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Article

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Petter Lundborg and Dan-Olof Rooth

The Effect of Nutritious School Lunches on Education, Health, and Life-Time Income*

ABSTRACT

In this article we present the long-run gains of adopting a nutritious school meal program for Swedish children. During the 1960s, Sweden rolled out a universal program that provided nutritious school lunches free of charge to all children in Swedish primary schools. Our results show that the school lunch program generated substantial long-term benefits, where pupils exposed to the program during their entire primary school period have 3 percent greater life-time earnings. This effect was greater for pupils from poor households, suggesting that the program reduced socioeconomic inequalities in adulthood. Exposure to the school lunch program also had substantial effects on educational attainment and health.

A growing literature shows that targeted policies that improve early-life conditions can have important long-run effects; however, much less is known about the long-run effects of universal policies that improve health and nutrition during the “middle” period between birth and adulthood. Government-sponsored school meal programs are particularly interesting in this regard, since the “middle” period is an important period for diets of high nutritional quality and since a large share of children can be reached through the education system at a low cost. But despite the large potential gains of school meal programs, and despite being around since the 1940s in countries such as Finland, Sweden, the UK, and the US, they have proven

difficult to evaluate. The US school lunch program, for instance, is federal, with little variation across areas, and commonly used quasi-experimental approaches are not easily applied (Hoynes and Schanzenbach 2015). It is therefore not clear how effective school meal programs are relative to targeted programs, such as the US Food Stamp Program or Head Start program, in improving long-term outcomes (Hoynes et al. 2016; Niemesh 2015).

The lack of evidence is reflected in how different countries, especially in the EU, have adopted vastly different school meal policies. Sweden, Finland, and Estonia have long since served nutritious school lunches to all pupils free of charge, while children in neighboring countries, such as Norway and Denmark, bring their own lunch package to school. France, Italy, and Great Britain serve school lunches according to nutritional standards, but the meals are means tested and come at a cost for most families. Germany has adopted a universal school lunch program, but without any mandatory nutritional requirements.¹

Studies that analyze the short-term impact of school-meal programs commonly arrive at positive effects. For example, Belot and James (2011) show beneficial effects of a program that improved nutritional standards of school lunches in the UK on short-term educational outcomes, while Anderson et al. (2018) have found positive short-term effects on achievement tests for students at public schools in California who had contracts with healthy school vendors. However, there is only one other study besides ours that has evaluated the long-term impact of school lunch provision. Hinrichs (2010) used a change in the formula employed by the US federal government to allocate funding to states in the 1960s to study the impact of the National School Lunch Program (NSLP). He found large and positive effects on educational attainment but evaluated the effect of the NSLP before the 1995 nutritional guidelines were introduced. No study has to date estimated the long-term impact of a policy



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¹ See, for example, Storcksdieck et al. (2014) for a description of school lunch policies in Europe.

that introduces school lunches with strictly controlled nutritional quality.²

In a recent article (Lundborg et al., forthcoming) we analyze the long-run effects of the Swedish school lunch reform, in which the government introduced state subsidies for municipalities that introduced nutritious school lunches free of charge for all pupils in primary school. The policy imposed strict nutritional standards on the meals served, which were to contain specified amounts of proteins, vitamins, calcium, and iron, contain a maximum fat content, and provide a third of the daily caloric need. Using this information together with rich administrative data we ask whether the rollout of the policy between 1959 and 1969 improved children's economic, educational, and health outcomes throughout life. Since the nutritional standards of the Swedish school lunch program are similar to those introduced in more recent school meal programs, such as the "School Meals Initiative for Healthy Children" in the US, evaluating the Swedish school lunch program constitutes a unique opportunity to improve our understanding of the long-term effects of such initiatives.

THE SWEDISH SCHOOL LUNCH REFORM

The background of the reform was a series of studies on the nutritional standard of the food consumed in the population, where the food consumed by children was perceived as being particularly problematic. Hence, the proposal emphasized that raising the nutritional standard for children was especially

important, and providing nutritious school meals was expected to be the most effective way to achieve this goal. The school lunch was to be comprised of freshly cooked hot food with an adequate amount of micronutrients, together with milk and bread. Detailed guidelines were provided by the National Medical Board regarding the amount of vitamins A, B, and C, protein, calcium, iron, phosphorus, and egg white, and the meals were to provide a third of the daily need of calories (>800 calories).³ These nutritional guidelines were implemented and expressed through three-week school lunch menus, often comprising meat-based stews, vegetable-based soups, fish and meat or egg-based dishes, and fruit, berry, or vegetable-based dishes. Figure 1 shows an example of such a three-week menu. With each lunch, 30 cl milk and rye bread with butter were to be served.

Further, the National School Board, a government office for school matters, provided guidance on how to best organize the school lunches by actively visiting schools and providing information on nutritious ingredients that could be bought locally. The school board also provided education programs at several levels, with the initial education programs for kitchen staff lasting up to two months, while continuing education programs were often given as week-long courses. The historical data shows that practically all students living in a municipality having adopted the school lunch program were served a nutritious school lunch. The students' exposure to the program depended on which grade they were in when the program was introduced and ranged from zero to nine years. Swedish children start primary school at age seven.

² Butikofer et al. (2018) analyzed the long-term economic benefits of a program that replaced a hot meal at the end of the school day with a nutritious breakfast in Norway. Our paper differs in that we estimate the effect of a universal program that introduced nutritious school lunches to all pupils, whereas they studied a targeted policy that replaced a late meal with an earlier (and healthier) one, limited to children with particular needs for extra nutrition in urban municipalities in the 1920s.

³ The guidelines were as follows: protein: 32 grams. Calcium: 0.4 grams. Phosphorus: 0.8 grams. Iron: 7 grams. Vitamin A: 2000 I.E. Vitamin B: 0.5 mg. Vitamin C: 25 mg. Egg white: 65 grams. These amounts correspond to half of the average daily need of vitamins, minerals, and egg white for school-age children.

Figure 1

Example of a Three-week School Lunch Menu

1 st week		2 nd week		3 rd week	
Monday	Smoked sausage, boiled cabbage or other vegetable, tomato sauce, potatoes.	Monday	Spinach or kale soup, egg or sausage. Sandwich filling: cheese.	Monday	Stewed fish balls, green peas, potatoes. Fruit or carrot.
Thursday	Blended vegetable soup. Sandwich filling: cheese.	Thursday	Beef stew, red beets, potatoes. Fruit.	Thursday	"Skånsk" cabbage soup. Sandwich filling: cheese.
Wednesday	Pan fried fish fillets, lemon, potatoes. Fruit.	Wednesday	Plate of vegetables, cheese/ham sauce, potatoes.	Wednesday	Meat loaf, brown sauce, tomato or other vegetable, potatoes.
Thursday	Eggs with spinach stew, tomato. Sandwich spread: liver pâté.	Thursday	Boiled herring, sharp sauce, salad, potatoes.	Thursday	Potato gratin. Sandwich filling: sausage. Fruit.
Friday	Beef liver, cabbage and carrot salad, potatoes.	Friday	Pork sausage, mashed carrots and potatoes. Fruit.	Friday	Liver stew, apple- and cabbage salad, potatoes.
Saturday	Blended rice dish, beans. Fruit.	Saturday	Macaroni casserole, sandwich, grated carrots.	Saturday	Pancake. Fruit.

Source: Lundborg, Rooth, and Alex-Petersen (2021).



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The Increase in Nutritional Quality

To understand the extent to which the program changed the nutritional quality of the lunch meals at schools, it is useful to compare the nutritional content of the pre- and post-reform lunches. Surveys at the time suggest that about two-thirds of the pupils had a lunch meal consisting of milk and cheese sandwiches before the program was introduced. Hence, for most pupils, the school lunch reform added a hot nutritious meal to the typical pre-reform milk and bread/sandwich package.

Comparing the nutritional content⁴ of the typical lunch pack with that of the school lunches, it is clear that the school lunches constituted a positive nutritional “shock.” The largest change is found for iron, increasing from 0.588 mg to 7 grams per meal, and for vitamin C, which increased from 1.2 mg to 25 mg. Large changes are also observed for vitamin A, increasing from 155 RE to 660 RE. For protein, phosphorus, and vitamin B, there was a doubling of the intake. The only nutritional component that did not change was calcium.

DATA AND METHOD

We estimated the impact of the program by using newly collected historical data from the Swedish National Archive on its gradual implementation across municipalities in Sweden between the years 1959 and 1969.⁵ The information was kept on paper forms, where each municipality, for each year, reported whether they served school meals, the number of pupils served, and their costs for the school meals. During this period, 265 municipalities introduced the program, with a roughly equal number of municipalities each year. We have linked these historical data to administrative records that cover the population

⁴ For this purpose we used the Swedish Food Agency’s Swedish Food Composition Database, which provides information on the nutritional composition for more than 2000 foods and dishes.

⁵ The National Archive has not kept forms sent by the municipalities before 1959, and hence, we lack information on year of adoption for municipalities that introduced the reform before 1959.

of primary school pupils, i.e., about 1.5 million pupils born 1942–1965.

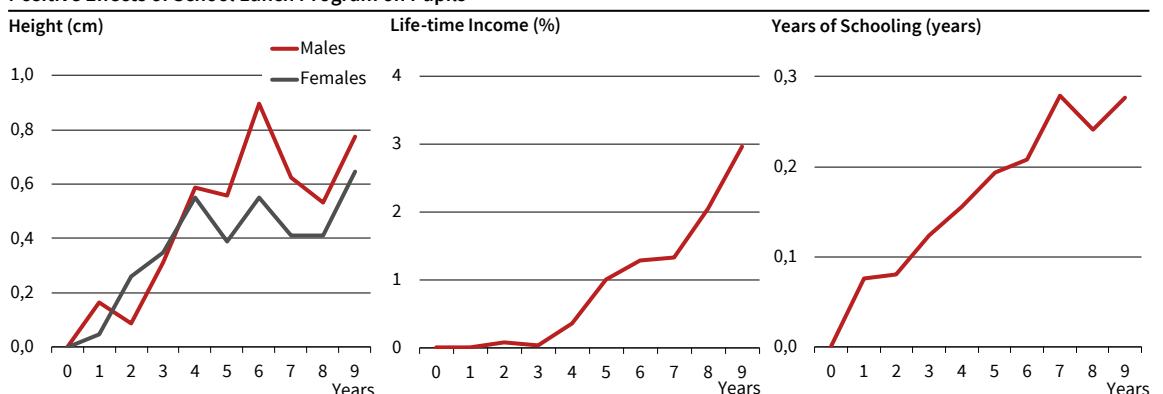
To estimate the effect of the program, we employed a difference-in-differences empirical design, where our identifying assumption was that exposure to school lunches is as good as random, conditional on birth cohort fixed effects and municipality fixed effects. We provided a number of specification checks that support this assumption. Using this empirical design, we estimated the impact of the school lunch reform on a broad range of outcomes taken from income and education registers, the military enlistment register, the medical birth register, and hospitalization and mortality registers. Our main outcome, lifetime income, was calculated by summing up annual income between 1968 and 2011 using the Swedish income and taxation register.

UNIVERSAL REFORM—UNIVERSAL EFFECTS

Our first result is that both male and female pupils exposed to the program became significantly taller, suggesting that improved nutrition is an important mechanism. Such positive effects of the reform were also manifested in large and positive effects on years of schooling and university attendance. Figure 2 shows that male and female pupils exposed to the school lunch program for nine years, i.e., during their entire primary school period, became about .5 and .7 centimeters taller, respectively, and invested in .3 more years of schooling.

Our two most important findings are, however, those for lifetime income. We first show that the program generated substantial long-term benefits, where pupils exposed during their entire primary school period have 3 percent greater lifetime income compared to unexposed pupils, see Figure 2. Second, we find interesting heterogeneity in the effects, where children from poor households benefit the most, although children from all households benefit to some extent. While pupils from poor households have 6 percent greater lifetime income compared to unexposed pupils, pupils from the other

Figure 2
Positive Effects of School Lunch Program on Pupils



Source: Lundborg, Rooth, and Alex-Petersen (2021).

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households still benefitted and have about 2 percent greater lifetime income, see Figure 3. Hence, the universal coverage of the reform led to universal effects. Our findings also suggest that the height improvements, together with increased schooling, can explain a large part of the effect of school lunches on lifetime income.

Interestingly, we find no long-term effects on mortality, morbidity, sick leave, and disability, or on health outcomes of children in the second generation, however. This is in line with our finding that the income effect of the program is largest up to the mid-30s, and then gradually declines.

OTHER POSSIBLE MECHANISMS

Another important motivation behind the school lunch program was to ease the burden on households, and especially on mothers, by releasing them from the task of providing meals. It was believed that the program would increase the female labor market participation rate, which was an important policy goal. An interesting feature of the program is thus that while it provided improved nutrition, it potentially also improved household finances and increased female labor supply. In addition, the program may have made it more attractive for some students to attend school. Hence, long-run effects of school meal programs can also arise through non-nutritional mechanisms, such as through increased school attendance, improved household finances, and parental labor supply. To this end, we collected and digitized data on school absence from municipality archives in Sweden and show that the school lunch reform did not lead to any changes in school attendance rates, which were already high before the reform. We also demonstrate that the reform led to small increases in parental labor supply and household income, but these effects are too small to explain the effect of the school lunch program on the children's lifetime income.

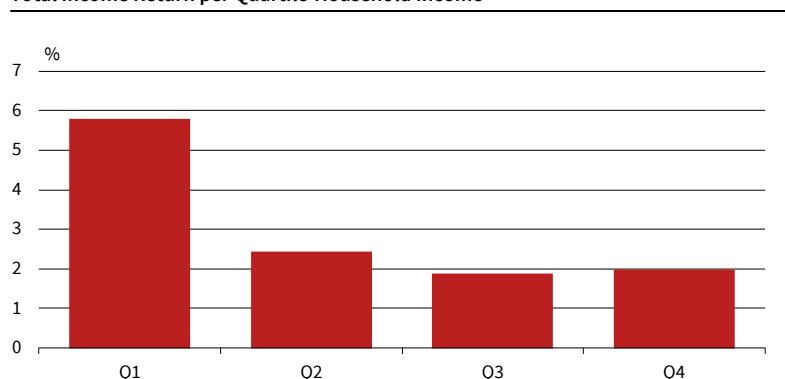
Given these findings, one reasonable interpretation of our results is that pupils became better equipped to absorb the material presented in school when eating a nutritious lunch every day. This interpretation is in line with the results in Belot and James (2011), where test scores among eleven-year-olds increased within the first year after the introduction of nutritious meals, following the Jamie Oliver campaign in the UK. Similar results have been found for US high schools (Anderson et al. 2018).

COSTS AND BENEFITS

An important question is whether the benefits of the school lunch program exceeded its costs. Our estimates suggest that nine years of school lunches increase lifetime earnings by about SEK 102,000

Figure 3

Total Income Return per Quartile Household Income



Source: Lundborg, Rooth, and Alex-Petersen (2021).

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(EUR 1,020), discounting future earnings at a three-percent interest rate and counting earnings from age twenty-one to sixty-five. This is almost four times the total discounted cost of the program, where the costs include both the cost of the food and the facilities and equipment needed. The benefit-cost ratio increases substantially if we instead focus on children in poor families (bottom quartile of household income). For these children, nine years of exposure increased earnings by 5.8 percent, meaning that the discounted benefits were seven times larger than the discounted costs. One should keep in mind that this back-of-the-envelope calculation only counts the income benefits of the school lunch program and that other important benefits are not accounted for.

CONCLUDING REMARKS

Our results show substantial long-term economic benefits of the Swedish school lunch program. Moreover, the benefit-to-cost ratio of the program is large and about twice the size of that of the US Head Start program (Kline and Walters 2016). The ratio for children from the poorest quartile of households is even larger and in the same ballpark as those reported for highly selective welfare programs, such as the Perry Preschool Project and the Carolina Abecedarian Project, which both target children below the age of five from very disadvantaged backgrounds (Heckman et al. 2010).

We believe our results are relevant for Western countries today, even though the school lunch program was rolled out during the 1950s and 1960s. The program was introduced in a wealthy country, where school children did not face food insecurity but where parents lacked knowledge about healthy food habits. The reform changed the nutritional content of the lunch meals and made pupils switch away from less nutritious lunch bags or lunches at home. This is of relevance for many countries that plan to improve, or have improved, the nutritional content of the food served in schools.

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