THE WELFARE EFFECTS OF ENCOURAGING RURAL-URBAN MIGRATION

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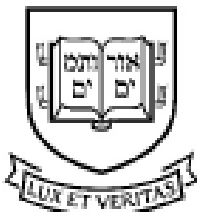

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John Maynard Keynes Narrates the Great Depression: His Reports to the Philips Electronics Firm†

Robert W. Dimand and Bradley W. Bateman

ABSTRACT

In October 1929, the Dutch electronics firm Philips approached John Maynatd Keynes to write confidential reports on the state of the British and world economies, which he did from January 1930 to November 1934, at first monthly and then quarterly. These substantial reports (Keynes's November 1931 report was twelve typed pages) show Keynes narrating the Great Depression in real time, as the world went through the US slowdown after the Wall Street crash, the Credit-Anstalt collapse in Austria, the German banking crisis (summer 1931), Britain's departure from the gold exchange standard in August and September 1931, the US banking crisis leading to the Bank Holiday of March 1933, the London Economic Conference of 1933, and the coming of the New Deal. This series of reports has not been discussed in the literature, though the reports and surrounding correspondence are in the Chadwyck-Healey microfilm edition of the Keynes Papers. We examine Keynes's account of the unfolding events of the early 1930s, his insistence that the crisis would be more severe and long-lasting than most observers predicted, and his changing position on whether monetary policy would be sufficient to promote recovery and relate his reading of contemporary events to his theoretical development.

Introduction

On October 23, 1929, just as Wall Street began to crash[1] and the world economy moved into exceptionally interesting times, Dr. H. F. van Walsem, counsel and secretary to the Dutch electronics firm N. V. Philips Gloeilampenfabrieken[2], wrote to "J. M. Keynes, Esq., C.B. Cambridge" asking him to write a monthly letter to the firm's Economic Intelligence Service about the state of the British economy and the world economy. John Maynard Keynes's letters to Philips, monthly from January 1930 to November 1931 and then, because of budget cuts to Philips's Economic Intelligence Service, quarterly from February 1932 to November 1934, show Keynes narrating the events of the Great Depression as they occurred, and reveal his perception of the convulsions of the

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world economy as he wrote his *General Theory of Employment, Interest and Money* (1936). This substantial body of Keynes's commentary on economic fluctuations (the November 1931 letter alone is twelve typed, double-spaced pages) has hitherto been neglected in the literature on Keynes. Keynes's reports and the associated correspondence, preserved in the Keynes Papers at King's College, Cambridge, are included in the 1993 Chadwyck-Healey microfilm edition of the Keynes Papers (section BM/5 Memoranda Exchanged with Business Houses), but the expense of this edition (which was sold only as a complete set of 170 reels of microfilm, priced at £9,700 or $17,000, plus $175 for a hardcover catalogue, Cox 1993) meant that only a few copies were sold. According to the WorldCat catalogue, there are five sets in libraries in the United States (Library of Congress, Harvard, Yale, Ohio State, and University of Texas at El Paso), two in Great Britain (Universities of Oxford and Sheffield), one in Canada (Victoria University in the University of Toronto) and a few in Germany (Göttingen), Italy and elsewhere but surprisingly little use has been made even of these copies of Keynes's letters to N. V. Philips. Neither Moggridge (1992) nor Skidelsky (1983–2000, 2003), major biographies of Keynes by the authors who know the Keynes Papers best, mentions Keynes's reports to Philips (but Backhouse and Bateman 2011, 129, have a paragraph about Keynes's July 1930 report). As Jacqueline Cox (1995, 171) notes, the thirty volumes of Keynes's *Collected Writings* (1971–1989) include "only a third of the bulk classified as economic" in the Keynes Papers at King's and do not include Keynes's philosophical papers there, while "the personal papers were barely touched." Donald Moggridge (2006, 136–137) observes that "There has, inevitably, been heavier use of the Keynes Papers in King's College Cambridge, which have the advantage of being available elsewhere on microfilm, than, say, his papers in the National Archives or his correspondence with his publishers, the last of which reveals the risks of depending on the Cambridge collection alone." A vast amount of research has been done about Keynes and his economics, yet not all the relevant material has been explored (see Backhouse and Bateman 2006, Dimand and Hagemann 2019).

These reports reveal Keynes's reading of what was happening in the British and world economies through the first four years of the Great Depression, and provide the empirical counterpart to the record of Keynes's theoretical development in this period given by notes taken by students at Keynes's lectures from 1932 to 1935 (Rymes 1987, 1989, Dimand 1988, Dimand and Hagemann 2019). After the success of *The Economic Consequences of the Peace* (1919), Keynes no longer needed to be paid for lecturing, and so gave a single series of eight lectures each year, on the subject of whatever book he was writing at the time, so his lectures from 1932 to 1935 are in effect annual drafts of the book that became *The General Theory*. These lectures at Cambridge and the reports to N. V. Philips on what was happening in the economy provide theoretical and empirical supplements to Keynes's *Collected Writings* (1971–1989), respectively, in following Keynes's intellectual development in the Great Depression, from *A Treatise on Money* (1930) to *The General Theory* (1936). In Keynes's workload, his reports to Philips from 1930 to 1934 took the place of the London and Cambridge Economics Service Special Memoranda on commodity markets that he wrote from 1923 to 1930 (Keynes [1923–30] 1983, 267–647), which provided an empirical counterpart to his normal backwardation theory of futures contracts ([1923] 1983, 1930, Chapter 29).

Replying on October 31 to von Walsem's letter inviting him to write the monthly letter to the firm's Economic Intelligence Service, Keynes was "quite ready to discuss this proposal with one of your representatives" but wished to clarify "that there will be no question of the publication of the letters and that they will be purely for the information of your own people" – and that "it would not be practicable to me to undertake such work except in return for a somewhat substantial fee which might be higher than you would be willing to offer." On November 4, von Walsem assured him that the letters would not be published and "There are only two persons who, though not in our service, are closely related to our firm, who also receive a copy of our Intelligence Service which they, however, are bound to consider as absolutely confidential." He suggested £100 a year. On November 13, Keynes, having "considered your kind proposal in relation to the fees which I have received on previous occasions for somewhat analogous work," offered to undertake the task for an initial six months, for £150 a year[3]. Although Van Walsem had initially asked for the suggestion of other authors if Keynes preferred not take on the task at the suggested £100 a year, and Keynes equally pointedly offered to suggest such alternative authors if Philips did not care to pay £150 a year, Van Walsem accepted Keynes's terms for Philips on November 22: "We think it desirable that one of our gentlemen will see you in order to discuss some details in the first half of December next."

In the event two representatives of Philips (Messrs. Sannes and du Pré) met with Keynes for a discussion summarized "for good order's sake" by van Walsem on December 21, 1929 (by which time van Walsem had already received a December 18 note by Keynes on the Australian exchange position). He recorded agreement that Keynes's monthly letter would treat "some important factor in the development of the British economic situation and give your opinion as to its effects on trade in general and on our business in particular. Also you will draw our attention to important events in the domains especially interesting us, in so far as these come to your knowledge … Whenever you think it necessary you will give us your views on the situation in different parts of the British Empire or eventually of other countries. If possible we shall suggest [to] you special points to be considered in your letters." Von Walsem wrote again on June 21, 1930 to confirm "that the arrangement has given us full satisfaction so that we are willing to continue on the same terms" and enclosed a cheque for 75 pounds. The arrangement also satisfied Keynes; he wrote on January 1, 1931, that "I have enjoyed preparing the letters." Keynes's letters balanced opinions about trade in general with observations about matters affecting Philips more specifically. Thus on January 11, 1930, Keynes stated that "The Factory capacity for Radio Sets seems to have become quite appalling during 1929" before proceeding more generally "to take this opportunity of emphasizing the anxiety which is felt here about the Australian position … I think that Australia may have more difficulties with her balance of trade during the coming year than the Argentine."[4]

The Slump of 1930: Investment, Debts and Deflation

Keynes's April 1930 letter suggested that, although a general improvement had not yet arrived, "there are a fair number of indications that we may be somewhere in the

neighborhood of the bottom point." In particular, "the continuance of cheap money, and even more the expectation of such continuance, is bound to be effective in the situation in the course of a few months," but the effect on employment would be slower than on business feeling and the Stock Exchange and "it would not be surprising to see British unemployment figures go on mounting even to the neighborhood of 2,000,000 up to the end of this calendar year. … The effect of many rationalization schemes now in train will be for some time to come to improve profits rather than employment." With a large amount of Australian gold en route to the Bank of England, "there is less anxiety about the British exchange position than there has been for a very considerable time past" and Keynes expected the creation of the Bank for International Settlements to have a positive effect on confidence, a foreshadowing of his emphasis at Bretton Woods on the importance of designing appropriate international monetary institutions. Keynes doubted that the Federal Reserve Board would reverse its cheap money policy "until business and employment in the United States is a great deal better than it is now." This emphasis on expectations would be characteristic of Keynes's *General Theory* (although equally in line with Irving Fisher's quantity theoretic concern with expected inflation), as is the measurement of the ease of monetary policy by the cheapness of money, that is, by low nominal interest rates. Because nominal interest rates (especially short-term rates such as the Treasury Bill rate) were very low in a period of deflation, the Federal Reserve Board continued to view monetary conditions as easy throughout what Milton Friedman and Anna Schwartz (1963) later termed the "Great Contraction" of the US money supply (during which the monetary base increased, but not by enough to offset the rise in currency/deposit and reserve/deposit ratios), despite Fisher drawing the attention of his former student, Federal Reserve Governor Eugene Meyer, to the statistics on the shrinkage of the money supply, the sum of currency and demand deposits (Cargill 1992, Dimand 2019).

On June 24, 1930, H. du Pré emphasized that, "In reply to your remarks about the character of your monthly letters, we assure you that we leave it entirely to you to judge in each case which are the topics which are most worth being discussed by you." Nonetheless, "There is one question upon which we particularly should like to have your opinion." Keynes's monthly letters had repeatedly stated that recovery depended on the bond market becoming more active, with new loans being used not just for the refunding of floating debt but for new productive investment. "But on the other hand these last months many articles in the economic press" saw excessive capacity in many industries; "in other words that the world has first to grow into a productive apparatus which is too big for immediate needs. If this should be true, can a renewed investment-activity soon be hoped for, and if it soon comes, would it really do good? Of course there would be less unemployment in a number of industries; but would not prices of consumptive commodities, and so cost of living, rise? And especially it might turn out after some time, that the new activity has only added to the – supposed – actual over-investment, so that the disequilibrium would only be greater. It may of course be that entirely new industries are going to take the lead, but we do not yet see any that are very likely to do so. We should be much obliged if you would solve this puzzle for us or at least give your views on the pretended overcapacity and its probable effects on future developments in your next letter." This letter sheds light on the audience for Keynes's reports in the secretariat of N. V. Philips: not just salesmen looking for tips

about the market for radio sets in Great Britain or elsewhere, but thoughtful businessmen pondering sophisticated economic issues such as the dual nature of productive investment in creating demand while increasing capacity (a problem to which the warranted growth rate of Harrod 1939 was an attempted solution).

In his July 1930 letter (seven typed pages, plus a six-page note on the bond market), Keynes warned that "it is now fully clear the world is in the middle of an international cyclical depression of unusual severity … a depression and a crisis of major dimensions … I believe that the prevailing opinion in the United States is still not pessimistic enough and is relying too much on a recovery in the early autumn, an event which is, in my opinion, most improbable. Nothing is more difficult than to predict the date of recovery. But all previous experience would show that a depression on this scale is not something from which the recovery comes suddenly or quickly." He felt that "The optimism of Wall Street and the hoarding tendencies of France may prevent any real recovery of the International Loan Market this year" and considered whether this might lead to "a psychological atmosphere in which really drastic scientific measures will be taken by Great Britain and the United States in conjunction to do what is humanly possible to cause a turn of the tide next spring. But one is traveling here into the realm of the altogether uncertain and unpredictable." In contrast, the Harvard Economic Society (founded by Harvard economics professors Charles J. Bullock and Warren Persons) stated in its weekly letter on June 28, 1930, that "irregular and conflicting movements of business should soon give way to sustained recovery" and on July 19 that "untoward elements have operated to delay recovery but the evidence nevertheless points to substantial improvement" (quoted by Galbraith 1961, 150, see also Walter Friedman 2014).

Responding to du Pré's query, Keynes reiterated that recovery would be preceded by "a substantial fall in the long-period rate of interest … leading in due course to the recovery of investment." But now he explained that he was not thinking of investment in manufacturing industry, "the world's capacity for which is probably quite ample for the present." Even at the highest estimate, the total cost of bringing Britain's industrial plant up to date "would not use up the country's savings for more than, say, three months. Moreover, when expected profits are satisfactory the rate of expenditure by manufacturing industry in fixed plant is not very sensitive to the rate of interest."

"On the other hand," in contrast to manufacturing, "the borrowing requirements for building, transport and public utilities are not only on a far greater scale, but are decidedly sensitive to the rate of interest. If I were to put my finger on the prime trouble to-day, I should call attention to the very high rate of interest for long-term borrowers … the long-term rate of interest is higher to-day than it has been in time of peace for a very long time past. When, at the same time, there is a big business depression and prices are falling, it is not surprising that new enterprise is kept back at the present level of interest." He drew attention to "those who might be called distress borrowers, that is say countries which have an urgent need for borrowing to pay off existing debts, and are consequently ready to pay a very high rate of interest," citing prospective Austrian, Hungarian and Australian loans on the London bond market, and remarked that "the effect of the German Loan has been to supply the French Treasury with funds, which it has withdrawn from the French market and is keeping unemployed in the

Bank of France." Keynes's July 1930 letter (discussed briefly by Backhouse and Bateman 2011, 129) illuminates both his analysis of the present situation and the role of investment in his economics. His distinction between investment in manufacturing, responsive to expected profit rather than interest rates, and interest-sensitive investment in construction, transport and public utilities clarifies his theory of investment. Increased investment was crucial for recovery of the world economy, and low long-term interest rates were necessary for high levels of investment in construction, transport and public utilities, the largest part of investment (even if manufacturing investment depended more on expected profits). In regard to the current situation, Keynes explained the forces getting long-term interest rates high even when prices were falling and short-term interest rates were low, but felt that "progress has been made toward getting the necessitous borrowers out of the way." On the immediate practical level, Keynes's distinction between the determinants of the two categories of investment dealt with du Pré's question of how low long-term interest rates could stimulate investment given excess productive capacity in manufacturing. And yet, unlike Harrod (1939), Keynes's July 1930 letter did not come to grips with the theoretical point raised by du Pré, the dual character of investment in creating both demand and productive capacity.

Keynes's August 1930 letter dissented from the view widely held in the United States "even in responsible quarters, that we may expect an autumn recovery with some confidence … a good deal of the American optimism is based on analogies drawn from the date of recovery after the 1920-21 slump" (compare the Harvard Economic Society's statement on August 30 that "the present depression has about spent its force," quoted by Galbraith 1961, 150). He argued that "Too much emphasis cannot be laid on the really catastrophic character of the price falls of some of the principal raw materials since a year ago" (even larger than appeared from published index numbers, because those included a number of commodities subject to price controls), which "must profoundly affect the purchasing power of all overseas markets." Long-term interest rates remained high, reducing new capital investment. In contrast, Keynes considered general opinion about the British position to be "perhaps a little too pessimistic." Britain was already in a difficult position before the slump of 1929 and 1930, because of the 1925 return to the gold exchange standard at the prewar parity (over the eloquent protests of Keynes 1925). But the heavy unemployment in the slump was limited to textiles and heavy industry (iron and steel, coal, and shipbuilding), export-based sectors already hit by the return to gold at an overvalued exchange rate (in his December 1930 letter, Keynes stated that if textiles, iron and steel, and coal were omitted, there was practically no decline in the Index of Production from a year before and an improvement from two years before). Keynes explained that British unemployment statistics, when used in international comparisons, "probably overstate the case" since the British statistics included "a great many workers in definite employment, but working short time … It is even the case that workers taking their normal summer holidays are now included in the figures of the unemployed." According to *The Economist*, the aggregate profits of all British joint stock companies reporting their earnings in the first half of 1930 "were not only greater than in the previous year, but were larger than in any previous year. This was partly due to the prosperity of British Oil Companies operating abroad, but by no means wholly." Nor did Keynes share the worries of financial opinion in London (and so some extent his own previous letter to Philips) about "the constant dribble of gold to France."

In Keynes's September 1930 letter to Philips, he was "still of the opinion that real recovery is a long way off. But at the same time it seems to me not unlikely that we are at, or near, the lowest point … It is time, therefore, to cease to be a 'bear', even if it is not yet time to be a 'bull'." His February 1931 letter began, "Glancing through the letters of previous months, I find that they were all extremely pessimistic (with a brief lapse into modified optimism in September, corrected in October). Nevertheless, in the light of the actual course of events they were scarcely pessimistic enough. Nor do I see any reason for expecting any appreciable alleviation in the coming months." His September 1930 letter reported that "An extraordinary example of the way in which a situation can suddenly turn round, when a tendency has been greatly overdone, has been seen on the London Stock Exchange in the last two weeks. There has been no recovery of business in Great Britain to account for it. The real facts are much as they were a month ago. But market pessimism, aided by bear operations, had brought security prices down to an absurdly low level not justified by the circumstances … everyone knew in his heart that prices were falling to foolish levels. The result was that within a few days the prices of many leading securities had risen from 10 to 20 per cent." The stock market had diverged from any level that could be construed as reflecting underlying fundamentals, but then abruptly bounced back. Keynes again stressed that Britain was not doing as badly as the United States in the slump: the fall in the British index of production from the previous year "is certainly less than 10 per cent" whereas the US index of industrial production for July 1930 was 37% below that for July 1929.

Keynes's 1930 "October Letter" warned that, "The catastrophic increase in the value of money has raised the burden of indebtedness of many countries beyond what they can bear … in many parts of the world the fall of prices has now reached a point where it is straining the social system at its foundations. Agriculturists and other producers of primary materials are being threatened with ruin and bankruptcy all over the world. It is useless to expect a recovery of markets in such conditions" (and in his February 1931 letter he again warned that "The prospect of a long series of defaults [by debtor countries exporting raw materials] during 1931 is not be excluded"). All of the gains that Germany had received in the Young Plan for reparations compared to the Dawes Plan were obliterated because "the clause in the Dawes Plan by which her [Germany's] liabilities in terms of gold were to be modified in the event of a change in prices was not included in the Young Plan." Keynes declared himself "rather more pessimistic … than a month ago." He remarked that in Britain, "Very slight steps have been taken, as yet, in the direction of reducing wages, which is probably inevitable, but will not get anyone much further if all countries alike embark on wage-cutting policies."

These themes of Keynes's October 1930 letter to Philips, the danger of ruin and bankruptcy from price deflation in a world where debts are fixed in money terms and the futility of wage-cutting, appeared publically in his December article in *The Nation and Atheneum* on "The Great Slump of 1930" (reprinted in his *Essays in Persuasion*, 1931). There Keynes (1931, 138–139) warned that, since wage and price deflation increases the real burden of debt and wage cuts reduce purchasing power, "neither the restriction of output nor the reduction of wages serves in itself to restore equilibrium" and went on to emphasize that "Moreover, even if we were to succeed eventually in reestablishing output at the lower level of money-wages appropriate to (say) the pre-war

level of prices, our troubles would not be at an end. For since 1914 an immense burden of bonded debt, both national and international, has been contracted, which is fixed in terms of money. Thus every fall of prices increases the value of the money in which it is fixed. For example, if we were to settle down to the pre-war level of prices, the British National Debt would be nearly 40% greater than it was in 1924 and double what it was in 1920; … the obligations of such debtor countries as those of South America and Australia would become insupportable without a reduction of their standard of life for the benefit of their creditors; agriculturalists and householders throughout the world, who have borrowed o mortgage, would find themselves the victims of their creditors. In such a situation it must be doubtful whether the necessary adjustments could be made in time to prevent a series of bankruptcies, defaults, and repudiations which would shake the capitalist order to its foundations" (see also Dimand 2011). Here, before Fisher (1932, 1933, see Dimand 2019), was the concern with the effect of deflation on the real value of nominal deflation that reappeared in Chapter 19, "Changes in Money Wages," of *The General Theory*, where Keynes (1936, 264) warned that "if the fall of wages and prices goes far, the embarrassment of those entrepreneurs who are heavily indebted may soon reach the point of insolvency – with severely adverse effects on investment."

Contested Budgets, Trade Balance and the Banking and Exchange Crises of 1931

In 1930, Keynes's "November Letter" argued that foreign opinion underestimated the financial strength that accompanied Britain's industrial weakness: "it is forgotten that the adverse tendencies of the foreign exchanges, until recently, have been due, not to the absence of a favorable foreign trade balance, but to the eagerness of British investors to take advantage of the high profits or high rates of interest obtainable abroad. In 1929 the British favorable balance available for new foreign investment was greater than that for any other country, greater even than that for the United States. The Bank of England's difficulties were due to the fact that the pressure of savers to take advantage of opportunities abroad was even greater." Subsequent events in Wall Street and elsewhere had made overseas investment less appealing to British savers, so that the Bank of England was holding twenty million pounds sterling more of gold than a year before. In his December 1930 letter, Keynes reported that, even though "The perpetual drain of gold to France provides a source of nervousness and irritation in the money market" and although thirty million pounds sterling of gold had moved from Britain to France in the previous three months, the Bank of England held twenty-two million pounds sterling more in gold than a year before (but Keynes's March 1931 letter reported that a drain of twenty million pounds sterling of gold from the Bank of England in the previous three months "causing nervous talk to prevail in London"). Despite Keynes's repeated insistence on the financial strength of sterling and the growing gold reserves of the Bank of England (less than a year before the crisis of August and September 1931 that forced Britain off the gold exchange standard), the underlying message was that capital mobility under fixed exchange rates would constrain even the Bank of England from trying to lower long-term interest rates to stimulate investment. Until Britain left

the gold standard and allowed sterling to float, Keynes's letters to Philips monitored the strength of protectionist sentiment in the British Government, but he lost interest in tariff proposals once the exchange rate was no longer pegged (see Keynes 1931). But there was one bright spot for Britain: Keynes's February 1931 letter stressed that "It must not be overlooked that England is gaining enormously by the tremendous drop in the price of her imports as compared with that of her exports."

Keynes's April 1931 letter to Philips is notable for explaining that Britain's apparent budget deficit of £23.5 million for the fiscal year ending March 31 "is not as bad as it sounds, since this figure is reached after allowing for the repayment of £67,000,000 of debt. So that, apart from debt repayments, there was a surplus on the year's workings of £43,500,000. It must be doubtful whether any other country is showing so favorable a result. Even if the sum borrowed for the unemployment fund, which lies outside the budget[5], were to be deducted, there would still have on the year a net reduction of debt." The next year's was expected to be larger, but "If no debt were to be repaid, there would probably be no deficit, even for the forthcoming year." Keynes's May 1931 letter, reporting on the budget presented by Labor Chancellor of the Exchequer Phillip Snowden, noted that "there will still be some reduction of debt during the forthcoming year, though not on as large as a scale as formerly." A few months later, when Snowden and Prime Minister Ramsay MacDonald broke with their party to join the Conservatives in a National Government to deal with a budget and exchange crisis, Snowden found it convenient to overlook that the apparent budget deficit was an artifact of budgeting for a reduction in the national debt, and to denounce his former Labor Cabinet colleagues for endangering the savings of small depositors by having the Post Office Savings Bank lend to the Unemployment Insurance Fund, without mentioned that such loans were guaranteed by the Treasury or that he had neglected to inform his Cabinet colleagues of the borrowing (as Keynes indignantly explained in two paragraphs in the draft of his November 1931 letter, deleted from the final version).

Keynes's May 1931 letter is also notable, in light of the subsequent exchange crisis that forced Britain off gold in September, for insisting that "The improvement in the sterling exchanges and the better gold position of the Bank of England, as it appears in the public returns, are not deceptive and may be assessed at even more than their face value." He held that "When there is no longer serious pressure on the Bank of England's gold, the stage will be set for really cheap money throughout the world … It will not mean a recovery, but it will pave the way for the recovery of investment which must precede the recovery of prices and profits." Keynes again emphasized that "the fall in the prices of the commodities imported by Great Britain has been so much greater than the fall in the prices of her exports. On the visible trade balance Great Britain was £5,000,000 better off in the first quarter of 1931 than in either of the preceding years … Thus the main burden of the present crisis falls on the raw-material-producing countries, and Great Britain is likely to gain gold in spite of the immense decline of her exports."

By the next month, as the Credit-Anstalt collapsed in Vienna (see Schubert 1991), as French and American capital then took flight from Germany (see Balderston 1994), and as share prices slumped in London, Wall Street and on most European bourses, Keynes felt "that we are now entering the crisis, or panic, phase of the slump. I am inclined to think that we look back on this particular slump we shall feel that this phase has been

reached in the summer months of 1931, rather than at any earlier date." He warned that "the consequences of a change in the value of money, as reflected in the prices of leading commodities, so violent as that which has occurred in the last eighteen months, cannot be regarded too gravely. Until prices show a material rise the whole fabric of economic society will be shaken. Each decline of commodity prices and each further collapse on the Stock Exchanges of the world brings a further group of individuals or institutions into a position where their assets doubtfully exceed their liabilities."

Looking across the Atlantic: The American Slump

Keynes's July 1931 letter focused on the United States, where 21% of the industrial population was unemployed with perhaps another 20% working only two or three days a week: "it is quite out of the question that there should be anything which could be called a true recovery of trade at any time within, say, the next nine months. The necessary foundations for such a recover simply do not exist." Many of the loans of small banks to farmers or secured by real estate "are non-liquid and probably impaired. Thus there is a strong desire for the utmost liquidity while obtainable on the part of the ordinary Bank; and general unwillingness to take any unnecessary risks or to embark on speculative enterprise, even where the risk may be actuarially a sound one. The nervousness on the part of the Bankers is accompanied by a nervousness of the part of their depositors … So there is quite a common tendency to withdraw money from the banks and keep resources hoarded in actual cash … It was estimated that in the country as a whole as much as $500,000,000 was hoarded in actual cash in this way" (see Fisher 1933, Friedman and Schwartz 1963, Bernanke 2000). Keynes stressed that, "The American financial structure is more able than the financial structure of the European countries to support the strain of so great a change in the value of money. The very great development of Bank deposit and of bondage indebtedness in the United States means that a money contract has been interposed between the real estate on the one hand and the ultimate owner of the wealth on the other. The depreciation in the money value of the real estate sufficient to cause margins to run off, necessarily tends therefore to threaten the solidity of the structure."

Keynes reported in his July 1931 letter that although US agricultural wages had fallen by 20 to 25%, and there had also been large cuts to wages in small-scale industrial enterprises, hourly wages were practically unchanged for two thirds of the workers in large-scale industrial enterprises while the hourly wages of the other third had been reduced by some 10%. In October 1934, however, Keynes stated in his Cambridge lectures that "Labor will and has accepted reductions in money wages, in the USA in 1932, and it will not serve to reduce unemployment" with one student's notes calling the money-wage reductions "catastrophic" (Rymes 1987, 131).

Germany Defaults, Britain Abandons the Gold Parity

Turning from the United States, Keynes remarked near the end of his July letter that, "At the moment of writing there are heavy gold drains from London; but I do not think that this need be regarded with any undue alarm," a judgment that proved too sanguine.

More presciently, he added "The real danger in the situation comes from the possibility of the declaration of a general moratorium in Germany and the collapse of the mark [Germany defaulted on July 15]. The repercussion of such events on the solvency of the banking and money market systems of the world would be most serious." The next month, in his August 1931 newsletter (dated August 4), Keynes reported that "the bulk of the remaining short-term German debt is due to British and American banks and accepting houses; many accepting houses being landed with what are certainly frozen and may prove doubtful debts. Their own credit has suffered with the inevitable result, since they were the holders of large foreign balances, of a drain of gold from London … it would seem to be only ordinary prudence to act on the assumption that, while worse developments in Germany are doubtless possible, even apart from this the general underlying position is worse than the ordinary reader of newspapers believes it to be." While "Great Britain is suffering from the temporary shock to confidence due to the difficulties of the accepting houses,"[6] the situation of the world economy as a whole was more serious: "We are certainly standing in the midst of the greatest economic crisis of the modern world. Important though the German developments have been I would emphasize that these have been essentially consequences of deeper causes which are affecting all countries alike … For there is no financial structure which can withstand the strain of so violent a disturbance of values." A handwritten postscript at the end of the typed August 1931 letter warns Keynes's readers "not to be encouraged even by the appearance of apparently good news. The world financial structure is shaken and is rotten in many directions. Patching arrangements will be attempted, but they will not do much good, and it would be a mistake to place reliance on them." The next day, August 5, Keynes, writing to Prime Minister J. Ramsay MacDonald to urge rejection of the May Report, stated that "it is now virtually *certain* that we shall go off the existing parity at no distant date … when doubts, as to the prosperity of a currency, such as now exist about sterling, have come into existence, the game's up" (Keynes 1971–1989, Vol. XX, 591–593; Skidelsky 2003, 446), but he did not say so in print or to Philips – and he rejected, on patriotic grounds, a suggestion by O. T. Falk that the Independent Investment Trust, of which Keynes and Falk were directors, should replace a dollar loan with a sterling loan, which Keynes condemned as "a frank bear speculation against sterling." The Independent Investment Trust lost £40,000 by not switching its financing (Keynes 1971–1989, Vol. XX, 611–612; Moggridge 1992, 528–529; Skidelsky 2003, 447).

It was not only the world financial structure that was shaken; so was the Secretary Department of N. V. Philips. On August 6, 1931, H. du Pré wrote plaintively to Keynes, "Though we could hardly expect otherwise from your former letters, we note that you are not at all optimistic about the developments in the latter part of this year. These last weeks we read in the papers some statements from several Americans (among them people of authority), which hold a somewhat more cheerful view for the coming months. Must we infer from your letter that they are still, or again, too optimistic or is it possible that since your return from America[7] there have been some improvements, which may lead one to expect some improvement at least for the autumn?" Even Roger Babson, who had made his reputation by being bearish about the stock market in September 1929 (as he had been since 1926), was bullish by early 1931 (see W. Friedman 2014).

Keynes's reply on August 12 crushed any hopes: "In response to your enquiry, nothing has happened to make me more optimistic. As regards America, I consider that recovery this autumn is altogether out of the question. But the minds of all of us are of course dominated by the European and indeed the world situation. This still seems to me to be, as I have already described it, more serious than the general public know. I should recommend as complete inaction as is possible until further crises, or further striking events of some kind or another have occurred to clear up the situation."

Keynes's September letter (dated September 10, 1931), after the Conservative-dominated National Government displaced Labor, warned that "the hysterical concentration on Budgeting economy, which has also spread to the curtailment of expenditure by Local Authorities is calculated to produce unfavorable developments. For the widespread curtailment of expenditure is certain to reduce business profits and increase unemployment and lower the receipts of the Treasury, whilst it will do very little to tackle what is the fundamental problem, namely the improvement of the British Trade Balance. We seem likely to be faced by a period during which the balance of trade will not be sufficient to give confidence to foreign depositors."

It turned out, however, that one part of the cuts in government spending, the reduction in pay of the armed services, did indirectly dispose of the balance of payments problem. Since the government's version of equal sacrifice was that a vice-admiral earning £5 10s a day would lose 10 shillings a day (a reduction of 1/11), while naval lieutenants earning £1 7s a day and able-bodied seamen earning 5 shillings a day should each lose a shilling a day, reductions of 1/27 and 1/5, respectively (Muggeridge 1940, 109n), a naval mutiny erupted at Invergordon on September 16 (the first British naval mutiny since 1797), leading to abandonment of a fixed exchange rate on September 21 and a prompt 20% depreciation of sterling. Once the gold parity was abandoned, interest rates could be lowered without any balance of payments crisis. Commander Stephen King-Hall remarked "the strange combination of circumstances which caused the Royal Navy to be used by a far-seeing Providence as the unconscious means of … releasing the nation from the onerous terms of the contract of 1925 when the pound was restored to gold at pre-war parity … In 1805 the Navy saved the nation at Trafalgar; it may be that at Invergordon it achieved a like feat" (quoted by Muggeridge 1940, 111n). As for the budget deficit, Chancellor Snowden, who in the preceding Labor government had steadfastly blocked any reduction in the Sinking Fund contributions for paying down the national debt, now presented a budget reducing the annual Sinking Fund contribution by £20 million. Keynes declared in his October 1931 letter to Philips, "Great Britain's inevitable departure from the gold standard having occurred, it has been received with almost universal relief and in industrial circles a spirit of optimism is now abroad … Since the City and the Bank of England did their utmost to avoid the change, they feel that honor is satisfied. In other quarters the effect is to relieve a tension which was becoming almost unbearable … I have no doubt at all as to the reality of the stimulus which British business has obtained." Fisher (1935), assembling data on twenty-nine countries, found that recovery began only once a country abandoned the gold parity and was able to pursue a looser monetary policy (see Dimand 2003).

Keynes concluded his October 1931 letter, "The general passion for liquidity is bringing the value of cash in terms of everything else to so high a level as to be very near breaking point. This does not apply to Great Britain since her crisis was a balance of payments crisis rather than a banking crisis strictly so called. Thus the possibility of a general European and American banking crisis is the main risk, the possibility of which has now to be borne in mind." The US banking crisis culminated in the "Bank Holiday" of March 1933, while all the major German and Italian banks passed into government ownership.

On November 3, 1931, Dr. du Pré was "very sorry to say that the necessity for the strictest economy which makes itself felt in all departments of our concern at present, impels us to an important curtailment of the budget of our Economic Intelligence Service" which would now issue bulletins every three months, instead of monthly. He asked Keynes for quarterly letters for £50 per annum, instead of monthly letters for £150 per annum. Keynes replied on November 9 that he read the letter "without any great surprise. I had been rather hesitating in my mind as to whether it is worth while to continue the arrangement on the new basis. But on the whole I feel that I should not like to break the friendly relations which have arisen between us, merely because times are bad." He accepted the offer[8], asking to be reminded when each quarterly report was due, and enclosed his November letter stating that Britain was "to a considerable extent getting the best of both worlds since broadly speaking the countries from which we buy our food and raw materials have followed us off gold, whilst our manufacturing competitors have remained on the old gold parity."[9] He felt that Continental observers were mistaken to think that Britain would want to return to gold: "Foreigners always underestimate the slow infiltration of what I have sometimes called 'inside opinion', whilst 'outside opinion' remains ostensibly unchanged. Then quite suddenly what 'inside opinion' becomes 'outside opinion'. Foreigners are quite taken by surprise, but the change is really one which had been long prepared. In the later months of the old gold standard there was a hardly a soul in this country who really believed in it. But it was considered that it was our duty for fairly obvious reasons to do everything we possibly could to keep where we were."

Keynes's May 1932 quarterly letter stressed that, "The most important development, if one is thinking not so much of the moment but of laying the foundations for future improvement, is to be found in the return to cheap money, which was interrupted by the financial crisis of last summer and the departure from gold. I am more and more convinced in the belief, which I have held for some time, that an ultra-cheap money phase in the principal financial centers is an indispensable preliminary to recovery … Nevertheless it would be imprudent to expect too much at any early date from the stimulus of cheap money. The courage of enterprise is now so completely broken, that the effect on prices of money however cheap will be very slow. I consider it likely, therefore, that the cheap money phase may be extremely prolonged and that it may proceed to unprecedented lengths before it produces its effect." He concluded, "For the time being the world is marking time, – waiting for it does not quite know what. I emphasize again the fact that the position in Great Britain, and in some of her Dominions, is relatively good. But for the time being, I see no light anywhere else … It would certainly be much too soon to take any steps whatever to be ready for a possible revival."

Looking across the Atlantic: Hope from the New Deal

Keynes's August 1932 memorandum was notable for its explanation of why US stock prices had risen sharply and why that need not signal an end to the industrial crisis: the financial crisis had driven down stock prices until "the securities of many famous and successful companies were standing at little more than the equivalent of the net cash and liquid resources owned by those companies … the assets in question would either be worth nothing as a result of the general breakdown of contract, or must, in any circumstances apart from that, be worth a very great deal more than their quotations. Consequently, it is logical and right that the fear of their being worth nothing having been brought to an end, there should be a rapid recovery of the quotations on a very striking scale. It does not need a termination of the industrial crisis, or even an expectation of its early cessation, in order to justify the new levels."

In his February 1933 memorandum, commenting on the likely futility of the projected World Economic Conference, Keynes recalled that "I have myself put forward more drastic proposals for an international fiduciary currency, which would be the legal equivalent of gold. If this were agreed to, the position would be so much eased that various other desirable measures would also become practicable. I do not despair of converting British opinion to such a plan, but I am told that continental opinion would be almost unanimously opposed it." Keynes had contemplated such proposals long before Bretton Woods.

Keynes's August 1933 memorandum (actually mailed July 20, before Keynes left for holidays) held that "My own view is that President's Roosevelt's programme is to be taken most seriously as a means not only of American, but of world recovery. He will suffer set-backs and no one can predict the end of the story. But it does seem fairly safe to say that his drastic policies have had the result of turning the tide in the direction of better security not only in the United States, but elsewhere … Perhaps in the end President Roosevelt will devalue the dollar in terms of gold by 30 or 40 per cent." His November 1933 memorandum regretted "the failure of the President during his first six months to act inflation as well as talk it. In actual fact Governmental loan expenditure in the United States up to the end of September was on quite a trifling scale" but since then it seemed to be increasing: "if during the next six months the President is at last successful in putting into circulation a large volume of loan expenditure, I should expect a correspondingly rapid improvement in the industrial prosperity of America. This, if it occurs, would have a great influence on the rest of the world and especially on Great Britain … it might pave the way for a rate of improvement sufficiently rapid to deserve the name of real recovery." Keynes's February 1934 memorandum reported that in the United States "everything is moving strongly upwards. This is to be largely attributed to the fact that Governmental loan expenditure is now at last occurring on a large scale … the disbursement by the American Treasury of new money against borrowing has reached or is approaching $50,000,000 weekly and should maintain this rate for a few months to come." In his August 1934 memorandum, having visited the United States since his May memorandum, he found there "a recession which is somewhat more than seasonal," aggravated since his visit by a "failure of the corn crop … so acute as to be little short of a national disaster" but the actual and prospective level of US Government loan-

financed expenditure made him optimistic about prospects for the US economy in the autumn and winter. He also reported that "the view is generally held in Great Britain that the gold block countries – including Holland not less than the others – cannot permanently maintain their present parity with gold without a disaster. Now or later it seems to us certain that the necessity for devaluation will be admitted." The reports end with Keynes's November 1934 memorandum, with no correspondence in the Keynes Papers concerning the end of his relationship with the Philips firm.

Conclusion: The Message of Keynes's Reports to Philips

Keynes's letters to the Philips electronics firm reveal he perceived events in the British and world economies from the beginning of 1930 through November 1934, and provide pungent and insightful commentary. These reports high-light the importance to Keynes of cheap money as a stimulus to investment – he was not just concerned with fiscal policy as the means to recovery, however much he placed emphasis from 1933 onward on the loan-financed expenditure of the Roosevelt Administration in the US. Keynes's response to a query from du Pré is particularly interesting about Keynes's distinction between those investment expenditures that are sensitive to interest rates and those that are not. The reports stress a theme discussed more briefly in Keynes's 1931 Harris Foundation lectures in Chicago (in Wright, ed., 1931) and in Chapter 19 of *The General Theory*, and at greater length by Irving Fisher (1932, 1933) (and later by Hyman Minsky 1975): since debt are contracted in nominal terms, a rise in the purchasing power of money increases the risk of bankruptcy, repudiation and default – and it is not just actual defaults that are costly, but also the perception of increased riskiness. Keynes recognized the exceptional seriousness of the Depression, dissenting firmly from predictions of an early recovery, and he saw clearly how defending overvalued gold parities forced central banks to keep interest rates high, instead of pursuing ultra-cheap money to restore investment. This hitherto-neglected body of evidence allows one to watch the unfolding of the world economic crisis of the early 1930s through Keynes's eyes, extraordinary events as viewed and narrated by an extraordinary economist. At £12 10s per report (by no means a trivial sum at the time), N. V. Philips certainly got their money's worth.

Notes

1. "Thursday, October 24, is the first of the days which history – such as it is on the subject – identifies with the panic of 1929" (Galbraith 1961, 103–104), but already on Monday, October 21, Irving Fisher had characterized the fall in stock prices as just the "shaking out of the lunatic fringe" and on Tuesday, Charles Mitchell of the National City Bank declared that "the decline has gone too far" (Galbraith 1961, 102).
2. Philips Incandescent Lamp Works, later Philips Electronics, successor to a firm founded by Lion Philips (originally Presburg), maternal uncle of Karl Marx (Gabriel 2011, 44, 110, 291-93, 295, 299, 315, 334, 366). Although relations between uncle and nephew were "strained by politics" (Gabriel 2011, 291), Mary Gabriel (2011, 299) refers to Marx's "fund of last resort, his uncle … He had sold himself to this pragmatic businessman as a successful writer only temporarily short of cash." Gabriel (2011, 642) remarks that "Marx's dabbling in the stock market has been questioned by some scholars, who believe he may simply have wanted his uncle to believe he was engaged in 'capital' transactions, not *Capital*." After the death of Lion

Philips, his sons did not reply to Marx's letter asking for help with his daughter Laura's wedding (Gabriel 2011, 364). Anthony Sampson (1968, 95) reported that the firm's chairman Frits Philips was "a keen Moral Rearmer and a fervent anti-communist, embarrassed by the fact that his grandfather was a cousin of Karl Marx."

3. For a sense of what £150 a year might have meant to Keynes: Moggridge (1992, 508, 585) and Skidelsky (2003, 417–418, 519, 565) report that Keynes's net worth fluctuated from £44,000 at the end of 1927 to £7,815 at the end of 1929, then rising to over £506,222 at the end of 1936, dropping again to £181,244 at the end of 1938. The offer from Philips came at a particularly low point in his finances. According to Skidelsky (2003, 265) "investment, directorship and consultancy income" accounted for more than 70% of Keynes's income between 1923-24 and 1928-29 (including £1,000 a year as chairman of National Mutual Life Assurance), books and articles for another 20%, leaving no more than a tenth of income from such academic sources as teaching, examining, being secretary of the Royal Economic Society and editor of its journal, and being Bursar and a Fellow of King's College.
4. However, writing to Keynes on January 21, H. du Pré was moved "to remark that the latest figures from the Argentine which, according to the handwritten note at the bottom of your letter, you intended to enclose, were not received here, so that we cannot give you an opinion about their importance for us."
5. When the majority report of the May Committee on National Expenditure projected on July 31, 1931, that the budget deficit for 1931-32 would be £120 million, necessitating £96 million of cuts to unemployment benefits, road construction, and government and armed forces pay, it counted all borrowing by the Unemployment and Road funds as "public expenditure on current account" as well as "the usual provision for the redemption of debt" of £50 million (Winch 1969, 126–130). Keynes accused the majority on the May Committee of not "having given a moment's thought to the possible repercussions of their programme, either on the volume of unemployment or on the receipts of taxation" – he estimated it would add 250,000 to 400,000 to the unemployed, and reduce tax receipts by £70 million (*New Statesman and Nation*, August 15, 1931; Keynes 1971-89, Vol. IX, 141–145; Winch 1969, 130, Skidelsky 2003, 446).
6. With regard to Britain, Keynes noted that "There is, however, tremendous pressure of public opinion towards the Government Economy, which means in the main a reduction in the salaries of Government employees and of the allowances of the unemployed. It is equally difficult for the present [Labour] Government either to refuse or concede concessions to this trend of opinion. But if a movement in this direction takes place, which is still most doubtful, it remains exceedingly open to argument whether the result on the actual level of unemployment will be favourable."
7. Keynes had given three Harris Foundation Lectures on "An Economic Analysis of Unemployment" at the University of Chicago in June and July 1931, published in Quincy Wright, ed. (1931), and reprinted in Keynes (1971-89), Vol. XIII. These lectures mostly expounded the analysis of Keynes's *Treatise*, but the third lecture also examined the debt-deflation process, the undermining of the financial structure by an increase in the real value of debts and fall in the nominal value of collateral (Keynes 1971-89, Vol. XIII, 359–361, see Dimand 2011).
8. He also raised a "small personal matter", asking for advice on buying a new wireless set that would "have a thoroughly good loud speaker, both for voice and music reproduction and should be able to pick up distant stations such as Moscow."
9. A passage crossed-out in the draft of Keynes's November 1931 letter, in the section discussing the general election, stated that, "As has been the case in the last three or four General Elections, it is that old wretch Lord Rothermere [publisher of the *Daily Mail*] who has been dead right. It is said that he has made a profit on the crisis of £100,000, buying majorities on the Stock Exchange." Skidelsky (2003, 472) relates that Keynes "consistently lost money (his own and his friends') on the results of general elections."

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THE WELFARE EFFECTS OF ENCOURAGING RURAL–URBAN MIGRATION

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This paper studies the welfare effects of encouraging rural–urban migration in the developing world. To do so, we build and analyze a dynamic general-equilibrium model of migration that features a rich set of migration motives. We estimate the model to replicate the results of a field experiment that subsidized seasonal migration in rural Bangladesh, leading to significant increases in migration and consumption. We show that the welfare gains from migration subsidies come from providing better insurance for vulnerable rural households rather than from correcting spatial misallocation by relaxing credit constraints for those with high productivity in urban areas that are stuck in rural areas.

KEYWORDS: Rural–urban migration, migration subsidies, spatial misallocation.

1. INTRODUCTION

DIFFERENCES IN INCOME PER CAPITA ACROSS COUNTRIES are largely accounted for by differences in total-factor productivity (TFP), and within an economy, misallocation of factors of production across firms, sectors, or regions may underlie these TFP differences.[1] One potentially large source of misallocation is an inefficient distribution of workers across space, and in particular across rural and urban areas, between which gaps in wages and productivity are particularly large (Young (2013), Gollin, Lagakos, and Waugh (2014), Herrendorf and Schoellman (2018)).

The view that workers are misallocated across space is seemingly reinforced by a recent series of field experiments in rural Bangladesh. In these experiments, small subsidies for seasonal migration led to substantial gains in income and consumption for migrants over multiple years (Bryan, Chowdhury, and Mobarak (2014), Akram, Chowdhury, and

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[1]See Restuccia and Rogerson (2008), Hsieh and Klenow (2009) and more recent work that links misallocation to financial frictions (Buera and Shin (2013), Midrigan and Xu (2014), Moll (2014)); heterogeneous markups (Peters (2020)); delegation and information frictions (David, Hopenhayn, and Venkateswaran (2016), Akcigit, Alp, and Peters (2021)); entry barriers (Yang (2021)); and other government policies (Guner, Ventura, and Xu (2008), Fajgelbaum, Morales, Suárez Serrato, and Zidar (2019)).

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Mobarak (2017)). Bryan, Chowdhury, and Mobarak (2014) articulate this view in a model in which migration is risky and households face credit constraints that limit migration. In their model, migration subsidies reduce spatial misallocation by helping rural households accumulate enough assets to migrate to the city, where they are permanently more productive. However, their model is quantitatively inconsistent with the returns to migration and seasonal migration rates in the experimental data.

In this paper, we provide a reinterpretation of these migration experiments and a normative evaluation of migration policies using a dynamic incomplete-markets model that is estimated to match the experimental data. Migration subsidies, in partial or general equilibrium, direct resources toward rural households that have experienced bad shocks and are willing to undergo the ordeal of seasonal migration in order to bolster their low consumption levels. Rural households in the model generally prefer to stay in the rural area, and migration decisions are not very constrained by lack of access to credit. Instead, the lack of access to credit and good savings opportunities keeps households vulnerable to bad shocks in the first place, which lead them to migrate seasonally. In other words, seasonal migration is more of an act of desperation than a "move to opportunity," which is often associated with permanent migration.

In order to understand the migration behavior observed in the experiments, the model is tailored to feature a rich set of migration motives that have been emphasized in the literature. It allows for migration risk, following a long tradition in development economics (e.g., Harris and Todaro (1970)) in which households face both idiosyncratic productivity shocks and seasonal income fluctuations. Households insure themselves through buffer-stock savings, as in Bewley (1977), Aiyagari (1994) and Huggett (1993) and following a large literature in macroeconomics (see, e.g., Heathcote, Storesletten, and Violante (2009), Kaplan and Violante (2010)). The model also features sorting by comparative advantage in the urban and rural regions, as in Roy (1951), following a number of recent studies (including Lagakos and Waugh (2013), Young (2013), Herrendorf and Schoellman (2018), Hamory, Kleemans, Li, and Miguel (2021)). Households can migrate either permanently or temporarily, as in Kennan and Walker (2011), and face both a monetary cost of migration and a nonmonetary disutility from migration that depends on past migration experience.

We estimate the model using the experimental data as well as several aggregate and cross-sectional moments. Matching these moments helps us isolate the characteristics of workers who are near the margin—meaning those who can most easily be induced to migrate—relative to those who are unlikely to migrate, those already migrating regularly or those who are permanently located in cities. The estimated model implies that workers near the margin must be modestly negatively selected on productivity and assets and that the nonmonetary disutility associated with migration is substantial on average for those who have not migrated recently. While each targeted moment plays a role in informing the model's parameter values, we show that the prediction of negative selection is governed in large part by the relatively large local average treatment effect (LATE) of migration on consumption coming from the experiment relative to the smaller OLS "return" to migration coming from the cross-section.

We show that our model is consistent with a number of experimental and cross-sectional moments, including several that are not targeted. Our model predicts a negligible migration response to an unconditional transfer, for example, which is consistent with a subsequent experiment conducted on the same population. Second, both in our model and in the data, people who choose to migrate are those with lower-than-average consumption and asset levels. These observations are consistent with our interpretation that migration

subsidies provide households a chance to more easily supply labor in urban areas in periods when rural opportunities are lacking. We show that the model of Bryan, Chowdhury, and Mobarak (2014), based on credit constraints, makes counterfactual predictions on these and other dimensions.[2]

We use our estimated model to quantify the welfare gains from subsidizing rural–urban migration either temporarily or permanently. The welfare gains from a one-time migration subsidy in partial equilibrium are about 0.5% in consumption-equivalent welfare on average and are substantially higher for the poorest households. Moreover, the welfare gains from migration subsidies are similar on average to the welfare gains arising from a one-time unconditional transfer program costing the same total amount, though they are somewhat worse for the poorest households. This suggests that migration per se is not the main source of the welfare gains from migration subsidies; rather, they come from targeting resources to needy households willing to undergo the ordeal of migration.

When migration subsidies are offered permanently to rural households with low assets in general equilibrium, the welfare gains are larger on average for poor rural households but negative for richer (mostly urban) households that finance the subsidies. The average welfare gain to rural households with low assets is now around 3% in consumption equivalents. Many rural households respond to the presence of permanent migration subsidies by holding fewer assets in equilibrium, and the rural population share rises. As in the case of temporary transfers, we show that most of the welfare gains arise from targeting resources to vulnerable rural households. In other words, the gains from offering permanent migration subsidies arise not through relaxing credit constraints for those stuck in rural areas, but from providing households with better insurance.

In order to quantify the importance of workers' misallocation across space, we solve the problem of a benevolent social planner in charge of making migration and consumption decisions for each household in each period. We then compare the solution to the planner's problem with the competitive equilibrium outcomes. Analytically, we show that the solution to the social planner's problem involves a novel set of conditions characterizing optimal migration decisions for each household, where the benefits of moving any individual household involve both a static component from higher current productivity and a dynamic component reflecting the future option value of having the household in the migration destination.

When we compute the social planner's solution for the estimated model, we find relatively modest welfare gains from better allocating workers across space. Moreover, the planner's solution entails substantially *fewer* seasonal moves than the competitive equilibrium. We show that many of these gains come from curtailing seasonal moves for marginal households that migrate after receiving a bad shock in the rural area when assets are low. Overall, comparisons of the planner's solution with the competitive equilibrium provide very little support for a simple story of spatial misallocation in which credit constraints keep workers in rural areas. Instead, such comparisons point toward a different type of misallocation, which arises from a lack of insurance possibilities.

[2]In terms of methodology, our work follows the seminal papers by Todd and Wolpin (2006) and Kaboski and Townsend (2011). These discipline dynamic structural models using quasi-experimental evidence rather than non-experimental moments, which are most common in macroeconomics. Our paper builds on these by estimating our structural model directly using variation induced by an RCT, in which concerns about endogeneity are even less present. In this sense, our quantitative work is similar to that of Buera, Kaboski, and Shin (2014), who use a macro model to help interpret the general-equilibrium effects of unconditional asset transfer programs, Greenwood, Kircher, Santos, and Tertilt (2019), who build a general equilibrium model of the AIDS epidemic to complement the many related RCTs, and Brooks and Donovan (2020), who draw on a structural general equilibrium model to help study the impacts of bridges built quasi-randomly.

Our paper contributes most directly to a recent literature on the economics of rural–urban migration in the developing world. Morten (2019) and Meghir, Mobarak, Mommaerts, and Morten (2022) also emphasize the links between insurance and seasonal migration, though their focus is mostly on network effects and spillovers from individual migration decisions. Neither of those studies explores on the role of migrant selection by asset levels or nonmonetary migration costs, or compares market outcomes to the efficient migration levels. Bryan and Morten (2019) find a large role for nonmonetary migration costs, as in the current study, though their focus is more on permanent migration. Our paper's focus on migration subsidies complements studies of other related policies, such as Imbert and Papp (2019), who show that rural public works can reduce seasonal migration to cities, and de Janvry, Emerick, Gonzalez-Navarro, and Sadoulet (2015), who find that land titling raises out-migration from rural areas. See Lagakos (2020) for a recent overview of this growing literature.

2. THE MIGRATION EXPERIMENTS: A SUMMARY

In this section, we summarize the experimental results of Bryan, Chowdhury, and Mobarak (2014) and Akram, Chowdhury, and Mobarak (2017) that motivate our modeling and estimation choices. The setting for both experiments are rural, rice-growing areas in the Rangpur region of Bangladesh, home to around ten million people. Like many other agrarian societies, these areas experience a "lean season," known in Bangladesh as the *monga*, during the 3-month period between planting and harvest. During this time, farmers mostly wait for the crop to grow, and labor demand falls. As a result, landless laborers experience a drop in wages and employment opportunities and incomes fall by an estimated 50% or more, on average (Khandker (2012)). To cope, some households migrate to towns and cities in search of employment during the lean season.

In the first experiment, reported in Bryan, Chowdhury, and Mobarak (2014), 19 poor households were randomly sampled from each of 100 randomly selected villages in two districts in the Rangpur region. "Poor" was defined as households with almost no land holdings (less than 50 decimals of land) and that reported having missed meals during the previous lean season. These households fall in roughly the lower half of the asset distribution. In August 2008, 68 villages were randomly assigned to treatment and 32 to control. In the 19 households in each of the treatment villages, subsidies encouraged one household member to migrate during the lean season. There were no subsidies in the control villages.[3] The travel subsidy was worth about 800 Taka ($11.50), which is sufficient to pay for round-trip bus fare plus a few days of food and is equivalent to about 7 to 10 days of rural wages during the lean season.

All 1900 sample households were surveyed in December 2008 (post-treatment) and June 2009 about their migration and consumption during the 2008 lean season. The random assignment of migration subsidies produced three important outcomes that will inform our modeling choices. First, while 36% of households in control villages sent a mi-

[3]The 32-village control group comprises of a pure control (16 villages) and an information treatment (16 villages in which general information about migration possibilities were offered, but without any travel subsidy), which looks indistinguishable from the control group in terms of the migration response. The 68-village treatment group is composed of travel subsidies in the form of a grant (37 villages) or a zero-interest loan (31 villages). The grant and loan treatments produced very similar outcomes, so for simplicity, we combine them, refer to them as the "the treatment group," and compare their outcomes with those of the combined control group.

grant during the lean season, 58% of households in treatment villages did so (Bryan et al., Table II). Second, if we use the randomized treatment assignment as an instrumental variable for migration, the estimated local average treatment effect (LATE) of migration on consumption was an increase of around 30% per household member (Table III of Bryan et al.). Migrants reported taking jobs such as rickshaw driving and construction work, which raised their household incomes. The LATE is too large to be explained by treatment households simply consuming the transfer. In practice, most of the subsidy was put toward bus fare. Third, the treatment and control groups were surveyed a year later, in December 2009, though neither group received any additional treatment. Remigration rates during the 2009 lean season remained nine percentage points higher in the treatment group, and this was statistically significant (Table II of Bryan et al.). Subsequent results in 2011 and 2013 show elevated, but decaying, migration rates in the treatment group.

The second experiment (Akram, Chowdhury, and Mobarak (2017)) was conducted in 2014 on a larger scale, with migration offers extended to 5792 poor, landless households. The authors measure income at high frequency and show that the migration offers led to significant increases in income of a magnitude consistent with the consumption increases observed in 2008. The new experiment also finds repeat migration effects of that one-time transfer during 2015–2016, similar to the remigration observed in 2009. Notably, the main experimental results from 2008–2009 that we use to estimate our model are consistent with this much larger experiment.

For the purposes of our model, it is important to note that this second experiment added random variation in the proportion of the landless population in the treatment villages that was provided migration subsidy offers simultaneously. This labor-market-level variation created labor supply shocks of different magnitudes in different villages, which provide an experimental estimate of the village wage response to out-migration. Later, we use this estimate to inform the general-equilibrium effect of emigration on the rural labor market in our model.

3. MODEL OF MIGRATION TO INTERPRET THE EXPERIMENTS

We turn now to a model of migration that is designed to be able to match the rich experimental evidence outlined above as well as salient cross-sectional facts, such as the rural–urban average wage gap. We focus on a stationary distribution of the model, in which the fraction of workers in each region and other aggregate variables remain constant in each period, as does the distribution of workers by state.[4] The model is flexible enough to incorporate several broad determinants of rural–urban migration, including worker sorting on permanent comparative advantage, credit and saving frictions, temporary and seasonal shocks to rural and urban productivity, and migration costs of a monetary and nonmonetary nature. We show in Section 4.9 that this model succeeds in matching the data, whereas that of Bryan, Chowdhury, and Mobarak (2014) fails. Moreover, while this model is flexible enough to entertain the ideas of Bryan, Chowdhury, and Mobarak (2014), we show that it offers an entirely different interpretation of the experimental data.

[4]In reality, net migration from rural to urban areas was positive over this period, though we abstract from this in the model, since it seems unlikely to change the model's basic interpretation of the data.

3.1. *Economic Environment*

Preferences. Households are infinitely lived and maximize expected discounted utility. Their period utility function over consumption, c_t, is given by

$$u(c_t) = \frac{1}{1-\alpha} c_t^{1-\alpha} \bar{u}^{x_t}, \tag{1}$$

where α is the coefficient of relative risk aversion; $\bar{u}$ captures the nonmonetary costs of migration; and $x_t \in \{0, 1\}$ is an indicator variable representing whether the household is an "inexperienced migrant." The households' problem is dynamic, and households discount the future at rate $0 < \beta < 1$.[5]

Inexperienced migrants experience disutility $\bar{u}$ if they locate in the urban area in period t, whereas experienced migrants experience no such disutility. After each period in the urban area, inexperienced migrants become experienced with probability $1 - \lambda$. This is meant to capture any way in which rural–urban migrants become accustomed to being in urban areas, for example, by developing a network of friends or potential employers, or adapting to housing conditions. Experienced migrants can become inexperienced again after returning to the rural area. In each period in the rural area, the probability that an experienced migrant will become inexperienced again is $1 - \pi$. The motivation behind these modeling choices is twofold. First, we want to model the fact that migrants dislike certain aspects of migrating to an urban area (see the discussion in the Online Supplementary Material, Appendix Section C (Lagakos, Mobarak, and Waugh (2023)). Second, we also want to model the idea that one's utility from a location improves as one becomes accustomed to living there.

Migration decisions are also subject to additive idiosyncratic taste shocks, which we describe formally below. These taste shocks are independently and identically distributed across time and migration options and are drawn from a Type-1 extreme value distribution with scale parameter σ_ν, following the quantitative migration literature (see, e.g., Caliendo, Dvorkin, and Parro (2019)). The rationale for migration taste shocks is that many migration decisions are undertaken for (largely) noneconomic reasons, such as marriage.

Endowments. Households supply one unit of labor inelastically, with efficiency units that vary across time and across locations, as in Roy (1951). Households differ in permanent productivity in the urban area z, which is drawn from a Pareto distribution: $z \sim 1 - z^{-\theta}$, where $z \geq 1$ and the shape parameter θ controls the variance of urban productivity. Here, a lower θ implies more variability in urban productivity. Households are identical in rural permanent productivity, and this value is normalized to one. Thus, the vector $\{1, z\}$ describes a household's permanent productivity in the rural and urban areas.[6]

[5]We model the disutility as multiplicative, rather than additive, because it is more flexible with respect to wealth effects in migration decisions. An additive urban disutility builds in a smaller disincentive for wealthier households to migrate, relative to that of poorer households. The data suggest the opposite pattern: poorer households are more likely to migrate than wealthier households. Thus, from a pragmatic point of view, a multiplicative disutility allows the model more flexibility in fitting the data, rather than imposing a predetermined pattern between migration and wealth. Appendix Table A.I reports the best fit of the data in an alternative model with additive disutility and highlights its difficulties in matching migration rates in the control and treatment groups and the consumption response to migration subsidies.

[6]The assumption of one-sided selection is supported by the empirical observation that we see very low variance in the level of consumption in rural areas. Moreover, this assumption eases the computational burden, allowing us to introduce transitory shocks and behavioral responses to them.

Households experience idiosyncratic transitory shocks to their endowments. Let s_t denote the current shock. This shock evolves according to an AR(1) process (in logs):

$$\log s_{t+1} = \rho \log s_t + \epsilon_{t+1} \quad \text{with } \epsilon_{t+1} \sim \mathcal{N}(0, \sigma_s),$$

where ρ is the autocorrelation parameter and σ_s is the standard deviation of the shocks.

To allow this shock to have a differential impact on earnings (and risk) across locations, we assume that the household-specific, transitory component on efficiency units is s for the rural area and s^γ for the urban area. Thus, the vector $\{s, zs^\gamma\}$ describes a household's endowments (both permanent and transitory) for the rural and urban areas.

The parameter γ governs differential risk across locations. In particular, if $\gamma > 1$, this formulation will imply that shocks have a larger impact on incomes in the urban area than in the rural area. Hence, if $\gamma > 1$, the urban area will be riskier than the rural area. The benefit of this modeling choice is that it allows us to reduce the dimensionality of the state space to focus on just one shock (versus multiple shock processes across locations). At the same time, it parsimoniously captures the old idea in development economics that differential risk in urban and rural areas may be a deterrent to migration, as well as a source of urban–rural average income differences (Harris and Todaro (1970)).[7]

Production. There is one homogeneous good produced in both locations by competitive producers. Locations differ in the technologies they operate. The rural technology is

$$Y_r = A_r^i N_r^\phi, \tag{2}$$

where N_r are the effective labor units working in the rural area; $0 < \phi < 1$, so that there is a decreasing marginal product of labor in the rural area; and A_r^i is rural productivity indexed by season i. Seasonality is modeled with the rural area experiencing deterministic, seasonal fluctuations. Specifically, rural productivity can take on one of two values: $i \in \{g, \ell\}$ with $A_r^g > A_r^\ell$, where if current rural productivity is A_r^g, then the economy deterministically transits to productivity state A_r^ℓ in the next period, and so forth. Superscript g is for the "growing" season, and superscript ℓ is for the "lean" season.

The urban technology is given by

$$Y_u = A_u N_u, \tag{3}$$

where A_u captures urban productivity and N_u is the effective labor units supplied by households working in the urban area. Notice that N_u and N_r do not sum to one but are the sum across efficiency units. Thus, they depend on the shock realizations and the pattern of the worker sorting across sectors.

Wages. In season i, with N_r workers in the rural area, wages per efficiency unit are

$$\omega_{r,i}(N_r) = A_r^i \phi N_r^{\phi-1} \quad \text{and} \quad \omega_u = A_u. \tag{4}$$

Agents working in a particular location receive wages that are the product of (4) and the number of their efficiency units (in both permanent and transitory terms). Thus, the labor

[7]The assumption of perfectly correlated shocks across regions is not an especially realistic one. We make it only for computational tractability. In Appendix Table A.II, we compute the welfare effects of migration subsidies in a model in which shocks are uncorrelated across regions and over time (which is the case when $\rho = 0$). The welfare effects are not that different in that model from the benchmark case to follow. This suggests that the welfare gains from a model with imperfectly correlated shocks would also be similar to those of the benchmark estimation.

income that a household with with permanent state $\{1, z\}$ and transitory state s receives for working in location i is

$$w_r(s, i) = s\omega_{r,i} \quad \text{and} \quad w_u(z, s) = zs^{\gamma}\omega_u, \tag{5}$$

which depends on the product of a household's permanent and transitory productivity and wages per efficiency unit in (4).

Location Options. Households have choices about where to reside and work. Those in the rural area have three options. First, they can work in the rural area. Second, they can pay a fixed cost m_T and work in the urban area for one period and return to the rural area in the next period. This is (temporary) *seasonal* migration in the model: a one-period working spell in the urban area by a rural household. Third, the household can pay a higher fixed cost $m_P > m_T$ and work in the urban area for the indefinite future. This is *permanent* migration, which enables the household to live and work in the urban area for more than one period.[8]

Households residing in the urban area have similar options. They can work in the urban area, or they can pay a fixed cost m_P and work in the rural area for the indefinite future. The latter option allows for rural-to-urban and then urban-to-rural moves as a household's comparative advantage, experience, and asset holdings change over time.

Asset Choices. Households can accumulate a nonstate-contingent asset, a, with a gross rate of return, R. Asset holdings are restricted to be nonnegative, and thus there is no borrowing. Furthermore, we assume that R is exogenous.

3.2. *Optimization*

Before we describe the value functions of a household, it is important to have a complete accounting of the state space. The state variables for a household can be divided into objects that are permanent, transitory, endogenous, and aggregate.

- *Permanent productivity state.* Each household is endowed with z efficiency units in the urban area and one efficiency unit in the rural area.
- *Transitory productivity state.* Each household faces transitory productivity, s.
- *Transitory moving shock.* Each household is subject to an i.i.d. moving shock, ν.
- *Endogenous state variables.* There are three endogenous (individual) state variables. The first is the household's asset holdings, a. The second is a composite variable that describes the household's location and migration status. The possible states are rural (r), seasonal-migrant (seas, i.e., living in the rural area but working in the urban area for one period), and urban (u). The third is whether the household is an inexperienced migrant, x, and thus whether it suffers disutility $\bar{u}$ from locating in the urban area.
- *Aggregate state variables.* There are two aggregate state variables: the season, $i \in \{g, \ell\}$, and the number of workers in the rural area, N_r. The season determines the current and future productivity in the rural area, and the two aggregate states jointly determine the current wage per efficiency unit as in equation (4).

We begin with the problem of a rural household. Because z is time-invariant for each household, we omit it as a state variable from the formulation of the household's problem below.

[8]The higher cost of a permanent move reflects, at least in part, the greater expenses of moving all of a household's property rather than just a part of it, as required for a temporary move.

Rural Households. A rural household with productivity z solves the following problem:

$$v(a, r, s, \nu, x, i, N_r) = \max\{v(a, r, s, x, i, N_r|\text{stay}) + \nu^{\text{stay}}, v(a, r, s, x, i, N_r|\text{seas}) + \nu^{\text{seas}}, v(a, r, s, x, i, N_r|\text{perm}) + \nu^{\text{perm}}\}, \quad (6)$$

where a household chooses among staying in the rural area, seasonally moving, and permanently moving. The value function associated with each option and the household's taste shock associated with each choice influence this choice. Here, we will follow the quantitative migration literature and assume that the taste shocks are independently and identically distributed across time and drawn from a Type-1 extreme value distribution with scale parameter σ_ν. This distributional assumption implies that the probability of staying in the rural location is

$$P(a, r, s, x, i, N_r|\text{stay}) = \frac{\exp\{\sigma_\nu^{-1} v(a, r, s, x, i, N_r|\text{stay}\}}{\sum_{j_r} \exp\{\sigma_\nu^{-1} v(a, r, s, x, i, N_r, |j_r)\}},$$

where the sum across j_r's are the different choices for rural households. Here, the scale parameter shows up and modulates the strength of the preference shock in determining the move. For example, as σ_ν goes to infinity, then only the shock matters for the moving choice, and the probability of each individual choice is simply one over the number of choices.

Conditional on staying in the rural area, the household's value function is

$$v(a, r, s, x, i, N_r|\text{stay}) = \max_{a' \in \mathcal{A}} \{u(\text{Ra} + w_r(s, i, N_r) - a') + \beta \mathbb{E}[v(a', r, s', \nu', x', i', N_r')]\}, \quad (7)$$

which means that the household solves only a consumption-savings problem. The asset holdings must respect the borrowing constraint, and thus must lie in the set $\mathcal{A}$. Given asset choices, a household's consumption equals the gross return on current asset holdings, Ra, plus labor income from working in the rural area, $w_r(z, s, i)$, minus future asset holdings. The next period's state variables are the new asset holdings, location in the rural area, the transitory productivity shock, the experience level, the subsequent season, and the aggregate rural efficiency units in the next period. The expectation operator is defined over two uncertain outcomes: the transitory shocks and the change in experience. Recall that if the household is experienced, it stays that way with probability π and becomes inexperienced with probability $1 - \pi$; if the household is inexperienced, then it stays inexperienced.

The value function associated with a permanent move is

$$v(a, r, s, x, i, N_r|\text{perm}) = \max_{a' \in \mathcal{A}} \{u(\text{Ra} + w_r(z, s, i, N_r) - a' - m_p) + \beta \mathbb{E}[v(a', u, s', \nu', x', i', N_r')]\}.$$

While this function is similar to the staying value function, there are several points of difference. First, the agent must pay m_p to make the permanent move, and this costs resources. Second, the continuation value function denotes that the household's location changes from the rural to the urban area.

The value function associated with a seasonal move is

$$v(a, r, s, x, i, N_r|\text{seas}) = \max_{a' \in \mathcal{A}} \{u(\text{Ra} + w_r(s, i, N_r) - a' - m_T) + \beta \mathbb{E}[v(a', \text{seas}, s', x', i', N_r')]\}. \quad (8)$$

If a household decides to move seasonally, it pays the moving cost m_T and works in the urban area in the next period. The key distinction between the permanent move and the seasonal move is that the seasonal move is for just one period. Hence, the location state variable is seas and not u, as this indicates that the household is going to work in the urban area and return in the next period. The value function associated with a seasonal move while in the urban area is

$$v(a, \text{seas}, s, x, i, N_r) = \max_{a' \in \mathcal{A}} [u(\text{Ra} + w_u(z, s) - a')\bar{u}^x + \beta \mathbb{E}[v(a', r, s', \nu', x', i', N_r')]]. \quad (9)$$

There are several important points to note in (9). First, this household has only one choice: how to adjust its asset holdings. By the definition of a seasonal move, the household works in the urban area for one period and then returns to the rural area. Second, note how the disutility from living in the urban area appears (i.e., the presence of $\bar{u}$). Moreover, the state variable of a household's experience x determines whether the disutility is experienced.

Equations (8) and (9) illustrate the forces that shape the decision to move seasonally, and in turn, our inferences from the experimental and survey results. Generally, the choice to move seasonally will relate to a household's comparative earnings advantage in the urban area relative to that in the rural area. However, several forces may lead a household with a permanent comparative advantage in the city not to move. First, the urban disutility may prevent the household from moving, even though its comparative advantage in the urban area is expected to be high. Second, there is risk associated with the move. A household does not know the realization of the transitory shock before moving, and hence there is a chance that the income realization in the urban area will not be favorable. Third, the household may have limited assets that simply make a move infeasible or not sufficient to insure against a bad outcome in the urban area.

Urban Households. Urban households face problems similar to those described above, though they choose between just two options: staying or making a permanent move. For a household with productivity level z, the problem is

$$v(a, u, s, \nu, x, N_r, i) = \max\{v(a, u, s, x, N_r, i|\text{stay}) + \nu^{\text{stay}}, v(a, u, s, x, N_r, i|\text{perm}) + \nu^{\text{perm}}\}. \quad (10)$$

Again the value function associated with each option and the household's taste shock associated with each choice influence this choice. These taste shocks are independently and identically distributed across time and distributed Type 1 extreme value distribution with the same scale parameter σ_ν.

The value functions for urban households are analogous to those of the rural households, so we omit them for brevity. However, these households have several key differences from those staying in the rural area. First, their wage depends on their permanent productivity level, z, and not on the season or number of aggregate efficiency units in the rural areas. Moreover, the transitory productivity shocks may have more or less volatility relative to those of the rural area, as determined by the γ parameter (see equation (5)).

Third, the disutility from living in the urban area appears (i.e., the presence of $\bar{u}$), and the state variable of a household's experience, x, determines whether the household suffers it.

As in the case with rural households, expectations are over the transitory shock and the change in experience. However, as these households are in the urban area, inexperienced households stay that way in the next period with probability λ and become experienced with probability $1 - \lambda$. Experienced households retain their experience. Urban households must pay m_p to make a permanent move back to the rural area. Furthermore, the continuation value function denotes the household's location changes from the urban to the rural area. After a permanent move to the rural area, experienced households keep their experience with probability π and lose it with probability $1 - \pi$.

3.3. *Discussion: Determinants of Migration and Location Choice*

The model allows for a rich set of determinants of migration and of location choice more generally. Although we allow the data to discipline the most important determinants in the following section, it is worth discussing them informally here first.

One clear determinant of migration in the model is the season. Since the growing season has higher productivity than the lean season, rural households will be more likely to migrate (seasonally or permanently) to the urban area in the lean season, all else equal. The permanent urban productivity level, z, is another important determinant of migration. All else equal, agents with higher values of z will have stronger incentives to locate in the urban area. The migration disutility, $\bar{u}$, is also an unambiguous deterrent to migration. The higher is $\bar{u}$, the less likely it is that inexperienced households will locate in the urban area. Furthermore, those with migration experience are more likely to migrate, as these households face no disutility of locating in the urban area. Finally, both effects (permanent comparative advantage and experience) will interact, as households with a stronger comparative advantage in the urban area are more likely to migrate, and hence are more likely to be experienced at migrating.

The probabilities of gaining or losing experience, λ and π, mostly affect the extent of repeat migration. When experience is easy to obtain and hard to lose, that is, λ is low and π is high, a subsidy to migration will induce inexperienced rural–urban migrants to repeat migrate (or to stay in the urban area) for many periods in the future. For rural households induced to migrate seasonally, the lower is π, the less likely they will be to migrate in subsequent periods, since experience is lost at a faster rate.

The transitory shock, s, and asset level, a, have ambiguous effects on migration and location choice. For concreteness, suppose that shocks are persistent, so that households with a high shock today are more likely to receive a high shock one period hence. Consider first the case that $\gamma > 1$, so that transitory shocks are more volatile in the urban area. In this case, rural households may be more likely to migrate to the urban area after receiving a good shock. The asset holdings also play a role in this case. High values of assets allow for insurance, which may mean that households migrate in this case only when their assets are sufficiently high. If this is the case, subsidizing migration may induce these high-productivity households to migrate and realize large consumption gains due to a better allocation of their urban-specific productivity. This is just how the model of Bryan, Chowdhury, and Mobarak (2014) works, as we discuss further below. It is worth emphasizing that this case is more likely to occur the lower is the return to saving, R, since for higher savings rates, workers can self-finance and save their way out of these credit constraints (see, e.g., Midrigan and Xu (2014), Moll (2014), Donovan (2021)).

Consider next the case that $\gamma < 1$, so that shocks are more volatile in the rural area than in the urban area. In this case, rural households may be more likely to migrate when they have bad shocks than when they have good shocks. Since migration is costly in both monetary terms and nonmonetary disutility, households may migrate only when they are sufficiently unproductive and when their assets are too low for them to insure themselves against their current low productivity. In this case, subsidizing migration may induce these low-productivity households to migrate and realize large consumption gains to avoid bad outcomes in the rural area and reap benefits of higher average productivity in the urban area. This case is related to the findings of Gröger and Zylerberg (2016) and Kleemans (2015), who find evidence that workers use migration as a coping mechanism after bad shocks.[9] In practice, whether induced migrants tend to be low-productivity workers with low assets or high-productivity workers with high assets is determined by the data.

4. MODEL ESTIMATION

We now estimate the model using a simulated method of moments. We draw on two sets of moments. The first is the migration experiments described in Section 2. The second is a large nationally representative household survey from Bangladesh. Taken together, these moments help the model to jointly fit key aggregate facts from the Bangladeshi economy relevant for understanding rural–urban migration, plus the household responses to migration incentives, which are well identified through the experimental evidence.

4.1. *Data and Targeted Moments*

To discipline the model, we draw on eight moments from the migration experiment of Bryan, Chowdhury, and Mobarak (2014). These are (i) the variance of log consumption growth from before and after the lean season in the control villages (0.19); (ii) the percentage of control households with no liquid assets (47%); (iii) the seasonal migration rate in the control villages (36%); (iv) the OLS "return" to migration in the control villages (10%); (v) the seasonal migration rate in the treatment villages minus that of the control villages (22 percentage points); (vi) the same difference but in year 2 (9 percentage points); (vii) the IV return to migration (LATE) in terms of consumption (30%); and (viii) the probability of repeat migration for individuals in the control villages (0.68).

We take three moments from a large nationally representative household survey called the 2010 Household Income and Expenditure Survey, which surveyed 12,240 households. These moments are (i) the fraction of households residing in rural areas (62%); (ii) the ratio of urban to rural average wages (1.89); and (iii) the variance of log wages in the urban area (0.56). To construct the wage variance, we restrict attention to wage earners, since the data on wage earnings are likely to be more reliable than the data on self-employed income or farm income. We also restrict attention to males aged 20 and older that work "full time" (which we define as having worked at least 5 months in the last year, for at least 15 days in the last month, and for an average 5 or more hours per day). We compute the wage as monthly earnings in the main occupation divided by weekly hours multiplied by four.

[9]For the case of international migration, Bazzi (2017) finds that credit constraints limit emigration from poorer rural areas in Indonesia, though in more developed rural areas, those with higher permanent income shocks are less likely to migrate.

TABLE I

PREASSIGNED PARAMETERS.

	α	β	R	A_{rl}/A_{rg}	m_T	m_p	ϕ
Value	2.0	0.95	0.95	0.50	0.1 × rural cons.	$2 \times m_T$	0.91

Note: The table reports the values of the 8 preassigned parameters in the model. A period is defined to be half a year; m_T is chosen to equal 10% of average rural consumption.

4.2. *Directly Chosen Parameters*

We begin by directly assigning some parameter values; Table I provides a summary. These are parameters that are related directly between the model and the data or are difficult to identify from the data. We choose the time period to be half a year, which allows for seasonal migration and seasonal variation in rural productivity, which are important features in the experimental data. We set the risk-aversion parameter, α, to be two, which is within the range of commonly chosen values in the macroeconomics literature. We choose the discount factor, β, to be 0.95. The return on assets, R, is set to 0.95 to capture Bangladesh's average half-yearly inflation rate, which is around 5%. This choice is consistent with the asset composition of households' balance sheets in our experimental sample, which is primarily cash.[10]

We set the ratio of productivity in the lean season to that in the growing season, A_{rl}/A_{rg}, to be 0.5, consistent with estimates by Khandker (2012). The seasonal moving cost, m_T, is set at 10% of average rural consumption. This is approximately the seasonal migration cost (round-trip bus fare plus a few days of food during travel) reported in Bryan, Chowdhury, and Mobarak (2014). We set the permanent migration cost, m_P, high enough so that gross flows across regions are negligible, which is what is observed in the 8 years of tracking in the Bangladeshi data. We find that our results are not substantially affected by this parameter value. We note that permanent migration is an important feature in the model because it allows individuals to sort endogenously into the rural and urban areas based on permanent comparative advantage (and the other other state variables.)

Finally, we set the elasticity of output with respect to labor, ϕ, to be 0.91, following the estimates of the effects of large-scale migration subsidies of Akram, Chowdhury, and Mobarak (2017). They observe that rural wages rise more in villages that randomly receive more migration subsidies (and have more out-migration). Our choice of ϕ replicates their elasticity of a 2.2% increase in rural wages for every 10% increase in seasonal migration. Akram, Chowdhury, and Mobarak (2017) also document that the consumption increase from travel subsidies is entirely due to migration income earned by the migrant (with no change in labor supply of other household members), and our modeling choices reflect that fact.

4.3. *Parameters to Estimate*

We estimate the remaining eleven parameters of our model. The first nine are part of the model and defined above. They are (i) θ, the shape parameter controlling the urban individual productivity distribution; (ii) $\bar{u}$, the disutility of migration; (iii) λ, the probability of remaining inexperienced after a move to the urban area; (iv) π, the probability

[10]We experiment with different values of β and R in Appendix Tables A.III and A.IV, and we find that our model's predictions are not substantively altered under alternative plausible choices.

of remaining experienced following a return to the rural area; (v) γ, the relative volatility of the urban area; (vi) A_u, the urban aggregate productivity level; (vii) σ_s, the standard deviation of stochastic shocks; (viii) ρ, the autocorrelation of urban shocks; and (ix) σ_ν, the standard deviation of idiosyncratic taste shocks.

The final two parameters govern the extent of measurement error in income and consumption, which we want to allow for, since income and consumption data at the micro level are clearly measured with noise. Hence, we do not want to force the model to ascribe all the income and consumption variance to permanent or temporary shocks rather than to measurement error. In particular, we assume that rural consumption growth (which we observe using the experimental data) satisfies

$$\hat{g}_{c,i} = g_{c,i} + \upsilon_{r,i}, \tag{11}$$

where $\hat{g}_{c,i}$ is observed consumption growth of household i, $g_{c,i}$ is actual consumption growth, and $\upsilon_{r,i}$ is measurement error, which we assume is normally distributed with mean zero and variance $\sigma_{r,c}$. Urban income, in turn, satisfies

$$\log \hat{y}_i = \log y_i + \log \upsilon_{u,i}, \tag{12}$$

where y_i is observed income of household i, y_i is actual income, and $\log \upsilon_{u,i}$ is measurement error in income, which we assume is normally distributed with mean zero and variance $\sigma_{u,i}$.

4.4. *Estimation by Simulated Method of Moments*

We estimate these eleven parameters of the model using simulated method of moments. The basic idea is to pick the parameter vector

$$\Theta = \{\theta, \bar{u}, \lambda, \pi, \gamma, A_u, \sigma_s, \rho, \sigma_\nu, \sigma_{r,c}, \sigma_{u,i}\} \tag{13}$$

to minimize the distance between the simulated moments and the data. The eleven data moments from which we estimate the parameters are listed in Table II and are divided into two basic groups: the experimental moments (top eight) and the cross-sectional survey moments (bottom three). We construct the simulated moments in the following way. For the cross-sectional moments, we solve the household's problem and construct the stationary distribution of households. From the stationary distribution, we compute the urban–rural wage gap, the percentage of households that permanently live in the rural area, and the variance of log income in the urban area.

A novel feature of our estimation procedure is that we replicate the experiment to be targeted directly in our model. We implement this procedure in the following way. First, we present the model households with a one-time, unanticipated seasonal migration opportunity without the monetary cost m_T and compute their optimal responses. We do this in partial equilibrium, which is an appropriate choice given the relatively small number of experiment participants in each village and the relatively small number of villages in the experiment. We then randomly sample rural households from the model's stationary distribution, consistent with the sample selection criteria in the migration experiments discussed in Section 2. Specifically, Bryan, Chowdhury, and Mobarak (2014) conducted their baseline survey before the lean season; thus, we follow the same timing in the baseline sample selection and measurement for our model. Furthermore, Bryan, Chowdhury, and Mobarak (2014) selected households that were relatively poor to start with, and we

TABLE II

MOMENTS TARGETED IN THE ESTIMATION.

Moments	Data	Model
Control: Variance of rural log consumption growth	0.19 (0.03)	0.19
Control: Percentage of rural households with no liquid assets	47 (1.13)	47
Control: Seasonal migration rate	36 (2.64)	36
Control: Consumption increase of migrants (OLS)	10 (4.47)	10
Control: Repeat migration rate	68 (0.46)	71
Treatment: Seasonal migration relative to control	22 (2.39)	21
Treatment: Seasonal migration relative to control in year 2	9 (2.44)	5
Treatment: Consumption increase of induced migrants (LATE)	30 (9.67)	29
Urban–rural wage gap	1.89 (0.18)	1.89
Percentage in rural area	62 (1.36)	60
Variance of log urban wages	0.56 (0.06)	0.56

Note: The table reports the moments targeted using simulated method of moments, their values in the data and in the model, and the standard errors of the empirical moments.

implement this in the model by selecting rural households that are in the bottom half of the asset distribution for rural residents.

Given the appropriate sample of households and their optimal policies if treated or not, we compute the moments from the control and treatment groups described above. To compute the OLS return to migration in the control group, we regress the consumption of the model's rural households in the lean season on an indicator variable for whether the household migrated in the lean season. To compute the LATE of migration on consumption, we use data from both the treatment and control groups in the model and run an IV regression in which consumption is regressed on (instrumented) migration, with migration instrumented by assignment to the treatment group in the first stage.

4.5. *Estimation Results*

Table II presents the data and the model moments. In general, the model's predicted moments are quite similar to its counterparts in the data. Ten of the eleven moments are matched exactly, or almost exactly it, while one (the repeat migration rate) is somewhat lower in the model than in the data.[11]

Table III shows the estimated parameter values and their bootstrapped confidence intervals. While the next two sections discuss the economic implications and identification of these parameter values, several features of Table III are worth pointing out. First, the shape parameter controlling permanent differences in ability, θ, is quite low, at 0.55. This implies that there is large variation in permanent productivity in the urban area. Second, the urban relative risk parameter, γ, is less than one, implying that shocks in the urban area are less volatile than those in the rural area. Third, the disutility of migrating, $\bar{u}$, is sizable (and positive, since the level of household utility is negative). In terms of magnitudes, the value of 1.55 for $\bar{u}$ implies that experiencing disutility of migration is equivalent, in a static sense, to cutting consumption by 33%. This is consistent with the large seasonal migration costs estimated by Imbert and Papp (2020) in India. Next, the probability of

[11]Figure A.1 plots the difference in migration rates between the treatment and control groups in the model and data in 2008 (the year of the experiment in the model) and for 5 subsequent years. By 5 years after the experiment, the difference in migration rates between the two groups is positive but statistically insignificant.

TABLE III

ESTIMATED PARAMETERS AND CONFIDENCE INTERVALS.

$\frac{1}{\theta}$	$\bar{u}$	λ	π	γ	A_u	σ_s	ρ	σ_ν
0.55	1.54	0.66	0.60	0.52	1.55	1.30	0.75	0.13
(0.42, 0.60)	(1.34, 1.90)	(0.40, 0.90)	(0.23, 0.88)	(0.15, 0.85)	(1.40, 1.70)	(0.80, 2.25)	(0.59, 0.87)	(0.01, 0.21)

Note: The table reports the estimated parameters values and their bootstrapped 95% confidence intervals.

remaining inexperienced, λ, and that of remaining experienced, π, are substantially less than one, with around one-third of experienced households losing their experience each half-year, and only around one-third of inexperienced households gaining experience after a move.

The bootstrapped confidence intervals are reasonably tight for $1/\theta$, A_u, and ρ. The migration disutility, $\bar{u}$, and urban relative risk parameter, γ, have somewhat wider confidence intervals but are always consistent with a moving cost substantially above one and an urban relative risk parameter below one. The variance of the transitory shock and that of migration taste shocks are even wider, though the latter is small relative to other studies in the literature employing a migration taste shock. The probabilities of remaining experienced and inexperienced, π and λ, have wide confidence intervals and rule out only fairly extreme cases near zero or one.[12]

4.6. *Who Migrates and Why?*

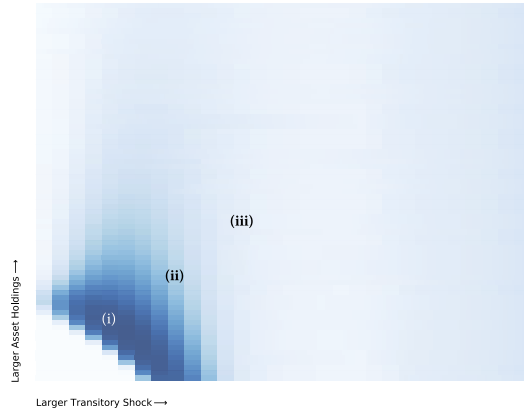
In this section, we discuss how the estimated model's policy functions for location choice depend on permanent productivity, asset holdings, the transitory shock, and migration experience. In the discussion of these outcomes, we discuss how the data informs them.

We focus on rural households leading into the lean season, since most migration occurs then. Figure 1 plots the migration probabilities in the estimated model for select rural households with different levels of urban productivity and migration experience as a function of their transitory shocks and asset holdings. The x-axis represents the transitory productivity shock, and the y-axis is the asset holdings of the household. For each transitory shock and possible asset value, the color represents the probability of migrating, with darker colors meaning higher probabilities.

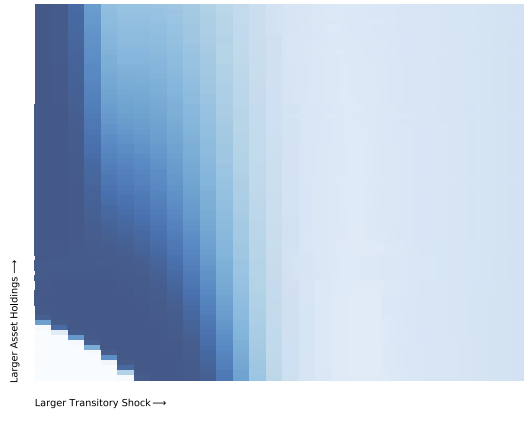
Higher urban productivity leads to more migration. Panels (a) and (b) contrast the moving policy for low-z households and moderate-z households. The darker migration region in the southwest portion of the panels is larger for moderate-z than for low-z households. This means that those with a stronger comparative advantage are more likely to seasonally migrate to the urban area. Intuitively, the key data moment determining how many moderate-z households there are, compared with the number of low-z households, is the experimental migration response to the treatment.

This observation highlights an important implication about whom migration subsidies may affect. Households sort themselves into rural and urban areas largely on the basis of permanent comparative advantage. Thus, the set of households living in the rural area in any given period consists most likely of those with relatively low z values. Households

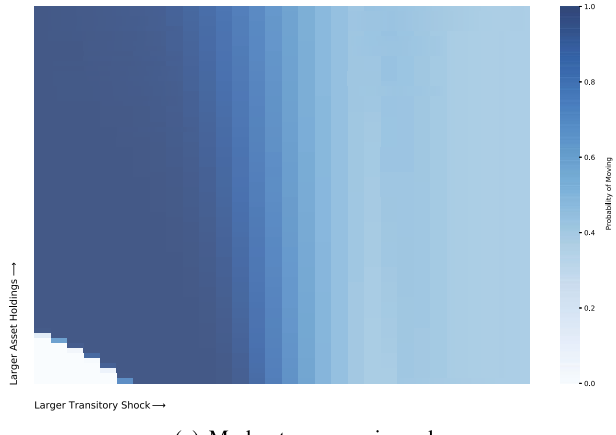
[12]For expositional purposes, Table III omits the values of measurement error terms, σ_{rc} and σ_{ui}. These are each estimated to be 0.15, with bootstrapped confidence intervals of (0.11, 0.22) and (0.00, 0.29).



(a) Low z, not experienced



(b) Moderate z, not experienced



(c) Moderate z, experienced

FIGURE 1.—Migration Probabilities for Select Household Types.

with higher z are more likely to be in the city. As a policy, migration subsidies will be offered to those with low comparative advantage in the urban area.

The disutility of the urban area is an important deterrent to migration. Panels (b) and (c) of Figure 1 contrast the moving policy for the same z but different experience levels. Hence, these households face a disutility to migrating or not. The darker migration region is larger for the experienced household than for the inexperienced one. This illustrates the point that in the estimated model, we infer an important role for a nonmonetary disutility of the urban area in shaping the migration choice.[13]

Several features of the data combine to push our model to infer a substantial nonmonetary disutility of the urban area. At the most basic level, this is about the overall level of migration (not the experimental response which informs the distribution of ability). In the lean season, productivity falls by 50%, yet many do not migrate. One way for our model to accommodate this observation is to have a large disutility of migration.

The alternative explanation is that households simply cannot afford to migrate. The important observation is that whatever force prevents migration must be consistent with the consumption response and the pattern of selection implied by it. As we discuss next, in both the data and the model, migrants are negatively selected on assets and income, and a large disutility of migration (to get the overall migration flows correct) is consistent with the pattern of selection in the data; a credit constraint story is not.

Households with low assets and low transitory shocks are more likely to migrate. All three panels of Figure 1 highlight how households with low assets and low transitory shocks are more likely to migrate. This point is seen by noting that in all cases, the darker migration region always originates out of the southwest corner. If one's expectation is that credit constraints are the primary reason that households do not migrate, this may seem surprising. If migration costs are high and the credit constraint binds, then the migration region would originate from the northeast corner in Figure 1, because this is where the constraint would be alleviated. In fact, credit constraints prevent migration for a very small part of our parameter space, seen as the white region in the very lower left corners of all three panels in the figure.

The key behind this result is the observation that the OLS coefficient from consumption regressed on migration is smaller than the IV (LATE) coefficient. Because OLS is smaller relative to IV, the implication is that migrants are *negatively selected* on the determinants of consumption. In our model, a household's state variables are the determinants of its consumption, specifically its transitory shock and asset holdings. Thus, the fact that the OLS coefficient is less than the IV coefficient pushes our model to accommodate the idea that households with low assets and low transitory shocks are more likely to migrate as in Figure 1.

This push is achieved through a large $\bar{u}$ parameter (as described above), but it is also facilitated by the inference that rural area is very risky $\gamma < 1$ and that households have

[13]To empirically investigate the source of the substantial migration disutility in our estimated model, we conducted some additional discrete-choice experiments on the same set of households used to estimate the model. We found evidence that potential migration opportunities involving poor housing conditions at destination were substantially less desirable in wage terms, all else equal. In particular, offering improved housing with a proper indoor latrine increases reported migration propensity by 17.4 percentage points. This effect size is equivalent to the effect of increasing migration wages by 21%. Thus, the lack of a good housing option after migrating, which is likely quite common for potential migrants in this setting, is one concrete example of the migration disutility in our model. See Appendix C for a complete description of these discrete-choice experiments and our empirical findings.

a low return on their savings, and hence difficulties in self-insuring. That is, rural households generally prefer rural areas but sometimes find themselves in periods of low productivity and low assets, particularly in the lean season. Because self-insurance through savings is difficult, these households use seasonal migration as a form of insurance allowing them to temporarily raise their incomes, and thus smooth their consumption over time. This latter observation is essentially a spatial analog to Pijoan-Mas (2006), in which households with low productivity or low assets increase their labor supply to self-insure.

This observation has an important implication for how migration subsidies may improve welfare in our model. They serve to channel resources toward the rural households that are unproductive and vulnerable owing to a lack of assets that can be used for self-insurance. In other words, the migration subsidy provides households an insurance opportunity to more easily supply their labor in the urban location.

4.7. *Nontargeted Moments*

How does the model fare in predicting nontargeted moments? We answer this question by examining several features of the data: migration rates by initial consumption level, asset holdings by migration status, variances of consumption growth by migration status, and the migration effects of unconditional cash transfers.

We focus on these nontargeted moments for the following reasons. Looking at how migration rates vary by initial consumption level speaks to households' heterogeneous responses to the treatment. Asset holdings by migration status tell us about the extent to which migration decisions are driven by buffer-stock savings strategies versus strategies in which migration serves as insurance when productivity and assets are low. The variance of consumption growth and the effects of unconditional transfers speak to the importance of potential spatial misallocation from credit constraints and migration risk, as in Harris and Todaro (1970) and the model of Bryan, Chowdhury, and Mobarak (2014).

Migration rates by initial consumption level. Table IV reports the migration rates in the control group by the levels of consumption and assets. Panel A exhibits migration rates from the data, and panel B reports the value in the estimated model (which are not targeted). For simplicity, we consider consider consumption only above and below the me-

TABLE IV

MIGRATION RATE BY ASSET AND CONSUMPTION LEVEL.

		Assets	
		$\leq$ 800 Taka	$>$ 800 Taka
	Panel A: Data		
Consumption	Below Median	40	29
	Above Median	36	31
	Panel B: Model		
Consumption	Below Median	41	28
	Above Median	41	38

Note: The table reports migration rates in the control group by consumption level and by level of assets, defined as cash plus bank account balances. Panel A shows the migration rate in data. Panel B reports the rates from the estimated model. Both are expressed in percentage points.

dian and assets above and below the 800 Taka, approximately the size of the transfer. As the table shows, migration rates are higher for people with lower consumption and asset levels. For the households with below-median consumption, those with less than 800 Taka in assets had a migration rate of 40%, compared to a migration rate of 29% for those with more than 800 Taka (p-value = 0.09). For those with above median consumption, migration rates were 36% and 31% for the two groups (p-value = 0.45). The model gets this prediction largely correct, with migration rates of 41% and 28% for households with below-median consumption, and migration rates of 41% and 38% for those with above-median consumption.

Effects of unconditional transfers. Table VII, Panel B, reports the migration response in the data of an unconditional transfer, which was conducted along with the original migration experiments. Households did respond positively to an unconditional transfer but to a much smaller extent than they did to the conditional transfers. However, the confidence interval is quite large and comfortably includes zero: the p-value of a test of the null hypothesis that the unconditional transfer has no effect is 0.24. In the model, the effect of an unconditional transfer is 1% higher migration. Thus, it is fair to say that the model predicts that an unconditional transfer has a smaller effect on migration than a conditional transfer, as in the data, and an effect that is small overall and within the confidence intervals of the model's prediction.

Variances of consumption growth by migration status. Table V lists the variance of log consumption growth for households that stay and those that migrate, in both the data and the model. In the data, the control group (upper panel) has log consumption growth variance of 0.15 for stayers and marginally higher variance, of 0.18 for those that migrate. The model is similar, with 0.18 for the stayers and a marginally higher at 0.19 for the migrants. The treatment group (lower panel) in the data is somewhat similar to the control group, and again the model matches the similar but marginally higher log consumption variance of the migrants.

It is worth discussing how our model correctly predicts higher consumption growth variance for migrants compared with that of nonmigrants, even though it features higher transitory shock variance in the rural area ($\gamma < 1$). The reason is as follows. The model's prediction is that households with relatively low transitory shocks and asset levels do more temporary migration, all else equal. In the estimated model, these temporary migrants see large gains in income and hence consumption, since they are largely "hand-to-mouth." This tends to increase consumption growth variance for migrants. In the aggregate, this force leads to larger consumption growth variance for migrants, even though migrants face lower income risk at the individual level.

TABLE V

VARIANCE OF LOG CONSUMPTION GROWTH.

Control Group			*Treatment Group*		
	Stay	Migrate		Stay	Migrate
Data	0.15	0.18	Data	0.16	0.19
Model	0.18	0.19	Model	0.17	0.19

Note: The table reports the variance of log consumption growth from before the lean season to afterwards. The left panel is for the control group, and the right panel is for the treatment group. The columns represent the set of households that stay (do not send a migrant) versus that of those that migrate (do send a migrant).

TABLE VI

MODEL MOMENTS WHEN MODEL IS REESTIMATED UNDER PARAMETER RESTRICTIONS.

Moments	Data	Baseline	$\theta = \infty$	$\bar{u} = 1$	$\lambda = 0$	$\gamma = 1$
Control						
Percentage with no liquid assets	47	47	46	47	48	46
Seasonal migration rate	36	36	55	56	36	45
Consumption gain, migrants (OLS)	10	10	18	6	8	24
Control: Repeat migration rate	68	71	56	55	67	66
Experiment						
Seasonal migration rate	22	21	16	13	27	20
Migration, year 2	9	5	2	2	0	4
Consumption gain, induced migrants (LATE)	30	29	24	25	29	29
LATE—OLS	20	20	6	19	21	5
Aggregate						
Urban–Rural wage gap	1.89	1.89	1.89	1.91	1.90	1.90
Percentage in rural	62	60	61	65	63	62

Note: The table reports the values of eight moments of the model when the model is reestimated under restrictions on model parameters. The first column contains the moments in the data, and the second contains the moments from the estimated model. The remaining columns present the model's moments when estimated to match the same moments but assuming that one particular parameter is restricted ex ante. Specifically, these columns focus on the cases when $\theta = \infty$, meaning no permanent worker heterogeneity; when $\bar{u} = 1$, meaning no migration disutility; when $\lambda = 0$, meaning no chance of retaining migration experience; and when $\gamma = 1$, meaning transitory shocks are equally volatile in both regions.

4.8. *Matching the Model to the Data*

In this subsection, we discuss how the main features of the model are necessary in order to match the moments in question. To do so, our approach is to reestimate the model several times under specific parameter restrictions and then to report the best fit of the targeted moments in each case. We report several such reestimations in Table VI. This approach generally results in a worse fit of the targeted moments since the model has fewer degrees of freedom once parameters are restricted ex ante. The value of the exercise comes from seeing exactly how the model fails once particular parameters are restricted.[14]

The first two columns reproduce the targeted moments from the data and the estimates from the baseline model. The third column illustrates the model's best fit taking $\theta \to \infty$ as a numerical limit, implying that heterogeneity in permanent productivity across workers is negligible. In this case, the model greatly overpredicts seasonal migration rates in the control group and the OLS return to migration, while underpredicting the LATE return to migration and repeat migration. This highlights how worker heterogeneity in the model is necessary for matching observational and experimental migration rates as well as returns to migration.

The fourth column of Table VI reports the best fit of the model when $\bar{u} = 1$, that is, when migration disutility is shut off. This version of the model substantially overpredicts seasonal migration rates in the control group, and underpredicts migration rates in the treatment group. These shortcomings highlight how it is hard to generate so little sea-

[14]A related but distinct approach is to compute the elasticity of each targeted moment to each parameter, starting from the estimated model. Appendix Table A.V reports these elasticities, which suggest broadly similar insights about which of the model's parameters are most relevant for each predicted moment.

sonal migration, and such a large response of migration to the subsidies, without migration disutility. Moreover, note that leaving off migration disutility forces the model to underpredict both the OLS return to migration and LATE of migration on consumption. In other words, matching both the observational and experimental returns to migration requires some nonmonetary migration disutility.

The next column explores the model's fit when $\lambda = 0$, meaning that no individual can retain migration experience. In this case, the model generates no repeat migration in the treatment group of the experiment. This illustrates the (intuitive) conclusion that the model's persistence of experience is important for matching repeat migration rates in the data. Moreover, since the model does fairly well in matching the other moments, we conclude that dynamics of experience are not crucial outside of repeat migration patterns.

The last column of Table VI explores the case when γ is restricted to equal one, meaning that transitory shocks are equally volatile in rural and urban areas for potential migrants. The big failure in this case is that the OLS coefficient of migration on consumption is far too high, and counterfactually similar to the LATE of migration on consumption. The model's inability to match these two measured returns to migration signals the importance of differential shock volatility, and the resulting patterns of sorting, in matching the larger experimental effect of migration on consumption than the simple OLS return to migration.

4.9. *Comparison to Model of Bryan, Chowdhury, and Mobarak (2014)*

We now compare our model with the one proposed by Bryan, Chowdhury, and Mobarak (2014) and show that their model is quantitatively inconsistent with the experimental evidence. As a result, it leads to an inaccurate interpretation of the experiment. To recap, the model of Bryan, Chowdhury, and Mobarak (2014) has three main features: migration risk, a credit constraint that prevents households from borrowing to migrate, and individual learning about urban productivity. The model starts from prespecified (i.e., nonequilibrium) initial conditions and offers a conditional migration transfer to all model households in the rural area. Rural households differ in permanent urban ability and their stock of assets, which they can accumulate through buffer stock savings. In contrast to our model, there is no disutility of migration, and there are no temporary productivity shocks. Learning in their model is permanent: no worker knows his or her productivity in the urban area until after migrating, and then the worker learns it forever.

To compare their model's prediction with the data, we assume a common CRRA parameter of two, which is the same value used in the current model and in the middle of the range of values explored by Bryan, Chowdhury, and Mobarak (2014). We compare our model's predictions with the data and their model, starting from their preferred initial conditions. A key difference between the two models' predictions is in the constraints that hold back migration, which determine how migrants are selected in equilibrium. In the model of Bryan, Chowdhury, and Mobarak (2014), many households would like to migrate, but they lack the credit or savings to do so. Their decision rule for migration is to migrate once disposable income reaches a certain threshold. A migration subsidy in that model induces migration by pushing up households over the threshold. In contrast, in our model, households wait until their prospects in the rural area are sufficiently bad for them to migrate, which means that households with lower income and asset levels migrate.

As one way to illustrate this, Panel A of Table VII reports the effect of migration on consumption in the data and models, measured two different ways. The first way is the simple

TABLE VII

COMPARISON TO MODEL OF BRYAN, CHOWDHURY, AND MOBARAK (2014).

Panel A: Effect of Migration on Consumption

	OLS	IV (LATE)
Data	10	30
Model	10	29
Model of Bryan, Chowdhury, and Mobarak (2014)	57	52

Panel B: Effects of an Unconditional Transfer on Migration

	Control	Treatment
Data	34	44
Model	36	35
Model of Bryan, Chowdhury, and Mobarak (2014)	66	88

Note: This table reports moments of the experimental data and the predictions for the same moments in the current model and the model of Bryan, Chowdhury, and Mobarak (2014). Panel A reports the values of the OLS and IV (LATE) returns to migration on consumption per capita, expressed in percentage points. Panel B reports the migration responses to an unconditional cash transfer in the control and treatment villages.

OLS coefficient from a regression of consumption on whether the household sent a seasonal migrant. The second is the LATE of migration on consumption, measured using an IV regression with migration instrumented using assignment to the treatment group. As the first two rows of Panel A show, the OLS coefficient on migration is substantially lower than the IV coefficient both in the data and in the current model. As we discussed above, getting an OLS coefficient smaller than the IV coefficient is a key determinant of whether model households that choose to migrate are negatively or positively selected on income and assets. The model of Bryan, Chowdhury, and Mobarak (2014) has a counterfactually high coefficient: 57%, compared with 10% in the data. Its IV coefficient is also too high: 52%, compared with 30% in the data. Perhaps most importantly, its OLS coefficient is counterfactually higher than the IV coefficient.

Another way of comparing the migration incentives in the two models is by considering the effects of an *unconditional* transfer that Bryan, Chowdhury, and Mobarak (2014) conducted as a component of the original experiment, on a smaller subset of villages. Panel B of Table VII reports the effects of this unconditional transfer in the data and in the two models. The top row reports the seasonal migration rates in the control and treatment groups, their simple difference, and the standard error of the difference. In the data, the migration rates were 34% in the control villages and 44% in the villages with the unconditional transfers, for a difference of 10 percentage points. The standard error of this difference is 6.5%, however, and the p-value is 0.24, meaning that this estimated effect is statistically insignificantly different from zero at any conventional significance level.

Our model predicts that unconditional transfers induce a negligible decrease in migration of around 1%. The model of Bryan, Chowdhury, and Mobarak (2014) predicts a counterfactually large increase in migration rates of 22 percentage points. This substantial increase again reflects the constraints on migration in that model namely, that households cannot save or borrow, and the migration decisions that involve migration once assets are

sufficiently high. The unconditional transfer helps the agents in that model get above the threshold asset level needed to make migration worthwhile.[15]

5. THE WELFARE EFFECTS OF CONDITIONAL MIGRATION SUBSIDIES

Given that the model does well in matching the salient features of the data, we feel confident in using it to measure the welfare implications of encouraging rural–urban migration through migration subsidies. To do so, we compute welfare as the percent increase in consumption, p, that makes the household indifferent between a p-percent consumption increase in perpetuity and being offered the conditional migration subsidy.

5.1. *One-Time Migration Subsidies in Partial Equilibrium*

We begin by computing the welfare gains of a one-time migration subsidy for rural households with low assets. We treat the migration subsidies as unanticipated, available only to the bottom half of the rural asset distribution, and in partial equilibrium, meaning that rural wages are held fixed. We assume, as in the experiments, that the funding for the transfers comes from outside the economy. As a frame of reference, we also compute the welfare gains of a one-time unconditional transfer to this same population. To compare apples to apples, we choose the size of the transfers to each household so that the total cost of the transfers equals the total cost of the migration subsidies.

Table VIII reports the welfare gains from the migration subsidy and unconditional transfer. For expositional purposes, we report the average welfare gain and seasonal migration rate by income quintile among rural households eligible for the subsidy (with one being the lowest). The first two columns of Table VIII focus on migration subsidies with endogenous migration responses, which represent the migration subsidies described in the field experiments of Section 2. Several features of these two columns are worth noting. First, the welfare gains for the one-time migration subsidy are modest on average, at 0.44% consumption equivalents. Second, gains are higher for the poorer quintiles and reach as high as 1.17% consumption equivalents for the poorest quintile. Third, migration rates are higher for the poorer quintiles, reaching as high as 85% for the poorest quintile. The average migration rate of 57% corresponds to the migration rate of the treatment group of the original migration experiment.

The middle two columns of Table VIII report the welfare effects of the conditional migration transfers where we make the transfers to all households willing to migrate given the transfer but counterfactually hold the migration polices of each household fixed at pretransfer levels. The purpose of this exercise is to illustrate how many of the gains occur just from making the transfers to the households willing to undergo the ordeal of seasonal migration in order to obtain the transfer. The welfare gains from this exercise are 0.30 consumption equivalents on average and rise up to 0.77 consumption equivalents for the poorest quintile. This implies that many of the welfare gains from the migration subsidies,

[15]The model of Bryan et al. also emphasizes subsistence consumption and permanent learning about migration ability, though in hindsight, neither of these features seems central to the interpretation of the experimental evidence in question. As we show in Appendix Tables A.VI, the predictions of the model of Bryan et al. are similarly counterfactual with and without subsistence constraints. Furthermore, the interpretation of the experimental evidence reached by the current model is not substantially changed once we add subsistence constraints (see Appendix Tables A.VII and A.VIII). As for permanent learning about migration ability, in Appendix Table A.IX, we show that the model of Bryan et al. makes counterfactually high predications for repeat migration rates.

TABLE VIII

WELFARE EFFECTS OF ONE-TIME MIGRATION SUBSIDIES.

	Migration Subsidy Migration Endogenous		Migration Subsidy Migration Policy Fixed		Unconditional Transfer Migration Endogenous	
	Welfare	Migr. Rate	Welfare	Migr. Rate	Welfare	Migr. Rate
Income Quintile						
1	1.17	85	0.77	48	1.05	45
2	0.45	63	0.31	38	0.56	37
3	0.29	52	0.20	34	0.40	33
4	0.20	46	0.15	31	0.32	31
5	0.12	40	0.10	31	0.20	31
Average						
Rural & Low Assets	0.44	57	0.30	36	0.51	35
All Rural	0.22	41	0.15	31	0.25	30

Note: The first two columns report the lifetime consumption-equivalent welfare gains and migration rates for rural assets with low assets from one-time conditional migration subsidies. The next two columns report the same when the migration policies are held fixed for every agent. The final two columns report the welfare gains and migration rates from a one-time unconditional transfer costing the same total amount as the migration subsides. The rows are for different income quintiles of the rural households eligible for the subsidy, with 1 being the poorest and 5 being the richest. All three experiments are in partial equilibrium, meaning that the rural wage is held fixed, and without financing the subsidies in equilibrium.

around two-thirds of them, arise just from making the transfers to the households willing to take them. Notice that the actual migration rates in this exercise are identical to the equilibrium without transfers, highlighting that none of the welfare gains here arise from actually migrating.

The last two columns report the welfare effects of making unconditional transfers to the same set of households, where the total amount of the transfers equals the total cost of the migration subsidies in the previous two exercises. Notice that this implies a smaller transfer to each household, since every eligible household gets the unconditional transfer, whereas only 57% of eligible households take up the migration subsidy. Overall, the unconditional transfers lead to modestly higher average welfare gains than the migration subsidies, at 0.51% consumption equivalents. The poorest households gain less, since they get a smaller transfer, and the richest gain more, signaling that the transfers are less precisely targeted to needier households. Interestingly, migration rates are far lower under the unconditional transfers, meaning that few eligible households actually want to migrate when given the choice not to do so. This is consistent with the evidence (of Section 4.9) on how an unconditional transfer had a modest effect on migration.

5.2. *Permanent Migration Subsidies in General Equilibrium*

We now consider the welfare gains from permanently offering migration subsidies to rural households with low assets, using the same asset availability criteria as for the temporary transfers above. We simulate offering these policies in general equilibrium, meaning that we allow rural wages and population shares to adjust, and financing the transfers through taxation of labor income on all households. We report the welfare gains on average for four subgroups of the population: rural households with low assets (i.e., those eligible for the subsidies), all rural households, all urban households, and all households.[16]

[16]A limitation of this analysis is that the experimental evidence is not well suited to measure impacts on urban wages. To the extent that capital, land and other nonlabor factors of production are fixed in urban

TABLE IX

WELFARE EFFECTS OF PERMANENT MIGRATION SUBSIDIES.

	Migration Fixed No Taxation	Migration Fixed Tax Financed	Migration Endogenous Tax Financed (G.E.)
Rural & Low Assets	2.06	1.62	2.26
All Rural	1.62	1.19	1.85
All Urban	0.15	−0.29	−1.26
All Households	1.03	0.59	0.80
% in Rural Area	60	60	66
% of Rural Seasonally Migrating	31	31	56
% of Rural with Low Assets	50	50	74
Tax Rate (% of labor income)	0	0.4	1.3

Note: The first column reports the effects of permanently offering conditional migration subsidies to rural households with sufficiently low assets, as in the migration experiments, but with migration policies held fixed and without any taxation to pay for the transfers. The second column is the same, but the migration subsidies are financed through labor taxation. The third column allows migration to be endogenous and finances the transfers through labor taxation.

Table IX reports the welfare gains for these population subgroups and other key statistics. We first report the welfare gains of the permanent migration subsidies abstracting from taxation, in the first column of the table. Rural households with no assets gain the most, at 2.06% consumption equivalents. However, all rural households gain nearly as much, at 1.62%, suggesting that the availability of migration subsidies in the future is still valuable even for households not migrating in the current period. Urban households have a modest gain from occasionally accessing the subsidies in some future period, and all households gain by just under 1% in consumption equivalents.

The second column of Table IX adds back in the financing of subsidies but holds migration decisions fixed ex post. This setting is not meant to capture an actual subsidy one could implement in practice. Instead, it illustrates the welfare gains just from targeting transfers to households willing to undergo the ordeal of migration in exchange for the subsidy. The welfare gains in this case are only somewhat lower than those in the first case, at 1.62%. In other words, most of the welfare gains arise from targeting transfers rather than from changes in income after migrating. Urban households now lose −0.29% in welfare equivalents, since they pay taxes but benefit little from the subsidies themselves.

The third column of Table IX reports the full welfare effects of permanent migration subsidies in general equilibrium. The welfare gains are now 2.26% for the poor rural households with low assets. Urban households now lose even more, at −1.26%, while all households gain 0.80% on average. Interestingly, when the migration transfers are permanently offered, household location and saving decisions change substantially. In particular, the share of households living in the rural area rises from 60 to 66%, and the share of rural households having low assets (i.e., below the original asset cutoff) rises from 50 to 72%. This raises the overall take-up of migration subsidies, which increases the labor tax rate required from 0.4% (in the case of fixed migration decisions) to 1.3%.

The welfare calculations of this section also highlight which behavioral and equilibrium responses are important considerations when considering permanently subsidizing migration, rather than just subsidizing it one time. Both the large increases in seasonal

areas, large changes in urban shares of the population could depress urban wages, all else equal. If there are agglomeration externalities, larger urban populations could result in positive externalities on the wages of urban residents.

migration rates and the overall increase in rural population shares play primary roles in driving the overall effects of a permanent subsidy scheme. General equilibrium impacts working through wages are modest, as rural wages rise by only around 3% in lean periods. The overall increase in tax burden is not enormous but not trivial either, especially since most low-income countries have limited capacity to raise tax revenues. An increased number of rural households with low asset levels means that households are substituting self-insurance through asset holdings for the public insurance offered by migration subsidies. This again suggests that insurance motives are behind most seasonal migration decisions.

6. THE SOCIAL PLANNER'S ALLOCATION

This section formulates and solves the efficient allocation in our model economy. Up to this point, we have measured the welfare gains from particular policy interventions aimed at increasing seasonal rural–urban migration. However, these experiments leave open the normative question of how much households *should* be migrating in an efficient allocation. In other words, how would a benevolent social planner choose migration rates in this setting, and how would that compare to actual migration outcomes?

6.1. *The Social Welfare Function*

To study these normative questions, we take a stand on the social welfare function. We focus on a planner with Pareto weights $\psi(z)$ that vary with the permanent productivity of an individual. The idea is to (potentially) restrict how much redistribution there is across households of different permanent ability levels while having the planner treat households with the same z identically and in a utilitarian manner. We define the social welfare function as

$$\mathcal{W}^{\mathrm{SP}} = \sum_{t=0}^{\infty} \sum_{j'} \sum_{j} \int_z \int_s \int_x \int_\nu \beta^t \psi(z) u_{j',j}\big(c_j(z,s,x,t),x,\nu\big) \times \lambda_j(z,s,x,\nu,t)\, d\nu\, dx\, ds\, dz. \tag{14}$$

Here, social welfare is the weighted average value of household utility across locations j and going to location j', productivity states z and s, experience x, and preference shocks ν. The average is computed with respect to the Pareto weights, $\psi(z)$, and the measure of households $\lambda_j(z,s,x,\nu,t)$ with those shock states, experience levels, and preference shocks at all dates t. Utility depends directly upon the consumption allocation $c_j(z,s,x,t)$, but also directly on the location j through the migration disutility $\bar{u}$ and the idiosyncratic preference shocks.

We formulate the social planner's problem so that her choice variables are the consumption allocations and migration probabilities for all households. To cast the problem in terms of migration probabilities, we integrate out the preference shocks conditional on a set of migration probabilities for each household state. These migration probabilities prescribe an assignment of those households with the largest relative preference shock to migrate or not. So, given the set of states j, z, s, x, t, utility is

$$u\big(c_j(z,s,x,t),x\big) + E\big[\nu|\{\mu_{j',j}(z,s,x,t)\}_{j'}\big], \tag{15}$$

where $\mu_{j',j}(z,s,x,t)$ is the migration probability going from location j to location j' and then $E[\nu|\{\mu_{j',j}(z,s,x,t)\}_{j'}]$ is the expected value of the preference shock conditional on

the migration probabilities. So, for example, if the Planner dictates that all people migrate from location j to location j', then this value is the unconditional mean of a Type-1 extreme value shock. Now we can rewrite the social welfare function as

$$\sum_{t=0}^{\infty}\sum_{j}\int_z\int_s\int_x \beta^t\psi(z)\{u(c_j(z,s,x,t),x)+E[\nu|\{\mu_{j',j}(z,s,x,t)\}_{j'}]\} \times \lambda_j(z,s,x,t)\,dx\,ds\,dz. \tag{16}$$

6.2. *The Law of Motion and Feasibility*

The planning problem maximizes (16) subject to the law of motion describing how the population evolves across states and locations and then how many resources are available, that is, feasibility. Below, we describe each of these aspects of the environment.

Law of Motion. The law of motion describing how the measure of households evolves across states and locations is

$$\lambda_j(z,s',x',t+1)=\int_s\int_x \mu_{j,j}(z,s,x,t)\pi(s',s)\varphi(x',x,j)\lambda_j(z,s,x,t)\,dx\,ds + \sum_{j'\neq j}\int_s\int_x \mu_{j,j'}(z,s,x,t)\pi(s',s)\varphi(x',x,j')\lambda_{j'}(z,s,x,t)\,dx\,ds, \tag{17}$$

where $\pi(s',s)$ describes the transition across transitory states and $\varphi(x',x,j')$ describes the transition in experience. This equation says that given the current distribution $\lambda_{j'}(z,s,x,t)$ in location j', the measure of households $\lambda_j(z,s',x',t+1)$ reflects the migration probabilities of households in each location (the μ's), how their productivity evolves over time ($\pi's$), and how their experience $\varphi(x',x,j)$ evolves.

Labor Supply, Aggregate Production, and the Resource Constraint. Given a distribution of households, the effective labor units in the urban and rural area are

$$\begin{aligned} N_{u,t}&=\sum_{j=[\text{urban,seas}]}\int_z\int_s\int_x zs^{\gamma}\lambda_j(z,s,x,t)\,dx\,ds\,dz, \quad \text{and}\\ N_{r,t}&=\int_z\int_s\int_x s\lambda_{\text{rural}}(z,s,x,t)\,dx\,ds\,dz. \end{aligned} \tag{18}$$

The urban area includes the seasonal and permanent urban workforce. Aggregate production of the final good is

$$Y_t=A_uN_{u,t}+A_{r,t}(N_{r,t})^{\phi}. \tag{19}$$

Combining the amount of resources available in (19) with the consumption and moving decisions, we have the following resource constraint:

$$Y_t\geq\sum_j\int_z\int_s\int_x c_j(z,s,x,t)\lambda_j(z,s,x,t)\,dx\,ds\,dz + \sum_j\sum_{j'}\int_z\int_s\int_x m_{j',j}\mu_{j',j}(z,s,x,t)\lambda_j(z,s,x,t)\,dx\,ds\,dz, \tag{20}$$

which says that production must be greater than or equal to consumption plus the moving costs associated with households migrating across locations. Here, we compactly sum across all j' and j location pairs making use of the fact that the moving cost for staying in a location is zero, that is, $m_{j,j} = 0$.

6.3. *The Planner's Problem and the Efficient Allocation*

The social planner's problem is the following:

$$\max_{c_j, \mu_{j',j}} \sum_{t=0}^{\infty} \sum_{j} \int_z \int_s \int_x \beta^t \psi(z) \{u(c_j(z,s,x,t),x) + E[\nu | \{\mu_{j',j}(z,s,x,t)\}_{j'}]\} \times \lambda_j(z,s,x,t)\, dx\, ds\, dz \tag{21}$$

subject to (17), (18), (19), (20), and an initial condition, $\lambda_j(z,s,x,0)$. Here, the planner is choosing consumption allocations and migration probabilities for each state and date and these allocations must respect the production technology, feasibility, the laws of motion, and an initial condition. Finally, note that the planner only considers allocations that depend on the current state, not the entire history.

In spite of the seemingly complicated problem facing the social planner, we show that the solution to the planner's problem has an intuitive characterization which we formalize as Proposition 1 below.

PROPOSITION 1—Efficient Consumption and Migration: *The consumption and migration rates solving the social planner's problem are as follows. Consumption allocations for each type z equate the marginal utility of consumption in all locations, productivity and experience states for each date*:

$$u'(z,t) = u'(c_j(z,s,x,t)) = u'(c_{\tilde{j}}(z,s',x',t)) \quad \forall j,s,x, \tag{22}$$

and for all types z and z':

$$\frac{u'(z,t)}{u'(z',t)} = \frac{\psi(z')}{\psi(z)}. \tag{23}$$

Migration probabilities satisfy

$$\mu_{j'j}(z,s,x,t) = \exp\left(\frac{-u'(z,t)m_{j',j} + \beta \mathbb{E}[\chi_{3j'}(z,s,x,t+1)]}{\sigma}\right) \Big/ \sum_{j'} \exp\left(\frac{-u'(z,t)m_{j',j} + \beta \mathbb{E}[\chi_{3j'}(z,s,x,t+1)]}{\sigma}\right), \tag{24}$$

with the multiplier $\chi_{3j'}(z,s,x,t+1)$ satisfying the following recursive relationship:

$$\chi_{3j'}(z,s,x,t+1) = u_{j'}(z,s,x,t+1) + u'(z,t+1)\kappa_{j'}(z,s,x,t+1) + \beta \mathbb{E}[\chi_3(t+2)|z,s,x], \tag{25}$$

where

$$\kappa_{j'}(z, s', x', t+1) = \text{mpl}_{j'}(z, s', t+1) - c_{j'}(z, s', x', t+1) - \sum_{j''} m_{j'',j'} \mu_{j'',j'}(z, s', x', t+1). \quad (26)$$

Proposition 1 has a lot of content to unpack. First, consumption allocations equalize the marginal utility of consumption each permanent productivity type z across all locations, productivity, and experience states for each date t. This is a standard optimality condition ensuring that there is no way to better allocation consumption across states for a given z type. Second, the ratio of marginal utilities for two different permanent productivity types z and z' are inversely proportional to the weights assigned to them by the planner. This allows the planner to potentially allocate more consumption to agents with higher permanent productivity, for example, as in Negishi (1960).

Note that these optimality conditions do not imply that the planner equates the level of consumption across households with a given permanent productivity z. In our model, a household's experience and the disutility of being in the urban area affect the households' marginal utility of consumption. Mechanically, this necessitates that the planner compensates nonexperienced rural–urban migrants with higher consumption to equate the marginal utility of consumption across all households of a particular z type.

Two observations follow from this one. First, when moving households across space, the planner must factor in the differential in the consumption cost associated with moving an inexperienced rural household to the urban area, not just the moving cost. Second, and more broadly, gaps in consumption (either in the cross-section or when households move, as in the migration experiments) arise in an efficient allocation because of migration disutility. In other words, consumption gaps do not necessarily imply the allocation is inefficient or that there is scope for gains to reallocate households across space.

While the migration probabilities (24) take on a familiar exp sum form that is facilitated by the Type 1 extreme value shocks, the way the migration probabilities connect with fundamentals in (25) and (26) is novel.

The destination-specific component of the migration probabilities reflects two components that capture the social cost and benefits of a move to that destination. The first is the cost of a move, which shows up directly but is evaluated at the marginal utility of consumption $-u'(z,t)m_{j',j}$. So, if the migration cost from j to j' is high, then fewer people move. The second component is the expected value of the multiplier for a given destination, $\chi_{3j'}(z, t+1)$, with the expectation taken across the shock states and experience. This multiplier takes on a recursive formulation in (25), where the multiplier today reflects current utility, the κ term (which we explain below), and the expected discounted value of the multiplier tomorrow, which takes into account all possible moving options out of location j'.

This term in (25) describes, on net, how much a household receives from the planner versus what is produced in return. What it receives is the first term in (25): utility evaluated at the optimal consumption allocation and the expected preference shock. Then the κ term in (26) reflects the net resources produced by the household, that is, it is the marginal product of labor net of consumption received and net expected moving costs, all evaluated at the marginal utility of consumption.

All of this gives rise to intuitive features of the allocation. The planner moves households expected to have a high marginal product of labor in location j. The planner is

unlikely to move a household if it requires relatively more consumption in that location (which would arise when the household is inexperienced). The planner also takes into consideration the moving cost associated with that location, including the term $\sum_{j''} m_{j'',j'} \mu_{j'',j'}(z, s', x', t+1)$, which is a migration-weighted average of the moving costs. This term thus indexes how hard it is to move a household out of that location in the future. If a location features high migration costs, the planner moves fewer people in.

How does this allocation relate to the competitive equilibrium? We know that with incomplete markets, the marginal utility of consumption in the competitive equilibrium allocation will not be properly equated across households of a given z level. Nor will marginal utilities between households of different z values necessarily be proportional to the planner's weights. What is less obvious is how the planner will locate households across space and how her seasonal migration decisions will compare to those of the competitive equilibrium. We explore these issues next.

6.4. *The Efficient Allocation versus the Competitive Allocation*

This section computes the efficient allocation using the same parameters as in Section 4 and compares the results to the competitive allocation. As in our competitive equilibrium, we focus on stationary equilibria that give rise to time-invariant consumption allocations and migration probabilities. Here, we present the planner's problem and summarize key features of its solution; Appendix B presents the planner's solution in full detail.

We assume that the planner's weights take the form $\psi(z) = \exp(\alpha/z)$, where α captures the relative weight the planner puts on households with lower z values. In practice, we find that our broad conclusions in this section do not depend on our choice of α (see Appendix B). Thus, in what follows we focus on the case of $\alpha = 0$, which corresponds to equal weights on all households. We measure welfare as the permanent percent increase in consumption that a household would require to be indifferent between the competitive equilibrium allocation and the planner's allocation.

Table X reports the results. The first column reproduces some moments from the competitive equilibrium from the baseline economy. Our main interest is in how the migration policies of the planner differ from migration outcomes under the competitive equilibrium. To this end we report, in the second column in Table X, the welfare gains of implementing the planner's consumption allocation but fixing the migration policies to be those of the competitive equilibrium allocation. In other words, we hold the size of the pie the

TABLE X

COMPETITIVE EQUILIBRIUM VERSUS SOCIAL PLANNER'S SOLUTION.

	(1) Competitive Equilibrium	(2) Planner, Migration Fixed	(3) Planner, Migration Endogenous	(4) Difference (3)–(2)
Average Welfare Gain (%)	–	46.6	48.5	1.9
% in Rural Area	60	60	54	−6
% Seasonally Migrating	31	31	27	−4
rural–urban Wage Gap	1.88	1.88	1.70	−0.18

Note: The first column reproduces features of the competitive-equilibrium outcome. The second column reports the welfare gains from moving to an allocation with full consumption insurance, but holding migration policies fixed, and the features of this allocation. The third column reports the welfare gains from moving to the efficient allocation, with full consumption insurance and allowing for endogenous migration decisions.

same as in the competitive allocation, and change only how the pie is divided up across households. Welfare gains from this second column arise from providing insurance for households of each z type and then from redistributing from low- to high-z types. The welfare gains are large, at 46.6%, but not our focus, as these gains are a consequence of known sources of gains from the redistribution across permanent types and completing markets.

Our main focus is on how much the planner can improve welfare by better allocating workers across space. The third column helps answer this question by computing the full efficient allocation including endogenous location and migration choices for each household. The difference between the third column and second column thus isolate the gains from a better allocation of workers across regions relative to the competitive allocation. Interestingly, the planner chooses an allocation that induces a smaller rural population (54% versus 60% in the competitive allocation) and has less seasonal migration than in the competitive economy (27% versus 31% in the competitive allocation). Moreover, the planner chooses a smaller—but still large—wage gap (as implied by the marginal product of labor) between rural and urban areas. The incremental welfare gains from changes in migration relative to the full insurance allocation are modest, at 1.9% (48.5% minus 46.6%). This suggests fairly modest gains from better allocating workers across space, and that in an efficient allocation there would be less, rather than more, seasonal migration.

To better understand these results, Figure 2 plots the seasonal migration policy function by transitory shock and asset holdings for low z households in the competitive allocation (left panel) and planner's allocation (right panel). One can see that in the competitive equilibrium, many migrants move out of "desperation." That is, there is a lot of seasonal migration by households with low transitory shocks and low assets. From the planner's perspective, these moves are socially wasteful, and they are virtually eliminated in the

FIGURE 2.—Migration Probabilities: Competitive Equilibrium versus Planner's Solution.

planner's allocation. From the planner's perspective, giving these households insurance and keeping them in the rural area is the efficient thing to do. In other words, the planner chooses lower seasonal migration rates because she eliminates these desperation moves.

The outcome from the planner's solution suggests that there is not much spatial misallocation overall. At best, the planner could raise welfare by around 1.9% by better allocating workers across space, and even then, this would entail less seasonal migration, not more. The planner's solution suggests that the real issue in the model is the lack of insurance and how households use seasonal migration as a device to raise incomes in periods when their asset holdings and productivity levels are low. In other words, the planner gains very little from releasing labor that is stuck in rural areas but does gain from reducing moves of desperation among vulnerable rural households.

How does the planner's solution relate to the permanent migration transfers discussed in the previous section? The results of this section show that such a policy is really "second best," in that it pushes migration in the opposite direction as the planner. However, the policy is still welfare enhancing because the costs of distorting migration are small relative to the gains from providing insurance even indirectly via migration. So, we see substantial gains from the permanent migration subsidies on average. This is consistent with the result from Table X that most of the welfare gains from moving to the planner's problem come from equalizing marginal utilities of consumption, rather than from better allocating workers across space.

7. CONCLUSION

This paper studies the welfare implications of subsidizing rural–urban migration in low-income countries. Cross-sectional data show that wages are much higher in urban areas than in rural areas, and recent experiments show that subsidies for seasonal migration raise the income and consumption of migrants. It is thus tempting to conclude from this evidence that many rural workers are stuck in poverty traps in which credit constraints and income risk keep them from the higher average wages of cities.

Our analysis, which uses a dynamic model of migration estimated to match this cross-sectional and experimental data, suggests that this is not the correct interpretation. Rather than migration being deterred by risk, we argue that households use migration as a way to insure themselves against states of the world in which their productivity and asset holdings are low. The welfare gains from subsidizing seasonal rural–urban migration thus come about largely from providing better insurance opportunities for rural households in periods when they are vulnerable.

The large nonmonetary costs of seasonal migration that we estimate in our model suggest scope for future research into the policies that can reduce the costs of rural–urban migration for vulnerable rural individuals. We provide suggestive evidence that the migration disutility is related in part to poor housing conditions for new migrants in urban areas (Appendix C). To the extent that policy makers can influence the living conditions for migrants arriving in urban centers, this could raise welfare by creating better opportunities for villagers to insure themselves by periodically moving to the city. Future research should look more broadly into the nonmonetary and monetary barriers to seasonal migration.

In terms of methodology, our paper departs from the previous macroeconomic literature in how we discipline our model quantitatively and, in particular, in how we replicate a randomized controlled trial within a macroeconomic model. Our method of combining a dynamic incomplete-markets model with experimental data can be used more broadly

to study other macroeconomic phenomena, such as savings behavior, labor market search activity, or investments in new technologies, that have been the focus of recent randomized experiments.

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