



6,7y8
SEPTIEMBRE
2023
ZARAGOZA

AEEA | **14** CONGRESO DE
ASOCIACIÓN ESPAÑOLA DE ECONOMÍA AGROALIMENTARIA | ECONOMÍA
AGROALIMENTARIA

ESTRATEGIAS DE LOS SISTEMAS AGROALIMENTARIOS
ANTE LOS DESAFÍOS GLOBALES

LIBRO DE ACTAS

ORGANIZAN:



Facultad de
Economía y Empresa
Universidad Zaragoza



Instituto Agroalimentario
de Aragón

UNDERSTANDING THE DRIVERS OF HOUSEHOLD FOOD WASTE IN SPANISH REGIONS

Nisrine Tahori, Hugo Ferrer Pérez*

**Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA, Zaragoza, ntahori@cita-aragon.es)*

**Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA, Zaragoza, hferrer@cita-aragon.es) *AgriFood Institute of Aragón-IA2 (CITA—University of Zaragoza)*

Abstract

Food waste has major impacts on the environment, economy, and society. An estimated one-third of food produced for human consumption is lost or wasted, with private households being the largest contributor. Despite growing recognition, there is a shortage of consistent data that hinders comparison and track progress on reducing food waste. Our research aims at assessing the drivers of food waste at household level in Spain. It contributes the relevant literature by providing a novel dataset of food waste rates at regional level and the implementation of advanced panel data econometric techniques to assess the relative importance of macroeconomic drivers. Results provide valuable insights for policymakers to take targeted measures to reduce food waste and enhance food security, and contribute to the broader literature on food waste, which is increasingly important for addressing population and climate change challenges.

Keywords: food waste, macroeconomic drivers, panel data.

1. Introduction

Food waste has gained significant attention recently. As the global population is expected to rise to 9 billion people by 2050, requiring an increment in food supply (Gobel et al., 2015), 17% of all food produced in the world is wasted (UNEP, 2021). A moral dilemma is created due to the disparity between food poverty and wasteful behaviours (Evans, 2012), along with an environmental burden as global food loss and waste accounts for 8-10% of total greenhouse gas emissions (Mbow et al., 2019). Hence, reducing food loss is key to achieving sustainable food security and tackling the climate crisis (Jeswani et al., 2021). One of the goals of the United Nations Sustainable Development Goal (SDG) is target 12.3, which aims to halve global per capita food waste at the retail and consumption level.

Private households are primarily to blame for the overall amount of food waste along the food chain (Jeswani et al., 2021). In Europe, households contribute more than half of total food waste (Eurostat, 2022), while some countries' ratios are even higher, such as 70% in the UK (WRAP, 2020). In the European Union, the FUSIONS Project estimated that households generate 53% of all food loss and waste, where each European household wastes about 0.53 kg of food per week.

One study conducted by the Spanish Ministry of Agriculture found that households waste an average of 1.3 million tons of food per year. Both food that is thrown away due to deterioration, as it was purchased, and products that are discarded after being cooked are quantified through daily scanner data (MAPA, 2021). This follows the EU common framework for food waste measurement as it uses diaries to report on the household waste (EP, 2019). However, this study did not focus specifically on the macroeconomic determinants of food waste and did not provide insights into the underlying drivers of waste (Eurostat, 2023). It has also been established that consumers can shape the entire food supply chain and drive food loss, even at early stages (Gobel et al., 2015). Therefore, minimizing household food waste is critical to reducing overall food waste. However, reducing food waste at the consumption level, particularly in households, is a challenging task compared to other stages due to the multifaceted and interactive factors driving food waste behaviours (Schanes et al., 2018). Accordingly, it is critical to understand how to address these factors to change food waste patterns to reduce food waste.

Our research therefore aims to investigate the food waste problem in Spain and its determinants. To achieve this, the study will adopt a comprehensive approach involving a thorough review of the literature, data collection and statistical analysis. The study aims to provide a comprehensive understanding of the causes of food waste in Spain and identify possible solutions to mitigate its negative impact by analysing the relative importance of the determinants of food waste in Spain using econometric techniques.

2. Literature review

Food waste can be the result of deliberate or accidental actions. For example, when food spills or goes bad prior to being sold at the retail level, it is referred to as food loss. Such food losses may be due to a variety of factors

such as problems during harvesting, storage, packaging, transportation, market mechanisms, and institutional or legal frameworks. On the other hand, food that is deemed fit for human consumption but is not consumed because it is compromised or discarded by consumers is called food waste. One reason for the occurrence of food waste is due to poor food labelling regulations at receiving and delivering food, resulting in significant amounts of food being wasted due to expiry, mis-storage, and purchasing or manufacturing (Hadi et al., 2020).

In 2020, Eurostat estimated 59 million tons of food were wasted in the European Union, being consumers responsible of 53%, ahead of the processing which contributes to almost 20%. Overall, food waste in the European Union costed 132 billion euros.

In a 2017 resolution, the European Parliament recalls that about 55 million people in the European Union, or about 9.6% of the population, do not have the possibility and the means to afford a quality meal every other day, while, according to FAO (2015) estimates, approximately 1.3 billion tons of food is lost per year, which are estimated by the FAO to be USD 1,7 trillion per year on a global scale. While these estimates show that around a third of the total food produced globally for human uses is wasted or lost, nearly half of all fruit and vegetables produced globally are wasted each year, with private households accounting for the largest share of food waste along the food supply chain.

Researchers have pinpointed many drivers of food waste consisting primarily of entangled dietary habits, such as poor planning for shopping, excessive buying, and stockpiling, that are persistent and changeable (i.e., Roodhuyzen et al., 2017). However, there is a lack of studies aiming at identifying macroeconomic factors showing how complicated the interactions are between economic, social, cultural aspects on driving food waste.

3. Methodology

We employed and adapted the databases gathered by the Spanish ministry of Agriculture regarding the volumes of both food waste and food consumption in Spanish households through the studies “Panel de consumo alimentario en hogares” and “Panel de Cuantificación del Desperdicio Alimentario en los Hogares” for 2017-2021. Both datasets are organised by geographical regions and the Food waste data is divided into waste of products that have been bought and thrown without use, and waste of leftover food dishes (products that has been transformed into recipes), we used the addition of both as the total food waste.

The regions through which we organised the data are: NorthEast (Cataluña, Aragon, Baleares), Levante (C. Valenciana, Murcia), Andalucía (Andalucía), North (Navarra, La Rioja, País Vasco, Cantabria), NorthWest (Galicia, Asturias) and Center (Madrid, Castilla y León, Castilla La Mancha, Extremadura).

Moreover, we gathered macroeconomic drivers at NUTS2 level (regional level) that could have an impact on the size of food waste. These were available on the INE website and on the Eurostat website.

The macroeconomic drivers that we were able to gather are Population (male and female), Male and Female population shares, Real GDP per capita, Unemployment rates, At risk of poverty rates, Percentages of females with tertiary education.

Finally, we have specified and estimate a panel fixed effects model with variables transformed into logs as follows:

$$y = \alpha_0 + X\beta + u$$

where y denotes a vector of dimension $NT \times 1$ for the endogenous variable, α_0 represents the $NT \times 1$ vector of fixed effects of each entity in the sample, and X is the matrix of a set of observed exogenous variables selected according to relevant literature. The error term is denoted by u , assumed to be identically and independently distributed following a normal distribution. Note as well that the sample units range from 1 to N and time from 1 to T ($=2021$). The equation regression will be estimated in Stata to obtain the estimates that measure the impact of the macro drivers on households' food waste.

4. Results

The results obtained using robust standard errors are presented in table below:

Table 1. Model estimates

Variable	Estimated value (p-value)
GDPpc	-1.302 (0.006)
Population	.257 (0.026)
Unemployment	-.753 (0.018)
Female tertiary education	-1.20 (0.036)
Pverty	-.263 (.122)
Female population share	-.177 (0.069)
Constant	35.35 (0.001)
R2: 0.40	
Observations: 30	

GDP and Female education have the biggest effect on food waste. A 1% increase in the GDP per capita leads to a 1.3% decrease in the food waste quantities, and this goes against what has been mentioned in several papers; that GDP and food waste have a positive correlation. Our results are recent (2017-2021), and this change in the relation between GDP and FW could be explained by the various initiatives and policies implemented in Spain in recent years to reduce food waste, ones which better-educated people tend to understand better and follow more thoroughly. For example, the "Aprovechamiento Alimentario" (Food Utilization) program that was launched in 2017 in addition to the fact that the Spanish government has included food waste reduction as a priority in its "Circular Economy Strategy".

As for female education, 1% increase in highly educated females (with tertiary education) leads to a 1.19% decrease in food waste in households. This is mainly because women still have the bigger role in managing grocery shopping, cooking and related chores; and educated females are more aware of the food waste dilemma, therefore, tend to help reduce the food waste in their households.

Moreover, female population share lessens FW by 0.17%, there may be more emphasis on reducing food waste as women are often responsible for managing household resources, including food. This might be due to women being more knowledgeable than men are and better experienced in cooking and grocery management because women are generally expected to take care of the household chores, including cooking and grocery shopping. And men tend to have poor management skills when it comes to the kitchen, they may prioritize their nutritional needs over minimizing food waste. This can result in more food being cooked and served than is needed, leading to more food waste.

As for the unemployment, it affects FW in a negative way causing a 0.75% decrease in FW. Unemployment may lead individuals to be more mindful of their spending and consumption habits, as they have less disposable income available to them. This can lead to more thoughtful meal planning and grocery shopping, reducing the likelihood of overbuying perishable items that may end up going to waste. While unemployment can potentially decrease food waste in certain situations, it is important to note that it is not a sustainable or desirable solution to the problem of food waste.

A 1% population growth can exacerbate food waste by 0.25% due to consumer behaviour. With a larger population, more consumers may waste food. This can be due to a lack of awareness about the consequences of food waste, or a failure to plan meals and store food properly, resulting in spoilage and discard.

The model also shows that a 1% growth in the at-poverty risk index leads to a 0.26% decrease of food waste, however, it might not be a factor that affects food waste as poverty can be the cause of less waste. The at-risk-of-poverty index is an indicator used to measure the percentage of individuals or households whose disposable income falls below the poverty line. Those who are at risk of poverty typically have limited resources to meet their basic needs, including food. Therefore, since they must prioritize their basic needs such as food intake, this leads to a lower likelihood of food waste.

5. Conclusions

Food waste is a growing problem that is drawing increasing attention, mainly due to the challenges caused by the increasing global population and the need to address the climate crisis. This paper focused on the issue of household food waste in Spain, which significantly contributes to the overall problem of food waste in the country. Through an extensive literature review, data collection, and statistical analysis, we identified several key drivers of food waste in Spain, including insufficient food labelling regulations, food storage and preservation issues, and socioeconomic factors such as income and education level.

Besides these, our analysis highlighted the relevant effect of macroeconomic factors such as GDP, population growth, women's education level, and unemployment on household food waste in Spain. Such macroeconomic factors are tightly connected to patterns of food consumption and waste and are set to grow in importance in terms of shaping the food waste landscape as Spain continues to develop economically.

Addressing these drivers will involve a layered strategy involving policy and regulatory changes, education and awareness campaigns, and changes in individual behaviours and attitudes. In the process, food waste and its negative effects on food security and the environment can be minimized. Our study provides a deeper insight into the determinants of food waste in Spain, which can inform future policies and initiatives to reduce food waste in the country and beyond.

Bibliography

EP (European Parliament) (2019). Commission Delegated Decision (EU) 2019/1597 of 3 May 2019 supplementing Directive 2008/98/EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste.

Evans, D. Beyond the Throwaway Society: Ordinary Domestic Practice and a Sociological Approach to Household FoodWaste. *Sociology* 2012, 46, 41–56.

Eurostat (2022). Food waste and food waste prevention - estimates, Eurostat-Statistics explained. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates.

Eurostat (2023). Food waste and food waste prevention by NACE Rev. 2 activity - tonnes of fresh mass https://ec.europa.eu/eurostat/databrowser/product/view/ENV_WASFW?lang=en

FAO 2015. Global Initiative on Food Loss and Waste Reduction, 8.

Göbel, C., Langen, N., Blumenthal, A., Teitscheid, P. y Ritter, G. (2015). Cutting Food Waste through Cooperation along the Food Supply Chain. *Sustainability*, 7, 1429-1445. Doi: [10.3390/su7021429](https://doi.org/10.3390/su7021429)

Hadi, S., Rombe, E., Vesakha, G. y Mustamin, M. (2020). Food Loss and Food Waste: A Literature Review in 2009-2018. *International Journal of Psychosocial Rehabilitation*, 24: 910-925.

Jeswani, H.K., Figueroa-Torres, G. y Azapagic, A. (2021). The extent of food waste generation in the UK and its environmental impacts, *Sustainable Production and Consumption*, 26: 532-547.

MAPA (2021). Informe sobre el desperdicio alimentario en los hogares 2021 (Acceso: Noviembre 2022)

Mbow, C., Rosenzweig, C., Barioni, L.G., Benton, T.G., Herrero, M., Krishnapillai, M., ... y Xu, Y. (2019). Food security. (2019). Food security. *Climate Change and Land*, 437–550.

Roodhuyzen, D.M.A., Luning, P.A., Fogliano, V. y Steenbekkers, L.P.A. (2017). Putting together the puzzle of consumer food waste: Towards an integral perspective. *Trends in Food Science & Technology*, 68: 37-50,

Schanes, K., Dobernig, K. y Gözet, B. (2018). Food waste matters - A systematic review of household food waste practices and their policy implications. *Journal of Cleaner Production*, 182: 978-991.

WRAP, Food surplus and waste in the UK – key facts, Wrap. (2020) 14. <https://wrap.org.uk/resources/report/food-surplus-and-waste-uk-key-facts>