	0.82	-1.08	-2.24	-3.47
Ready-to-Eat (mil lbs)	22.19	-0.66	-1.36	-2.12
US Exports to Canada				
Wings (mil lbs)	0.01	-0.32	-0.66	-1.03
Dark Meat (mil lbs)	0.26	-0.52	-1.09	-1.69
Ready-to-Eat (mil lbs)	0.03	-0.32	-0.67	-1.04
US Exports to Mexico				
Wings (mil lbs)	0.01	-0.48	-0.99	-1.54
Dark Meat (mil lbs)	1.17	-0.44	-0.91	-1.42
Ready-to-Eat (mil lbs)	0.09	-0.49	-1.01	-1.57
US Exports to China				
Feet (Paws) (mil lbs)	0.46	-0.46	-0.96	-1.49
US Exports to ROW				
Wings (mil lbs)	0.15	-0.7	-1.45	-2.25
Dark Meat (mil lbs)	4.21	-0.64	-1.33	-2.07
Feet (Paws) (mil lbs)	0.78	-0.77	-1.59	-2.48
Ready-to-Eat (mil lbs)	0.17	-0.72	-1.48	-2.3

Notes: *Units in parentheses in the first column are for baseline values.

JARE Preprint

upstream sector, but only indirectly through the higher wage rates. Consequently, the upstream sector experiences modest decline in production and input use. Removal of undocumented workers lead to a production decline in the downstream sector.

Starting with the results at the top of the supply chain (Table 1), corn and soymeal use in the feed declines slightly by 0.01% and 0.05%, which causes the price of these two feeds and the composite feed to fall by 0.47%, 0.03%, and 0.27%. The small decline in feed prices helps to mitigate the adverse effects of the reduction in production due to higher wages arising from the deportation. In the breeder segment, the supply of fertilized eggs falls due to a higher wage rate for labor, and demand for fertilized eggs declines due to production contraction in the hatchery segment, leading to a decline in the quantity of fertilized eggs by -0.03%. The production decline dominates the demand decline, resulting in a higher transfer price of fertilized eggs by 1.02%. Similar production and demand changes occur in the hatchery segment, leading to fewer Day-Old-Chicks (DOCs) (-0.04%) and an increase in the DOCs price by 1.01%. The decrease in the number of DOCs causes the production of grown chicken to fall. Meanwhile, the demand for grown chickens declines due to production cuts in the downstream processing plants, causing the number of grown chickens to fall by 0.04%. The demand reduction exceeds the supply reduction, resulting in a lower price for grown chickens by 0.08%.

Because undocumented workers are a large and important part of poultry processing in the downstream sector, deportation of these workers has a greater impacts on the poultry processing plants. Due to a lack of labor, the production of processed chicken products (whole chicken, breast meat, wings, dark meat, feet, processed chicken productions, and ready-to-eat products) also declines, ranging from 0.73% to 2.11%. These supply contractions are accompanied by higher prices, ranging from 1.41% for feet to 2.94% for ready-to-eat products, indicating that deportations lead to higher US consumer prices for chicken products.

With the production curtailment in the processing sector and higher prices for processed chicken products, US consumption of these products also falls, ranging from 0.73% for whole chicken to 2.24% for dark meat. Furthermore, the reduced production also causes exports of wings, dark meat, and ready-to-eat meat to Canada, Mexico, and the ROW, and feet to China to decrease in the range of 0.66% to 1.59%.

Comparing the results across 10%, 20%, and 30% deportation rates, impacts are less pronounced under 10% and more pronounced under 30%. For 30% deportation rate, the price, quantity, and consumption impacts are larger. These results indicate the severity of removing a large share of undocumented workers from this sector due to a substantial production contraction inflicted by larger deportation rates. Particularly, wage rate increases are higher under the 30% deportation rate than the 20% deportation rate. As undocumented workers are largely employed in the downstream meat processing sectors, these pronounced wage rate increases under the 30% deportation rates also have relatively large impacts on prices and quantities in these downstream sectors.

Table 2 presents the welfare effects of the deportation of undocumented workers in various segments throughout the supply chain. Because of the reduction of workers due to the deportation, production declines in all segments of the supply chain, which causes price to rise, leading to a decline in consumption of all chicken products. In the production side, producer surplus declines in almost all segments of the supply chain, ranging from $1.55 million in the soymeal sector to $106.37 million in ready-to-eat products. Only two segments (fertilized eggs and processed chicken) experience positive producer surplus because the effect of the increase in prices outweighs the reduction in production and increase in wage expenditures, leading to an increase in producer surpluses. The sum of producer surplus changes in the poultry supply chain (-$63.86 million) indicate the adverse effects of removing these workers from the poultry processing.

With higher prices and reduced consumption of various chicken products, consumer surplus declines for every product category. The consumer surplus losses in the United States are more pronounced in ready-to-eat products ($1.49 billion) and breast meat ($276.58 million) as these two products are the largest components of the chicken products consumed. Consumer surplus losses in

JARE Preprint

Table 2. Welfare Impacts of Deportation of Undocumented Workers (40% Undocumented)

	Reduction in Undocumented Workers		
	10%	20%	30%
		(Million $)	
Producer Surplus			
Corn	-13.28	-27.73	-43.55
Soymeal	-0.74	-1.55	-2.44
Feed	-27.31	-57.02	-89.57
Fertilized Egg	25.12	52.72	83.29
Day-Old Chicks	0	0	0
Grown Chicken	-2.02	-4.22	-6.62
Whole Chicken	-4.15	-9.4	-16.02
Chicken Parts	-1.64	-9.65	-25.82
Processed Chicken	51.62	99.36	141.68
Ready-to-Eat Product	-47.95	-106.37	-177.88
Consumer Surplus			
US			
Whole Chicken	-48.31	-101.05	-158.99
Breast Meat	-133.27	-276.58	-431.55
Wings	-22.32	-46.37	-72.42
Dark Meat	-10.49	-21.74	-33.85
Ready-to-Eat Product	-717.78	-1,490.48	-2,327.04
Total US	-932.17	-1,936.21	-3,023.86
Canada			
Wings	-0.37	-0.77	-1.2
Dark Meat	-6.93	-14.4	-22.51
Ready-to-Eat Product	-1.88	-3.92	-6.13
Mexico			
Wings	-0.22	-0.46	-0.71
Dark Meat	-15.37	-31.94	-49.93
Ready-to-Eat Product	-3.06	-6.36	-9.94
China			
Feet (Paws)	-1.73	-3.59	-5.59
ROW			
Wings	-2.82	-5.86	-9.14
Dark Meat	-68.5	-142.25	-222.07
Feet (Paws)	-3.22	-6.67	-10.38
Ready-to-Eat Product	-6.86	-14.23	-22.2
Total Foreign	-110.96	-230.44	-359.82

the whole chicken product are modest at $101.05 million. In all, US consumers lose by $1.94 billion due to this immigration policy. In the export market, consumer surplus losses in dark meat exports are larger ($142.25 million in the ROW, $31.94 million in Mexico, and $14.4 million in Canada) than in the other meat categories because dark meat is the largest volume exported among chicken products. The total consumer surplus loss in the export markets is $230.44 million. The consumer surplus loss in the United States and export markets add to $2.17 billion.

Comparing the welfare measures across the three scenarios, the 30% deportation rate has larger impacts than the 10% and 20% deportation rates because of the labor shortfalls arising from the greater deportation of undocumented workers. These results clearly highlight the economic losses caused by this disruptive labor policy.

JARE Preprint

Conclusions and Policy Implications

Since the COVID-19 pandemic, meat processing companies have been struggling to hire workers and have been offering higher wages and spending millions on new incentives (Groves and Tareen, 2020). These companies' hiring efforts depend on national unemployment, availability of immigrant workers, employees' view of work, and President Trump's strict immigration policies. Depending on the intensity of Trump's policy in deporting unauthorized workers, it could cause drastic labor supply shortfalls in the poultry processing sector. Because of Immigration and Custom Enforcement raids of meat packing plants, undocumented workers are afraid to show up for work (Acevedo, 2025). Consequently, shrinkage of labor supply not only increases wage rates and production costs but could also cause some of the plants to close, which could further reduce the supply of chicken products and increase the prices for these products. Our results show that a deportation rate of 20% of undocumented workers in poultry processing could increase the wage rate by 7.28%, which will pose a burden to processors due to higher production costs. These higher production costs are passed on to consumers through higher prices ranging from 1.41% to 2.94% for various chicken products.

Furthermore, the reduction in exports due to the decline in production could cause permanent shifts by importing countries reallocating their imports to competing exporters. For instance, in the US-China trade war, China shifted its soybean imports from the United States to Brazil permanently (Sabala and Devadoss, 2019; Dhoubhadel, Ridley, and Devadoss, 2023).

Three key policy implications emerge from Trump's policy of deporting undocumented workers: First, this policy will cause labor shortfalls and raise the wage rate of all workers in the poultry processing sector. The unintended consequence of this policy in raising the wage rate is that it will widen the gap between the U.S. illegal wage rate and wage rates in Mexico and other Latin American countries. Because relatively high U.S. wages are a primary driver of unauthorized immigration, in the long-run, this policy may increase the likelihood that deported and other workers may attempt to enter the United States to benefit from the higher wage rate. This will further exacerbate the cost of securing the border. Furthermore, this policy may induce new workers to enter the United States illegally because of the higher wage rate arising from the deportation. Second, this policy will cause price inflation for chicken products. Consumers are already saddled with higher prices, and further increases in grocery prices can lead to more hardship. Third, given the economic damages caused to the producers in the broiler supply chain and to the consumers of chicken products, policymakers need to expand the guest-worker program to bring more foreign-born labor force to work legally in this industry. Fourth, if the labor supply continue to fall, poultry processing segments may need to explore a more mechanized operation.

[First submitted January 2025; accepted for publication July 2025.]

JARE Preprint

References

Acevedo, N. 2025. "How a city in Nebraska is recovering after the state's largest worksite immigration raid." NBC News. https://www.nbcnews.com/news/us-news/omaha-immigration-workplace-raid-aftermath-rcna212931. Accessed on 7/8/2025.

Aguiar, A. 2009. "An analysis of U.S. immigration and policy reforms (Doctoral dissertation)."

Aguiar, A.H., and T.L. Walmsley. 2014. "The importance of timing in the US response to undocumented immigrants: A recursive dynamic approach." *Economic Modelling* 41:253–262.

Angioloni, S., M. Berrittella, Z. Wu, and A.H. Aguiar. 2022. "Liberalizing Immigration Policies for the UK Agricultural Sector in the Post-Brexit Era." *Journal of Economic Integration* 37(1):158–178.

BLS. 2024. "Injuries, Illnesses, and Fatalities." US Bureau of Labor Statistics. https://www.bls.gov/web/osh/table-1-industry-rates-national.htm. Accessed on 12/2/2024.

Chaudhry, M.I., and M.J. Miranda. 2018. "Complex price dynamics in vertically linked cobweb markets." *Economic Modelling* 72:363–378.

Corong, E., and A. Aguiar. 2019. "Economic impact of skilled labor mobility within the ASEAN Economic Community." In *Skilled Labor Mobility and Migration,* Edward Elgar Publishing, 57–88.

Cunningham, D.L. 2013. "Guidelines for Prospective Contract Hatching Egg Producers." The Poultry Site. https://www.thepoultrysite.com/articles/guidelines-for-prospective-contract-hatching-egg-producers. Accessed on 5/13/2025.

Devadoss, S., and J. Luckstead. 2011. "Implications of immigration policies for the US farm sector and workforce." *Economic Inquiry* 49(3):857–875.

———. 2018. "US immigration policies and dynamics of cross-border workforce in agriculture." *The World Economy* 41(9):2389–2413.

Devadoss, S., X. Zhao, and J. Luckstead. 2020. "Implications of US immigration policies for North American economies." *Journal of Agricultural and Resource Economics* 45(1):161–178.

Dhoubhadel, S.P., W. Ridley, and S. Devadoss. 2023. "Brazilian soybean expansion, US–China trade war, and US soybean exports." *Journal of the Agricultural and Applied Economics Association* 2(3):446–460.

Driver, A. 2024. "How the meatpacking industry exemplifies the challenges of American workers." Fast Company. https://www.fastcompany.com/91181711/how-the-meatpacking-industry-exemplifies-the-challenges-of-american-workers. Accessed on 5/19/2025.

GAO. 2016. *WORKPLACE SAFETY AND HEALTH Additional Data Needed to Address Continued Hazards in the Meat and Poultry Industry*. United States Government Accountability Office. GAO-16-337, chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.gao.gov/assets/gao-16-337.pdff. Accessed on 12/2/2024.

Groves, S., and S. Tareen. 2020. "U.S. meatpacking industry relies on immigrant workers. But a labor shortage looms." LA Times. https://www.latimes.com/food/story/2020-05-26/meatpacking-industry-immigrant-undocumented-workers. Accessed on 12/2/2024.

Hamilton, S.F., and D.L. Sunding. 2020. "Joint Oligopsony-Oligopoly Power in Food Processing Industries: Application to the US Broiler Industry." *American Journal of Agricultural Economics* .

Krogstad, J.M., M.H. Lopez, and J.S. Passel. 2020. "A Majority of Americans Say Immigrants Mostly Fill Jobs U.S. Citizens Do Not Want." Pew Research Center. https://www.pewresearch.org/short-reads/2020/06/10/a-majority-of-americans-say-immigrants-mostly-fill-jobs-u-s-citizens-do-not-want/. Accessed on 12/9/2024.

Luckstead, J., and S. Devadoss. 2020. "Impacts of COVID-19-induced labor and income shocks on the broiler supply chain." *Journal of Agricultural and Resource Economics* 46(2):189–213.

Luckstead, J., S. Devadoss, and A. Rodriguez. 2012. "The effects of North American Free Trade Agreement and United States farm policies on illegal immigration and agricultural trade."

JARE Preprint

Journal of Agricultural and Applied Economics 44(1):1–19.

MacDonald, J.M. 2008. *The Economic Organization of U.S. Broiler Production*. EIB-38.

———. 2014. *Technology, organization, and financial performance in U.S. broiler production*. EIB-126.

Mukherjee, S., and J.M. Krogstad. 2024. "Most US Voters Say Immigrants–No Matter Their Legal Status–Mostly Take Jobs Citizens Do Not Want." Pew Research Center. https://www.pewresearch.org/short-reads/2024/10/21/most-us-voters-say-immigrants-no-matter-their-legal-status-mostly-take-jobs-citizens-dont-want/. Accessed on 12/9/2024.

Musolin, K., J. Ramsey, J. Wassell, D. Hard, and C. Mueller. 2013. "Musculoskeletal disorders and traumatic injuries among employees at a poultry processing plant. Interim Report HHE No. 2012-0125." *National Institute for Occupational Safety and Health* .

Quandt, S.A., A.E. Arcury-Quandt, E.J. Lawlor, L. Carrillo, A.J. Marín, J.G. Grzywacz, and T.A. Arcury. 2013. "3-D jobs and health disparities: The health implications of latino chicken catchers' working conditions." *American journal of industrial medicine* 56(2):206–215.

Sabala, E., and S. Devadoss. 2019. "Impacts of Chinese tariff on world soybean markets." *Journal of Agricultural and Resource Economics* 44(2):291–310.

Southern Poverty Law. 2013. "Unsafe at these speeds: Alabama's poultry industry and its disposable workers." Southern Poverty Law Center and Alabama Appleseed Center for Law & Justice.

Unveren, H., and J. Luckstead. 2020. "Comprehensive Broiler Supply Chain Model with Vertical and Horizontal Linkages: Impact of US–China Trade War and USMCA." *Journal of Agricultural and Applied Economics* :1–17.

Volker, S. 2022. "Are Meat And Dairy Doomed Without Immigrant Labor?" Faunalytics. https://faunalytics.org/are-meat-and-dairy-doomed-without-immigrant-labor. Accessed on 12/2/2024.

JARE Preprint

Appendix:Model

This study adapts the model developed in Unveren and Luckstead (2020) and expanded by Luckstead and Devadoss (2020) by decomposing labor into domestic and undocumented workers in the processing sectors of the poultry supply chain. Specifically, Corn and Soymeal Segment, Feed Mills, Breeders, Hatcheries, and Grow-out Farms are from Luckstead and Devadoss (2020). However, we extend this model by modifying Chicken Processing and Ready-to-Eat Processing segments to include both domestic and undocumented workers in the production function and derive input demands for these two labor types. In addition, Market-clearing Condition for labor incorporates supply and demand of both labor types.

Corn and Soymeal Segment

Corn and soymeal are two major feeds utilized in the poultry supply chain. Supply of corn and soymeal to the feed mills are modeled as

$$S_{C,t} = \psi_C \left(p_{C,t}\right)^{\epsilon_C}, \tag{A1}$$

$$S_{SM,t} = \psi_{SM} \left(p_{SM,t}\right)^{\epsilon_{SM}}, \tag{A2}$$

where $S_{C,t}$ is corn supply to integrators at time t, $p_{C,t}$ is the corn price, ψ_C is a scale parameter, ϵ_C is the corn-supply elasticity in the poultry industry, $S_{SM,t}$ is soymeal supply to integrators, $p_{SM,t}$ is the soymeal price, ψ_{SM} is a scale parameter, and ϵ_{SM} is the soymeal-supply elasticity in the poultry industry.

Feed Mills

Integrator-owned feed mills produce feed by combining corn and soymeal and transfer the feed to breeder and grow-out farms, which are under contracts with the integrator. The profit function of the integrator-owned feed mills is

$$\Pi_{F,t} = \rho_{F,t} Q_{F,t} - C_F\left(p_{C,t}, p_{SM,t}, Q_{F,t}\right), \tag{A3}$$

where $\rho_{F,t}$ and $Q_{F,t}$ are, respectively, the transfer price and quantity of feed. The feed cost function is

$$C_F(\cdot) = \left(\frac{Q_{F,t}}{A_F}\right)^{\frac{1}{\nu_F}} \left[\left(\alpha_F^C\right)^{\frac{1}{1+\eta_F}} \left(p_{C,t}\right)^{\frac{\eta_F}{1+\eta_F}} + \left(\alpha_F^{SM}\right)^{\frac{1}{1+\eta_F}} \left(p_{SM,t}\right)^{\frac{\eta_F}{1+\eta_F}}\right]^{\frac{1+\eta_F}{\eta_F}},$$

where A_F is the total factor productivity (TFP) parameter, ν_F is the returns to scale parameter, α_F^C and α_F^{SM} are share parameters, and η_F is the CES parameter.[7] Profit maximization with respect to $Q_{F,t}$ yields the feed supply as a function of the feed, corn, and soymeal prices:

$$Q_{F,t} = \left(\frac{1}{\rho_{F,t}\nu_F} \left(A_F\right)^{\frac{-1}{\nu_F}} \left[\left(\alpha_F^C\right)^{\frac{1}{1+\eta_F}} \left(p_{C,t}\right)^{\frac{\eta_F}{1+\eta_F}} + \left(\alpha_F^{SM}\right)^{\frac{1}{1+\eta_F}} \left(p_{SM,t}\right)^{\frac{\eta_F}{1+\eta_F}}\right]^{\frac{1+\eta_F}{\eta_F}}\right)^{\frac{\nu_F}{\nu_F - 1}}. \tag{A4}$$

[7] These definitions for the parameters for A, ν, α, and ηs carry through the rest of the model, with subscripts to these parameters indicating the particular segment of the poultry supply chain.

JARE Preprint

The input demand functions for corn ($D^F_{C,t}$) and soymeal ($D^F_{SM,t}$) are obtained by differentiating the cost function (Shepard's lemma):

$$\text{(A5)} \qquad D^F_{C,t} = \frac{\partial C_F(\cdot)}{\partial p_{C,t}} = \left(\frac{Q_{F,t}}{A_F}\right)^{\frac{1}{\nu_F}} \left(\left(\alpha^C_F\right)^{\frac{1}{1+\eta_F}} (p_{C,t})^{\frac{\eta_F}{1+\eta_F}} + \left(\alpha^{SM}_F\right)^{\frac{1}{1+\eta_F}} (p_{SM,t})^{\frac{\eta_F}{1+\eta_F}}\right)^{\frac{1}{\eta_F}} \times \left(\alpha^C_F\right)^{\frac{1}{1+\eta_F}} (p_{C,t})^{\frac{-1}{1+\eta_F}},$$

$$\text{(A6)} \qquad D^F_{SM,t} = \frac{\partial C_F(\cdot)}{\partial p_{SM,t}} = \left(\frac{Q_{F,t}}{A_F}\right)^{\frac{1}{\nu_F}} \left(\left(\alpha^C_F\right)^{\frac{1}{1+\eta_F}} (p_{C,t})^{\frac{\eta_F}{1+\eta_F}} + \left(\alpha^{SM}_F\right)^{\frac{1}{1+\eta_F}} (p_{SM,t})^{\frac{\eta_F}{1+\eta_F}}\right)^{\frac{1}{\eta_F}} \times \left(\alpha^{SM}_F\right)^{\frac{1}{1+\eta_F}} (p_{SM,t})^{\frac{-1}{1+\eta_F}}.$$

Breeders

Independently-owned breeders are under contract with the integrator to house integrator-owned birds to produce fertilized eggs by utilizing feed (supplied by the integrator) and labor and transfers the eggs to integrator-owned hatcheries. The profit function for breeders is

$$\text{(A7)} \qquad \Pi_{E,t} = p_{E,t} Q_{E,t} - C_E\left(\rho_{F,t}, p^D_{L,t}, Q_{E,t}\right),$$

where $p_{E,t}$ and $Q_{E,t}$ are, respectively, the contract price and quantity of fertilized eggs. The breeder cost function is

$$C_E(\cdot) = \left(\frac{Q_{E,t}}{A_E}\right)^{\frac{1}{\nu_E}} \left[\left(\alpha^F_E\right)^{\frac{1}{1+\eta_E}} (\rho_{F,t})^{\frac{\eta_E}{1+\eta_E}} + \left(\alpha^L_E\right)^{\frac{1}{1+\eta_E}} \left(p^D_{L,t}\right)^{\frac{\eta_E}{1+\eta_E}}\right]^{\frac{1+\eta_E}{\eta_E}},$$

where $p^D_{L,t}$ is the wage rate of domestic workers. Profit maximization with respect to $Q_{E,t}$ yields the fertilized egg supply as a function of egg, feed, and domestic labor prices:

$$\text{(A8)} \qquad Q_{E,t} = \left(\frac{1}{p_{E,t}\nu_E} (A_E)^{\frac{-1}{\nu_E}} \left[\left(\alpha^F_E\right)^{\frac{1}{1+\eta_E}} (\rho_{F,t})^{\frac{\eta_E}{1+\eta_E}} + \left(\alpha^L_E\right)^{\frac{1}{1+\eta_E}} \left(p^D_{L,t}\right)^{\frac{\eta_E}{1+\eta_E}}\right]^{\frac{1+\eta_E}{\eta_E}}\right)^{\frac{\nu_E}{\nu_E - 1}}.$$

Application of Shephard's lemma to the cost function yields the input demand functions for feed ($D^E_{F,t}$) and domestic labor ($D^E_{L,t}$):

$$\text{(A9)} \qquad D^E_{F,t} = \frac{\partial C_E(\cdot)}{\partial \rho_{F,t}} = \left(\frac{Q_{E,t}}{A_E}\right)^{\frac{1}{\nu_E}} \left(\left(\alpha^F_E\right)^{\frac{1}{1+\eta_E}} (\rho_{F,t})^{\frac{\eta_E}{1+\eta_E}} + \left(\alpha^L_E\right)^{\frac{1}{1+\eta_E}} \left(p^D_{L,t}\right)^{\frac{\eta_E}{1+\eta_E}}\right)^{\frac{1}{\eta_E}} \times \left(\alpha^F_E\right)^{\frac{1}{1+\eta_E}} (\rho_{F,t})^{\frac{-1}{1+\eta_E}},$$

$$\text{(A10)} \qquad D^E_{L,t} = \frac{\partial C_E(\cdot)}{\partial p^D_{L,t}} = \left(\frac{Q_{E,t}}{A_E}\right)^{\frac{1}{\nu_E}} \left(\left(\alpha^F_E\right)^{\frac{1}{1+\eta_E}} (\rho_{F,t})^{\frac{\eta_E}{1+\eta_E}} + \left(\alpha^L_E\right)^{\frac{1}{1+\eta_E}} \left(p^D_{L,t}\right)^{\frac{\eta_E}{1+\eta_E}}\right)^{\frac{1}{\eta_E}} \times \left(\alpha^L_E\right)^{\frac{1}{1+\eta_E}} \left(p^D_{L,t}\right)^{\frac{-1}{1+\eta_E}}.$$

Hatcheries

Breeder farms supply fertilized eggs to integrator-owned hatcheries, which incubate the eggs to produce day-old-chicks (DOCs). A batch of eggs produce a batch of DOCs with an incubation

JARE Preprint

period of around 3 weeks. Since chick producers utilize eggs to produce DOCs whose prices depend on the uncertainty in the market conditions for chicks, we treat the DOCs price as random. Given the time lag in production, employ the dynamic framework of Chaudhry and Miranda (2018) to model the DOCs production. The profit function of DOCs producers is

$$\Pi_{H,t+1} = \tilde{\rho}_{H,t+1} Q_{H,t+1} - p_{E,t} D^H_{E,t} - C_H\left(D^H_{E,t}\right), \tag{A11}$$

where $Q_{H,t+1} = k_H D^H_{E,t}$, $0 < k_H < 1$, is the production function that converts the number of eggs $\left(D^H_{E,t}\right)$ into number of DOCs $(Q_{H,t+1})$, $\tilde{\rho}_{H,t+1} = E_t\left(\rho_{H,t+1}\right)$ is the expected transfer price of DOCs in period $t+1$, and $C_H(\cdot) = \left(\frac{D^H_{E,t}}{A_H}\right)^{\frac{1}{\nu_H}}$ is the cost function of other inputs used in the production of DOCs. One time period is three weeks, i.e., $\triangle t = 3$ weeks. Profit maximization with respect to $Q_{H,t+1}$ yields the supply as a function of the expected transfer price of DOCs and egg price:

$$Q_{H,t+1} = (A_H k_H)^{\frac{\beta_H}{\beta_H - \nu_H}} \left(\tilde{\rho}_{H,t+1} - \frac{p_{E,t}}{k_H}\right)^{\frac{\nu_H}{\beta_H - \nu_H}} \left(\frac{\nu_H}{\beta_H}\right)^{\frac{\nu_H}{\beta_H - \nu_H}}. \tag{A12}$$

Input demand is given by

$$D^H_{E,t} = \frac{Q_{H,t+1}}{k_H}. \tag{A13}$$

Grow-Out Farms

Hatcheries deliver DOCs to the independent grow-out farms, which have contracts with the integrator to raise DOCs for about 7 weeks to full-grown broiler chickens. The grown chickens are then transferred to the processors. Growers face uncertainty in production process and market condition. Grow-out farms receive payments from the integrator based on relative performance that depends on the grower's *a priory* unknown feed conversion ratio (Hamilton and Sunding, 2020). Due to the lag in production, we model the production process in a dynamic framework. The profit function for grow-out farmer, $\Pi_{G,t+2}$, is

$$\Pi_{G,t+2} = \tilde{p}_{G,t+2} Q_{G,t+2} - \rho_{H,t} D^G_{H,t} - C_G\left(\rho_{F,t}, p^D_{L,t}, D^G_{H,t}\right), \tag{A14}$$

where $Q_{G,t+2} = k_G D^G_{H,t}$, $0 < k_H < 1$, is the production function that converts DOCs $\left(D^G_{H,t}\right)$ into grown broilers $(Q_{G,t+2})$, $\tilde{p}_{G,t+2} = E_t\left(p_{G,t+2}\right)$ is the expected price of grown-broiler chickens in period $t+2$. The cost, $C_G(\cdot)$, is a function of output and input prices:

$$C_G(\cdot) = \left(\frac{Q_{G,t+2}}{A_G}\right)^{\frac{1}{\nu_G}} \left[\left(\alpha^F_G\right)^{\frac{1}{1+\eta_G}} \left(\rho_{F,t}\right)^{\frac{\eta_G}{1+\eta_G}} + \left(\alpha^L_G\right)^{\frac{1}{1+\eta_G}} \left(p^D_{L,t}\right)^{\frac{\eta_G}{1+\eta_G}}\right]^{\frac{1+\eta_G}{\eta_G}}.$$

With the production process taking 6 weeks and $\triangle t = 3$ weeks, the time lag is $t+2$. Profit maximization with respect to $Q_{G,t+2}$ yields supply as a function of the output price and input prices:

$$Q_{G,t+2} = (A_G k_G)^{\frac{1}{1-\nu_G}} \left(\tilde{p}_{G,t+2} - \frac{\rho_{H,t}}{k_G}\right)^{\frac{\nu_G}{1-\nu_G}} \times \tag{A15}$$

$$\left(\frac{\nu_G}{\beta_G \left[\left(\alpha^F_G\right)^{\frac{1}{1+\eta_G}} \left(\rho_{F,t}\right)^{\frac{\eta_G}{1+\eta_G}} + \left(\alpha^L_G\right)^{\frac{1}{1+\eta_G}} \left(p^D_{L,t}\right)^{\frac{\eta_G}{1+\eta_G}}\right]^{\frac{1+\eta_G}{\eta_G}}}\right)^{\frac{\nu_G}{1-\nu_G}}.$$

JARE Preprint

Using the production function, the demand for DOCs is

$$D^G_{H,t} = \frac{Q_{G,t+2}}{k_G}. \tag{A16}$$

From Shepard's lemma, we obtain the input demand functions for feed (D^G_F) and labor (D^G_L):

$$D^G_{F,t} = \frac{\partial C_G(\cdot)}{\partial \rho_{F,t}} = \left(\frac{D^G_{H,t}}{A_G}\right)^{\frac{\beta_G}{\nu_G}} \left(\left(\alpha^F_G\right)^{\frac{1}{1+\eta_G}} (\rho_{F,t})^{\frac{\eta_G}{1+\eta_G}} + \left(\alpha^L_G\right)^{\frac{1}{1+\eta_G}} \left(p^D_{L,t}\right)^{\frac{\eta_G}{1+\eta_G}}\right)^{\frac{1}{\eta_G}} \times \left(\alpha^F_G\right)^{\frac{1}{1+\eta_G}} (\rho_{F,t})^{\frac{-1}{1+\eta_G}}, \tag{A17}$$

$$D^G_{L,t} = \frac{\partial C_G(\cdot)}{\partial p^D_{L,t}} = \left(\frac{D^G_{H,t}}{A_G}\right)^{\frac{\beta_G}{\nu_G}} \left(\left(\alpha^F_G\right)^{\frac{1}{1+\eta_G}} (\rho_{F,t})^{\frac{\eta_G}{1+\eta_G}} + \left(\alpha^L_G\right)^{\frac{1}{1+\eta_G}} \left(p^D_{L,t}\right)^{\frac{\eta_G}{1+\eta_G}}\right)^{\frac{1}{\eta_G}} \times \left(\alpha^L_G\right)^{\frac{1}{1+\eta_G}} \left(p^D_{L,t}\right)^{\frac{-1}{1+\eta_G}}. \tag{A18}$$

Processing Plants

There are N_N integrator-owned processing firms that exercise market power both in buying broilers and selling chicken products to retailers. We model this market power using Cournot competition. We denote the quantities of the processing firms using lower-case letters, rather than upper-case letters used in the aggregate production process in the above segments. The processing firm uses the broilers from the grow-out farmers to produce three different chicken products: whole chickens, chicken parts (breast meat, wings, dark meat, feet), and chickens slaughtered for ready-to-eat processing segment.

Whole Chickens

In the production process of whole chickens, the integrator-owned firm exerts market power in the design of contracts with grow-out farms in raising the broilers and also in the sales of whole chickens to retailers. The profit function of whole chicken production is

$$\pi_{W,t} = p_{W,t}(Q_{W,t})\, q_{W,t} - p_{G,t}\left(D^W_{G,t}\right) d^W_{G,t} - p^D_{L,t} D^{DW}_{L,t} - p^U_{L,t} D^{UW}_{L,t}, \tag{A19}$$

where $p_{W,t}$ is the output price per pound of whole chickens, $Q_{W,t}$ is the total pounds of whole chickens produced, $q_{W,t}$ is the pounds of whole chickens produced by the representative integrator, $D^W_{G,t}$ is total demand for grown chickens by all firms, $d^W_{G,t}$ is demand for grown chickens by the representative integrator, $D^{DW}_{L,t}$ and $D^{UW}_{L,t}$ are respectively demand for domestic and undocumented workers by the representative integrator. The production function is

$$q_{W,t} = A_W \left[\alpha^G_W \left(d^W_{G,t}\right)^{\eta_W} + \alpha^{DL}_W \left(D^{DW}_{L,t}\right)^{\eta_W} + \alpha^{UL}_W \left(D^{UW}_{L,t}\right)^{\eta_W}\right]^{\frac{\nu_W}{\eta_W}}. \tag{A20}$$

JARE Preprint

Profit maximization with respect to inputs $d^W_{G,t}$, $D^{DW}_{L,t}$, and $D^{UW}_{L,t}$ under Cournot competition results in

$$\frac{\partial \pi_{W,t}}{\partial d^W_{G,t}} = p_{W,t}\left(1+\frac{1}{N_N}\frac{1}{\epsilon_W}\right)\frac{\partial q_{W,t}}{\partial d^W_{G,t}} - p_{G,t}\left(1+\frac{1}{N_R}\frac{1}{\epsilon_G}\right) = 0, \tag{A21}$$

$$\frac{\partial \pi_{W,t}}{\partial D^{DW}_{L,t}} = p_{W,t}\left(1+\frac{1}{N_N}\frac{1}{\epsilon_W}\right)\frac{\partial q_{W,t}}{\partial D^{DW}_{L,t}} - p^D_{L,t} = 0, \tag{A22}$$

$$\frac{\partial \pi_{W,t}}{\partial D^{UW}_{L,t}} = p_{W,t}\left(1+\frac{1}{N_N}\frac{1}{\epsilon_W}\right)\frac{\partial q_{W,t}}{\partial D^{UW}_{L,t}} - p^U_{L,t} = 0, \tag{A23}$$

where $\epsilon_W = \frac{p_{W,t}}{Q_{W,t}}\frac{\partial Q_{W,t}}{\partial p_{W,t}}$ is the elasticity of demand for whole chicken, N_R is the average number of firms regionally, $\epsilon_G = \frac{p_{G,t}}{D^W_{G,t}}\frac{\partial D^W_{G,t}}{\partial p_{G,t}}$ is the elasticity of supply of grown chickens,

$$\frac{\partial q_{W,t}}{\partial d^W_{G,t}} = A_W \nu_W \left[\alpha^G_W \left(d^W_{G,t}\right)^{\eta w} + \alpha^{DL}_W \left(d^{DW}_{L,t}\right)^{\eta w} + \alpha^{UL}_W \left(d^{UW}_{L,t}\right)^{\eta w}\right]^{\frac{\nu_W}{\eta W}-1} \alpha^G_W \left(d^W_{G,t}\right)^{\eta w-1},$$

$$\frac{\partial q_{W,t}}{\partial D^{DW}_{L,t}} = A_W \nu_W \left[\alpha^G_W \left(d^W_{G,t}\right)^{\eta w} + \alpha^{DL}_W \left(D^{DW}_{L,t}\right)^{\eta w} + \alpha^{UL}_W \left(D^{UW}_{L,t}\right)^{\eta w}\right]^{\frac{\nu_W}{\eta W}-1} \alpha^{DL}_W \left(D^{DW}_{L,t}\right)^{\eta w-1},$$

$$\frac{\partial q_{W,t}}{\partial D^{UW}_{L,t}} = A_W \nu_W \left[\alpha^G_W \left(d^W_{G,t}\right)^{\eta w} + \alpha^{DL}_W \left(D^{DW}_{L,t}\right)^{\eta w} + \alpha^{UL}_W \left(D^{UW}_{L,t}\right)^{\eta w}\right]^{\frac{\nu_W}{\eta W}-1} \alpha^{UL}_W \left(D^{UW}_{L,t}\right)^{\eta w-1}.$$

N_N and N_R are different because chicken products are sold nationally, while broiler are bought regionally as live birds are not transported over long distances.

Chicken Parts

From one chicken, ω pounds of chicken breasts ($Q_{Br,t}$), γ pounds of chicken wings ($Q_{Wi,t}$), μ pounds of dark meat ($Q_{D,t}$), and θ pounds of feet ($Q_{F,t}$) are produced, which yields the following production relationships

$$Q_{Br,t} = \omega Q_{P,t}, Q_{Wi,t} = \gamma Q_{P,t}, Q_{D,t} = \mu Q_{P,t} \text{ and } Q_{F,t} = \theta Q_{P,t}, \tag{A24}$$

with $\omega + \gamma + \mu + \theta = 1$. Thus, the total pounds of chicken parts, $Q_{P,t}$, is given by

$$Q_{P,t} = Q_{Br,t} + Q_{Wi,t} + Q_{D,t} + Q_{F,t}. \tag{A25}$$

Price times quantity of each chicken part sum to total revenue for chicken parts:

$$p_{P,t}Q_{P,t} = p_{Br,t}Q_{Br,t} + p_{Wi,t}Q_{Wi,t} + p_{D,t}Q_{D,t} + p_{F,t}Q_{F,t},$$

where $p_{P,t}$, $p_{Br,t}$, $p_{Wi,t}$, $p_{D,t}$, and $p_{F,t}$ are, respectively, the price for chicken parts, price per pound of chicken breast, price of per pound of chicken wings, price per pound of chicken dark meat, and price per pound of chicken feet. By combining the above equation and (A24), we can obtain the price for chicken parts $p_{P,t}$

$$p_{P,t} = \omega p_{Br,t} + \gamma p_{Wi,t} + \mu p_{D,t} + \theta p_{F,t}. \tag{A26}$$

Broilers from the grow-out farms are the major input and domestic and undocumented labor are the other inputs. The profit function in chicken-parts production is

$$\pi_{P,t} = p_{P,t}\left(Q_{P,t}\right) q_{P,t} - p_{G,t}\left(D^P_{G,t}\right) d^P_{G,t} - p^D_{L,t} D^{DP}_{L,t} - p^U_{L,t} D^{UP}_{L,t}, \tag{A27}$$

JARE Preprint

where $q_{P,t}$ is the number of pounds of chicken parts produced by the representative integrator, $D^P_{G,t}$ and $d^P_{G,t}$ are, respectively, total demand for grown chickens and demand for grown chickens by the representative integrator, and $D^{DP}_{L,t}$ and $D^{UP}_{L,t}$ are, respectively, demand for domestic and undocumented workers by the representative integrator. The CES technology for chicken-parts production is

$$q_{P,t} = A_P \left[\alpha^G_P \left(d^P_{G,t}\right)^{\eta_P} + \alpha^{DL}_P \left(D^{DP}_{L,t}\right)^{\eta_P} + \alpha^{UL}_P \left(D^{UP}_{L,t}\right)^{\eta_P}\right]^{\frac{\nu_P}{\eta_P}}. \tag{A28}$$

With Cournot competition, profit maximization yields

$$\frac{\partial \pi_{P,t}}{\partial d^P_{G,t}} = p_{P,t}\left(1 + \frac{1}{N_N}\frac{1}{\epsilon_P}\right)\frac{\partial q_{P,t}}{\partial d^P_{G,t}} - p_{G,t}\left(1 + \frac{1}{N_R}\frac{1}{\epsilon_G}\right) = 0, \tag{A29}$$

$$\frac{\partial \pi_{P,t}}{\partial D^{DP}_{L,t}} = p_{P,t}\left(1 + \frac{1}{N_N}\frac{1}{\epsilon_P}\right)\frac{\partial q_{P,t}}{\partial D^{DP}_{L,t}} - p^D_{L,t} = 0, \tag{A30}$$

$$\frac{\partial \pi_{P,t}}{\partial D^{UP}_{L,t}} = p_{P,t}\left(1 + \frac{1}{N_N}\frac{1}{\epsilon_P}\right)\frac{\partial q_{P,t}}{\partial D^{UP}_{L,t}} - p^U_{L,t} = 0, \tag{A31}$$

where $\epsilon_P = \frac{p_{P,t}}{Q_{P,t}}\frac{\partial Q_{P,t}}{\partial p_{P,t}}$ is the elasticity of demand for chicken parts, $\epsilon_G = \frac{p_{G,t}}{D^P_{G,t}}\frac{\partial D^P_{G,t}}{\partial p_{G,t}}$ is the elasticity of supply of grown chickens,

$$\frac{\partial q_{P,t}}{\partial d^P_{G,t}} = A_P \nu_P \left[\alpha^G_P \left(d^P_{G,t}\right)^{\eta_P} + \alpha^{DL}_P \left(d^{DP}_{L,t}\right)^{\eta_P} + \alpha^{UL}_P \left(d^{UP}_{L,t}\right)^{\eta_P}\right]^{\frac{\nu_P}{\eta_P}-1} \alpha^G_P \left(d^P_{G,t}\right)^{\eta_P - 1},$$

$$\frac{\partial q_{P,t}}{\partial D^{DP}_{L,t}} = A_P \nu_P \left[\alpha^G_P \left(d^P_{G,t}\right)^{\eta_P} + \alpha^{DL}_P \left(D^{DP}_{L,t}\right)^{\eta_P} + \alpha^{UL}_P \left(D^{UP}_{L,t}\right)^{\eta_P}\right]^{\frac{\nu_P}{\eta_P}-1} \alpha^{DL}_P \left(D^{DP}_{L,t}\right)^{\eta_P - 1},$$

$$\frac{\partial q_{P,t}}{\partial D^{UP}_{L,t}} = A_P \nu_P \left[\alpha^G_P \left(d^P_{G,t}\right)^{\eta_P} + \alpha^{DL}_P \left(D^{DP}_{L,t}\right)^{\eta_P} + \alpha^{UL}_P \left(D^{UP}_{L,t}\right)^{\eta_P}\right]^{\frac{\nu_P}{\eta_P}-1} \alpha^{UL}_P \left(D^{UP}_{L,t}\right)^{\eta_P - 1}.$$

Preparation of Dressed Chickens

This segment converts live broilers into dressed chickens in preparation for the ready-to-eat (RTE) segment. With the integrator owning the slaughtering and processing segments, it exerts market power with the Grow Out Farms. The profit function for chicken preparation is

$$\pi_{FP,t} = \rho_{FP,t} q_{FP,t} - p_{G,t}\left(D^{FP}_{G,t}\right) d^{FP}_{G,t} - p^D_{L,t} D^{DFP}_{L,t} - p^U_{L,t} D^{UFP}_{L,t}, \tag{A32}$$

where $\rho_{FP,t}$ and $q_{FP,t}$ are the transfer price and pounds of dressed chicken, $D^{FP}_{G,t}$ is total demand for grown chickens, $d^{FP}_{G,t}$ is demand for grown chickens by the representative integrator, and $D^{DFP}_{L,t}$ and $D^{UFP}_{L,t}$ are demand for domestic and undocumented labor workers. The production function for $q_{FP,t}$ is

$$q_{FP,t} = A_{FP}\left[\alpha^G_{FP}\left(d^{FP}_{G,t}\right)^{\eta_{FP}} + \alpha^{DL}_{FP}\left(D^{DFP}_{L,t}\right)^{\eta_{FP}} + \alpha^{UL}_{FP}\left(D^{UFP}_{L,t}\right)^{\eta_{FP}}\right]^{\frac{\nu_{FP}}{\eta_{FP}}}. \tag{A33}$$

JARE Preprint

The first-order conditions of profit maximization under Cournot are

$$\frac{\partial \pi_{FP,t}}{\partial d^{FP}_{G,t}} = \rho_{FP,t}\frac{\partial q_{FP,t}}{\partial d^{FP}_{G,t}} - p_{G,t}\left(1 + \frac{1}{N_R}\frac{1}{\epsilon_G}\right) = 0, \tag{A34}$$

$$\frac{\partial \pi_{FP,t}}{\partial D^{DFP}_{L,t}} = \rho_{FP,t}\frac{\partial q_{FP,t}}{\partial D^{DFP}_{L,t}} - p^{D}_{L,t} = 0, \tag{A35}$$

$$\frac{\partial \pi_{FP,t}}{\partial D^{FP}_{L,t}} = \rho_{FP,t}\frac{\partial q_{FP,t}}{\partial D^{UFP}_{L,t}} - p^{U}_{L,t} = 0, \tag{A36}$$

where $\epsilon_G = \frac{p_{G,t}}{D^{FP}_{G,t}}\frac{\partial D^{FP}_{G,t}}{\partial p_{G,t}}$ is the elasticity of supply of grown chickens,

$$\frac{\partial q_{FP,t}}{\partial d^{FP}_{G,t}} = A_{FP}\nu_{FP}\left[\alpha^{G}_{FP}\left(d^{FP}_{G,t}\right)^{\eta_{FP}} + \alpha^{DL}_{FP}\left(d^{DFP}_{L,t}\right)^{\eta_{FP}} + \alpha^{UL}_{FP}\left(d^{UFP}_{L,t}\right)^{\eta_{FP}}\right]^{\frac{\nu_{FP}}{\eta_{FP}}-1}\alpha^{G}_{FP}\left(d^{FP}_{G,t}\right)^{\eta_{FP}-1},$$

$$\frac{\partial q_{FP,t}}{\partial D^{DFP}_{L,t}} = A_{FP}\nu_{FP}\left[\alpha^{G}_{FP}\left(d^{FP}_{G,t}\right)^{\eta_{FP}} + \alpha^{DL}_{FP}\left(D^{DFP}_{L,t}\right)^{\eta_{FP}} + \alpha^{UL}_{FP}\left(D^{UFP}_{L,t}\right)^{\eta_{FP}}\right]^{\frac{\nu_{FP}}{\eta_{FP}}-1}\alpha^{DL}_{FP}\left(D^{DFP}_{L,t}\right)^{\eta_{FP}-1},$$

$$\frac{\partial q_{FP,t}}{\partial D^{UFP}_{L,t}} = A_{FP}\nu_{FP}\left[\alpha^{G}_{FP}\left(d^{FP}_{G,t}\right)^{\eta_{FP}} + \alpha^{DL}_{FP}\left(D^{DFP}_{L,t}\right)^{\eta_{FP}} + \alpha^{UL}_{FP}\left(D^{UFP}_{L,t}\right)^{\eta_{FP}}\right]^{\frac{\nu_{FP}}{\eta_{FP}}-1}\alpha^{UL}_{FP}\left(D^{UFP}_{L,t}\right)^{\eta_{FP}-1}.$$

Ready-to-Eat Processing Segment

With the integrators owning the upstream operation in slaughtering broilers, they exert market power in the retail market only. The RTE chicken products are produced using dressed broilers and domestic and undocumented labor. The profit function for ready-to-eat plants ($\pi_{RE,t}$) is

$$\pi_{RE,t} = p_{RE,t}\left(Q_{RE,t}\right)q_{RE,t} - \rho_{FP,t}D^{RE}_{FP,t} - p^{D}_{L,t}D^{DRE}_{L,t} - p^{U}_{L,t}D^{URE}_{L,t}, \tag{A37}$$

where $p_{RE,t}$ and $q_{RE,t}$ are price per pound and pounds of RTE products produced by one integrator, $Q_{RE,t}$ is the total pounds of RTE products, $\rho_{FP,t}$ is the transfer price of the dressed chickens, $D^{RE}_{FP,t}$ is the demand for dressed chickens by one integrator, and $D^{DRE}_{L,t}$ and $D^{URE}_{L,t}$ are demand for domestic and undocumented labor. The CES technology for RTE product production is

$$q_{RE,t} = A_{RE}\left[\alpha^{FP}_{RE}\left(D^{RE}_{FP,t}\right)^{\eta_{RE}} + \alpha^{DL}_{RE}\left(D^{DRE}_{L,t}\right)^{\eta_{RE}} + \alpha^{UL}_{RE}\left(D^{URE}_{L,t}\right)^{\eta_{RE}}\right]^{\frac{\nu_{RE}}{\eta_{RE}}}. \tag{A38}$$

The first-order conditions from profit maximization under Cournot competition yields

$$\frac{\partial \pi_{RE,t}}{\partial D^{RE}_{FP,t}} = p_{RE,t}\left(1 + \frac{1}{N_N}\frac{1}{\epsilon_{RE}}\right)\frac{\partial q_{RE,t}}{\partial D^{RE}_{FP,t}} - \rho_{FP,t} = 0, \tag{A39}$$

$$\frac{\partial \pi_{RE,t}}{\partial D^{DRE}_{L,t}} = p_{RE,t}\left(1 + \frac{1}{N_N}\frac{1}{\epsilon_{RE}}\right)\frac{\partial q_{RE,t}}{\partial D^{DRE}_{L,t}} - p^{D}_{L,t} = 0, \tag{A40}$$

$$\frac{\partial \pi_{RE,t}}{\partial D^{URE}_{L,t}} = p_{RE,t}\left(1 + \frac{1}{N_N}\frac{1}{\epsilon_{RE}}\right)\frac{\partial q_{RE,t}}{\partial D^{URE}_{L,t}} - p^{U}_{L,t} = 0, \tag{A41}$$

where $\epsilon_{RE} = \frac{p_{RE,t}}{Q_{RE,t}}\frac{\partial Q_{RE,t}}{\partial p_{RE,t}}$ is the elasticity of demand for ready-to-eat products, $\frac{\partial q_{RE,t}}{\partial D^{RE}_{FP,t}} = A_{RE}\nu_{RE}\left[\alpha^{FP}_{RE}\left(D^{RE}_{FP,t}\right)^{\eta_{RE}} + \alpha^{DL}_{RE}\left(D^{DRE}_{L,t}\right)^{\eta_{RE}} + \alpha^{UL}_{RE}\left(D^{URE}_{L,t}\right)^{\eta_{RE}}\right]^{\frac{\nu_{RE}}{\eta_{RE}}-1}\alpha^{FP}_{RE}\left(D^{RE}_{FP,t}\right)^{\eta_{RE}-1}$,
$\frac{\partial q_{RE,t}}{\partial D^{DRE}_{L,t}} = A_{RE}\nu_{RE}\left[\alpha^{FP}_{RE}\left(D^{RE}_{FP,t}\right)^{\eta_{RE}} + \alpha^{DL}_{RE}\left(D^{DRE}_{L,t}\right)^{\eta_{RE}} + \alpha^{UL}_{RE}\left(D^{URE}_{L,t}\right)^{\eta_{RE}}\right]^{\frac{\nu_{RE}}{\eta_{RE}}-1}\alpha^{DL}_{RE}\left(D^{DRE}_{L,t}\right)^{\eta_{RE}-1}$,
and $\frac{\partial q_{RE,t}}{\partial D^{URE}_{L,t}} = A_{RE}\nu_{RE}\left[\alpha^{FP}_{RE}\left(D^{RE}_{FP,t}\right)^{\eta_{RE}} + \alpha^{DL}_{RE}\left(D^{DRE}_{L,t}\right)^{\eta_{RE}} + \alpha^{UL}_{RE}\left(D^{URE}_{L,t}\right)^{\eta_{RE}}\right]^{\frac{\nu_{RE}}{\eta_{RE}}-1}\alpha^{UL}_{RE}\left(D^{URE}_{L,t}\right)^{\eta_{RE}-1}$.

JARE Preprint

Market-Clearing Conditions

The market-clearing conditions for corn and soymeal inputs are

$$S_C\left(p_{C,t}\right) = D_C^F\left(p_{C,t}\right), \tag{A42}$$

$$S_{SM}\left(p_{SM,t}\right) = D_{SM}^F\left(p_{SM,t}\right). \tag{A43}$$

The market-clearing condition for feed is

$$Q_F\left(\rho_{F,t}; p_{C,t}, p_{SM,t}\right) = D_F^B\left(p_{F,t}\right) + D_F^G\left(\rho_{F,t}; p_{H,t}\right). \tag{A44}$$

The market-clearing condition for fertilized eggs is

$$Q_E\left(p_{E,t}; \rho_{F,t}\right) = D_E^H\left(p_{E,t}\right), \tag{A45}$$

The market-clearing condition for DOCs in the hatchery segment is

$$Q_H\left(\rho_{H,t}; p_{E,t}\right) = D_H^G\left(\rho_{H,t}; p_{F,t}, p_{L,t}\right), \tag{A46}$$

The market-clearing condition for fully-grown chickens in the grow-out segment is

$$Q_G\left(p_{G,t}; \rho_{H,t}, \rho_{F,t}\right) = D_G^W\left(p_{G,t}; p_{L,t}\right) + D_G^P\left(p_{G,t}; p_{L,t}\right) + D_G^{FP}\left(p_{G,t}; p_{L,t}\right). \tag{A47}$$

The market-clearing condition for chickens slaughtered for further processing is

$$Q_{FP}\left(p_{FP,t}; p_{G,t}, p_{L,t}\right) = D_{FP}^{RE}\left(p_{FP,t}; p_{L,t}\right), \tag{A48}$$

where $Q_{FP}(\bullet) = N_N q_{FP}$. The market-clearing condition for labor comprises of supply of domestic and undocumented workers and demand for these two groups of workers in the poultry supply chain:

$$\begin{aligned} S_L^D\left(p_{L,t}^D\right) + S_L^U\left(p_{L,t}^U\right) =& D_L^{DE}\left(p_{L,t}^D, \rho_{F,t}\right) + D_L^{DG}\left(p_{L,t}^D; p_{H,t}, p_{F,t}\right) + D_L^{DW}\left(p_{L,t}^D; p_{G,t}, p_{L,t}^U\right) + \\ & D_L^{DP}\left(p_{L,t}^D; p_{G,t}, p_{L,t}^U\right) + D_L^{DFP}\left(p_{L,t}^D; p_{G,t}, p_{L,t}^U\right) + D_L^{DRE}\left(p_{L,t}^D; p_{FP,t}, p_{L,t}^U\right) +, \\ & D_L^{UW}\left(p_{L,t}^U; p_{G,t}, p_{L,t}^D\right) + D_L^{UP}\left(p_{L,t}^U; p_{G,t}, p_{L,t}^D\right) + \\ & D_L^{UFP}\left(p_{L,t}^U; p_{G,t}, p_{L,t}^D\right) + D_L^{URE}\left(p_{L,t}^U; p_{FP,t}, p_{L,t}^D\right), \end{aligned} \tag{A49}$$

Given that the wage rate for undocumented workers are only ω fraction of the wage rate of domestic workers: $p_{L,t}^D = \omega p_{L,t}^U$, where $\omega = 0.88$. We consider labor supply of domestic workers to be more inelastic at 0.25 than that for undocumented workers at 0.75.

The market-clearing conditions for final products are

$$Q_k\left(p_{k,t}; p_{G,t}, p_{L,t}\right) = H_k^U\left(p_{k,t}; I_t^U\right) + H_k^C\left(p_{k,t}; I_t^C\right) + H_{k,t}^M\left(p_{k,t}; I_t^M\right) + H_k^{Ch}\left(p_{k,t}; I_t^{Ch}\right) + H_k^R\left(p_{k,t}; I_t^R\right), \tag{A50}$$

where $k = W, Br, Wi, D, F, RE$ and

$$H_k^h\left(p_{k,t}\right) = \delta_k^h\left(p_{k,t}\right)^{\varepsilon_k^h}, \tag{A51}$$

are reduced-form consumer demand functions for meat k of the United States (U), Canada (C), Mexico (M), China (Ch) and the rest of the world (ROW). Since wings, dark meat, and ready-to-eat products are exported to Canada, Mexico, and ROW, and chicken feet to China, the above market-clearing conditions account for trade in these products. However, since whole chickens and

JAPE Preprint

breast meat are not exported due to high domestic consumption, the market clearing for these two products do not include trade.

The simulation analysis examines the impact of deportations of undocumented workers by considering changes in the steady-state values, where all dynamic variables are stationary across time (e.g., $Q_{H,t+1} = Q_{H,t} = Q_H$ and $Q_{G,t+2} = Q_{G,t} = Q_G$). Changes in the number of undocumented workers impacts the values of the endogenous variables from the steady state in the baseline to a new steady state under the alternate scenario.

The data, sources, and calibration process are explained in Unveren and Luckstead (2020); Luckstead and Devadoss (2020).

Sensitivity Analysis

We consider two scenarios for the sensitivity analysis. In the first scenario, 30% of the workforce in the poultry processing plants is undocumented. The results of this scenario are reported in Tables A1 and A2. In the second scenario, 50% of the workforce in the poultry processing plants is undocumented. The results of this scenario are reported in Table A3 and A4.

JARE Preprint

Table A1. Impacts of Deportation of Undocumented Workers (30% Undocumented Workforce)

		Reduction in Undocumented Workers		
		10%	20%	30%
	Baseline*	Percent Change		
Price				
Domestic Wage Rate ($/hr)	13.86	2.92	6.08	9.53
Undocumented Wage Rate ($/hr)	12.19	2.92	6.08	9.53
Corn ($/tonne)	165.08	-0.18	-0.37	-0.57
Soymeal ($/tonne)	420.28	-0.01	-0.02	-0.03
Feed ($/tonne)	265.25	-0.1	-0.21	-0.32
Fertilized Egg ($/dozen eggs)	3.35	0.38	0.8	1.24
Day-Old Chicks ($/dozen heads)	4.3	0.38	0.79	1.23
Grown Chicken ($/lbs)	0.55	-0.03	-0.06	-0.1
Whole Chicken ($/lbs)	1.48	0.63	1.3	2.04
Breast Meat ($/lbs)	3.35	0.57	1.17	1.82
Wing ($/lbs)	1.73	0.7	1.45	2.26
Dark Meat ($/lbs)	1.56	0.65	1.34	2.09
Feet (Paws) ($/lbs)	0.35	0.54	1.1	1.71
Processed Chicken ($/lbs)	2.15	0.71	1.47	2.28
Ready-to-Eat Product ($/lbs)	2.8	1.11	2.3	3.57
Weighted Average Retail ($/lbs)	2.42	0.56	1.17	1.81
Quantity				
Corn (1000 tonne)	0.04	0	-0.01	-0.01
Soymeal (1000 tonne)	0.01	-0.02	-0.04	-0.06
Feed (1000 tonne)	0.09	0	-0.01	-0.02
Fertilized Egg (mil dozens)	1.09	-0.01	-0.03	-0.04
Day-Old Chicks (mil dozens)	0.77	-0.01	-0.03	-0.04
Grown Chicken (mil lbs)	52.48	-0.01	-0.03	-0.04
Whole Chicken (mil lbs)	4.1	-0.28	-0.57	-0.89
Breast Meat (mil lbs)	5.55	-0.52	-1.07	-1.65
Dark Meat (mil lbs)	6.45	-0.52	-1.07	-1.65
Wings (mil lbs)	1.63	-0.52	-1.07	-1.65
Feet (Paws) (mil lbs)	1.23	-0.52	-1.07	-1.65
Processed Chicken Products (mil lbs)	18.29	-0.45	-0.92	-1.42
Ready-to-Eat (mil lbs)	18.53	-0.81	-1.66	-2.55
US Consumption of				
Whole Chicken (mil lbs)	4.1	-0.28	-0.57	-0.89
Breast Meat (mil lbs)	5.55	-0.52	-1.07	-1.65
Wings (mil lbs)	1.45	-0.52	-1.07	-1.65
Dark Meat (mil lbs)	0.82	-0.86	-1.75	-2.7
Ready-to-Eat (mil lbs)	22.19	-0.52	-1.07	-1.65
US Exports to Canada				
Wings (mil lbs)	0.01	-0.25	-0.52	-0.8
Dark Meat (mil lbs)	0.26	-0.41	-0.85	-1.31
Ready-to-Eat (mil lbs)	0.03	-0.25	-0.52	-0.81
US Exports to Mexico				
Wings (mil lbs)	0.01	-0.38	-0.78	-1.2
Dark Meat (mil lbs)	1.17	-0.35	-0.72	-1.1
Ready-to-Eat (mil lbs)	0.09	-0.38	-0.79	-1.22
US Exports to China				
Feet (Paws) (mil lbs)	0.46	-0.37	-0.75	-1.16
US Exports to ROW				
Wings (mil lbs)	0.15	-0.55	-1.13	-1.75
Dark Meat (mil lbs)	4.21	-0.51	-1.04	-1.61
Feet (Paws) (mil lbs)	0.78	-0.61	-1.25	-1.93
Ready-to-Eat (mil lbs)	0.17	-0.57	-1.16	-1.79

Notes: *Units in parentheses in the first column are for baseline values.

JARE Preprint

Table A2. Welfare Impacts of Deportation of Undocumented Workers (30% Undocumented)

	Reduction in Undocumented Workers		
	10%	20%	30%
		(Million $)	
Producer Surplus			
Corn	-10.46	-21.64	-33.66
Soymeal	-0.58	-1.21	-1.88
Feed	-21.5	-44.5	-69.22
Fertilized Egg	19.75	41.05	64.14
Day-Old Chicks	0	0	0
Grown Chicken	-1.59	-3.29	-5.12
Whole Chicken	-10.26	-21.79	-34.81
Chicken Parts	-0.83	-5.48	-14.8
Processed Chicken	41.26	80.31	116.44
Ready-to-Eat Product	-37.28	-80.96	-132.25
Net Producer Surplus	-21.49	-57.51	-111.17
Consumer Surplus			
US			
Whole Chicken	-38.02	-78.8	-122.74
Breast Meat	-105.03	-216.4	-334.91
Wings	-17.59	-36.27	-56.17
Dark Meat	-8.27	-17.02	-26.3
Ready-to-Eat Product	-565.65	-1,165.9	-1,805.24
Total US	-734.57	-1,514.39	-2,345.36
Canada			
Wings	-0.29	-0.6	-0.93
Dark Meat	-5.46	-11.26	-17.45
Ready-to-Eat Product	-1.48	-3.06	-4.75
Mexico			
Wings	-0.17	-0.36	-0.55
Dark Meat	-12.11	-24.97	-38.71
Ready-to-Eat Product	-2.41	-4.97	-7.7
China			
Feet (Paws)	-1.36	-2.81	-4.34
ROW			
Wings	-2.22	-4.58	-7.09
Dark Meat	-53.99	-111.27	-172.28
Feet (Paws)	-2.54	-5.22	-8.07
Ready-to-Eat Product	-5.41	-11.14	-17.23
Total Foreign	-87.44	-180.25	-279.11

JARE Preprint

Table A3. Impacts of Deportation of Undocumented Workers (50% Undocumented)

		Reduction in Undocumented Workers		
		10%	20%	30%
	Baseline*	Percent Change		
Price				
Domestic Wage Rate ($/hr)	13.86	4.43	9.44	15.14
Undocumented Wage Rate ($/hr)	12.19	4.43	9.44	15.14
Corn ($/tonne)	165.08	-0.27	-0.56	-0.9
Soymeal ($/tonne)	420.28	-0.01	-0.03	-0.05
Feed ($/tonne)	265.25	-0.15	-0.32	-0.51
Fertilized Egg ($/dozen eggs)	3.35	0.58	1.23	1.96
Day-Old Chicks ($/dozen heads)	4.3	0.58	1.22	1.95
Grown Chicken ($/lbs)	0.55	-0.05	-0.1	-0.15
Whole Chicken ($/lbs)	1.48	0.95	2.02	3.21
Breast Meat ($/lbs)	3.35	0.86	1.8	2.84
Wing ($/lbs)	1.73	1.06	2.24	3.54
Dark Meat ($/lbs)	1.56	0.98	2.07	3.27
Feet (Paws) ($/lbs)	0.35	0.81	1.7	2.67
Processed Chicken ($/lbs)	2.15	1.08	2.26	3.57
Ready-to-Eat Product ($/lbs)	2.8	1.68	3.54	5.6
Weighted Average Retail ($/lbs)	2.42	0.86	1.8	2.84
Quantity				
Corn (1000 tonne)	0.04	-0.01	-0.01	-0.02
Soymeal (1000 tonne)	0.01	-0.03	-0.06	-0.1
Feed (1000 tonne)	0.09	-0.01	-0.02	-0.03
Fertilized Egg (mil dozens)	1.09	-0.02	-0.04	-0.06
Day-Old Chicks (mil dozens)	0.77	-0.02	-0.04	-0.07
Grown Chicken (mil lbs)	52.48	-0.02	-0.04	-0.07
Whole Chicken (mil lbs)	4.1	-0.42	-0.88	-1.39
Breast Meat (mil lbs)	5.55	-0.78	-1.63	-2.55
Dark Meat (mil lbs)	6.45	-0.78	-1.63	-2.55
Wings (mil lbs)	1.63	-0.78	-1.63	-2.55
Feet (Paws) (mil lbs)	1.23	-0.78	-1.63	-2.55
Processed Chicken Products (mil lbs)	18.29	-0.68	-1.41	-2.19
Ready-to-Eat (mil lbs)	18.53	-1.22	-2.52	-3.93
US Consumption of				
Whole Chicken (mil lbs)	4.1	-0.42	-0.88	-1.39
Breast Meat (mil lbs)	5.55	-0.78	-1.63	-2.55
Wings (mil lbs)	1.45	-0.78	-1.63	-2.55
Dark Meat (mil lbs)	0.82	-1.29	-2.68	-4.17
Ready-to-Eat (mil lbs)	22.19	-0.79	-1.63	-2.55
US Exports to Canada		NA	NA	NA
Wings (mil lbs)	0.01	-0.38	-0.79	-1.25
Dark Meat (mil lbs)	0.26	-0.62	-1.3	-2.04
Ready-to-Eat (mil lbs)	0.03	-0.38	-0.8	-1.25
US Exports to Mexico				
Wings (mil lbs)	0.01	-0.57	-1.19	-1.86
Dark Meat (mil lbs)	1.17	-0.53	-1.09	-1.72
Ready-to-Eat (mil lbs)	0.09	-0.58	-1.21	-1.89
US Exports to China				
Feet (Paws) (mil lbs)	0.46	-0.55	-1.15	-1.8
US Exports to ROW				
Wings (mil lbs)	0.15	-0.83	-1.73	-2.71
Dark Meat (mil lbs)	4.21	-0.77	-1.59	-2.49
Feet (Paws) (mil lbs)	0.78	-0.92	-1.91	-2.98
Ready-to-Eat (mil lbs)	0.17	-0.85	-1.77	-2.77

Notes: *Units in parentheses in the first column are for baseline values.

JARE Preprint

Table A4. Welfare Impacts of Deportation of Undocumented Workers (50% Undocumented)

	Reduction in Undocumented Workers		
	10%	20%	30%
	(Million $)		
Producer Surplus			
Corn	-15.85	-33.34	-52.81
Soymeal	-0.89	-1.87	-2.96
Feed	-32.58	-68.56	-108.63
Fertilized Egg	30	63.52	101.34
Day-Old Chicks	0	0	0
Grown Chicken	-2.41	-5.07	-8.03
Whole Chicken	5.69	11.17	16.26
Chicken Parts	-2.59	-14.49	-38.86
Processed Chicken	60.73	115.55	161.66
Ready-to-Eat Product	-57.84	-130.81	-223.41
Net Producer Surplus	-15.74	-63.91	-155.44
Consumer Surplus			
US			
Whole Chicken	-57.67	-121.56	-193.01
Breast Meat	-158.84	-331.73	-521.34
Wings	-26.61	-55.64	-87.54
Dark Meat	-12.5	-26.05	-40.85
Ready-to-Eat Product	-855.59	-1,788.09	-2,812.28
Total US	-1,111.2	-2,323.08	-3,655.02
Canada			
Wings	-0.44	-0.92	-1.45
Dark Meat	-8.26	-17.29	-27.21
Ready-to-Eat Product	-2.24	-4.7	-7.43
Mexico			
Wings	-0.26	-0.55	-0.86
Dark Meat	-18.32	-38.34	-60.39
Ready-to-Eat Product	-3.65	-7.63	-12.02
China			
Feet (Paws)	-2.06	-4.3	-6.76
ROW			
Wings	-3.36	-7.03	-11.05
Dark Meat	-81.66	-170.65	-268.37
Feet (Paws)	-3.84	-7.99	-12.53
Ready-to-Eat Product	-8.18	-17.07	-26.82
Total Foreign	-132.26	-276.46	-434.89

Notes: *Units in parentheses in the first column are for baseline values.

JARE Preprint

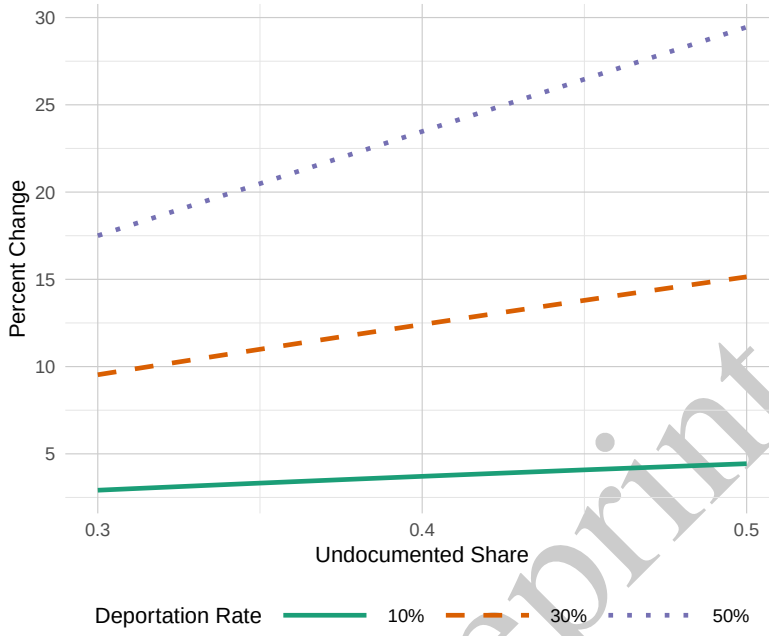

Figure A1. Wage Rate

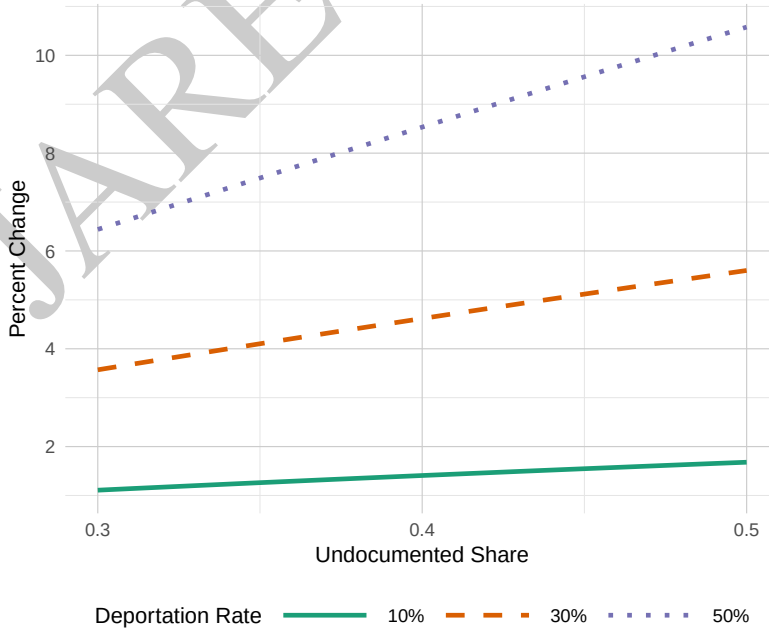

Figure A2. Price Ready-to-Eat Products

JARE Preprint

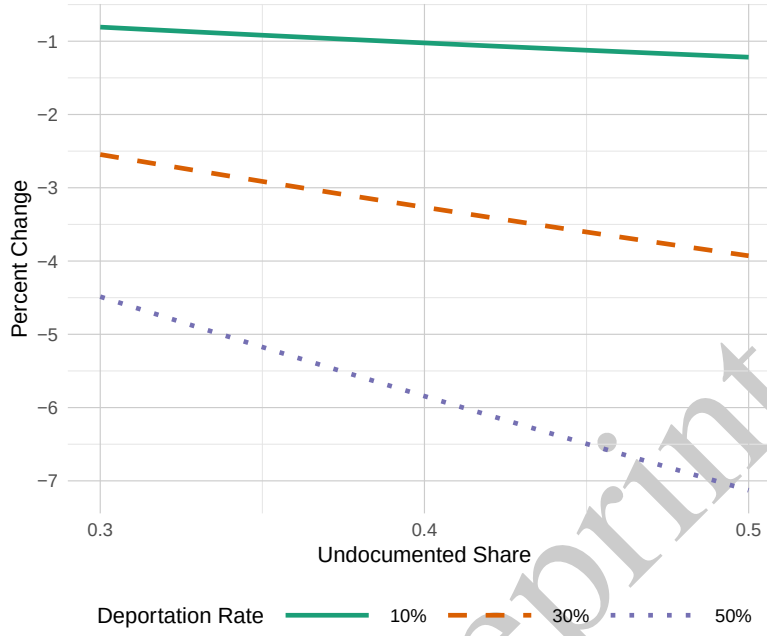

Figure A3. Quantity Produced of Ready-To-Eat Products

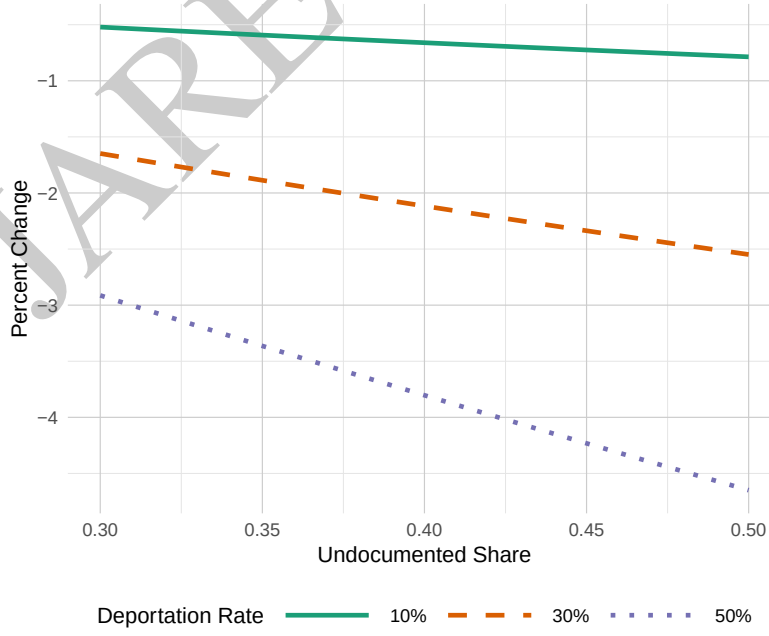

Figure A4. Quantity Consumed of Ready-To-Eat Products

JARE Preprint